Otago Regional Council

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MEMORANDUM

To: **Matthew McCallum-Clark**

From: **Jason Augspurger**

Date: **26/02/2024**

Re: **TN, TP, *E. coli* and sediment FMU overall summary**

Name	**Role**	**Date Completed**
Rachel Ozanne	Reviewer 1	28 February 2024
Helen Manly	Reviewer 2	7 March 2024

Purpose

The purpose of this memo is to inform the overall state and compliance of FMUs with proposed target attributes for total nitrogen (periphyton), total phosphorus (periphyton), *E.coli* and Sediment (clarity).

Context

Otago Regional Council's (ORC) current report suite (Srinivasan et al. 2021; Snelder and Fraser 2021; Snelder 2023; Ozanne et al. 2023; Snelder and Fraser 2023; Augspurger 2024a; Augspurger 2024b; Augspurger 2024c) has been developed to inform the setting of baseline, and target, attribute states and provides information about the state and trends present at sites and the wider river network within a Freshwater Management Unit (FMU) or Rohe.

These reports provide a large amount of information, at various spatial scales, for multiple attributes. This memo qualitatively aggregates results from the differing information sources and spatial scales to present a summary assessment of whether the differing attributes comply with their proposed target attribute states. This summary does not override results from other reports; it is provided as a brief overview of patterns present in underlying technical reports.

Methods

To provide a simplified overview, four attributes were selected: total nitrogen as it relates to periphyton biomass, total phosphorus as it relates to periphyton biomass, *E.coli* and sediment (through water clarity). These attributes were selected as they are four critical contaminants which are often responsible for declines in water quality and higher trophic level attributes such as the Macroinvertebrate Index (MCI), Average Score Per Metric (ASPM), and periphyton biomass.

Summaries for these attributes in relation to their proposed target attribute states are provided for the three categories outlined in the baseline state report: network state, monitoring site and trend analysis. Three frameworks were used aggregate results.

For network state:

- Fully compliant - where the upper confidence interval and mean reach 100% of segments complying, and there is little risk of non-compliance.
- Low non-compliance - where the mean is less than 100% compliant but greater than 90%
- Moderate non-compliance – where the mean is more than 70% compliant but less than 90%
- High non-compliance – the mean is less than 70% compliant

For monitoring sites:

First the rolling analysis was considered. If a site did not comply with its target attribute state over the rolling period, it was considered as failing to comply. Then, a qualitative assessment was made.

- Fully compliant – if all sites in the FMU complied
- Low non-compliance - where most sites in the FMU complied or straddled compliance in the rolling analysis
- Moderate non-compliance – where compliance across the FMU was mixed
- High non-compliance – where few sites in the FMU complied

For trend results:

Both 10 and 20-year results were considered.

- Where multiple sites had similar degrading or improving trends, they were classed as such.
- Where sites were stable, or an FMU had no clear pattern, trend results were considered as “mixed”. The mixed class does not mean degrading or improving trends were not present within an FMU. Instead, it means an overall pattern could not be assigned to the FMU.

Notably, some FMUs (Upper Lakes and Roxburgh) have few monitoring sites. In these cases, it was not possible to aggregate and summarise results to provide an overview. Sediment results are also not provided for some FMUs where natural processes result in lower clarity, such as the Taieri and Catlins.

Results

North Otago

Table 1: Results summary for the North Otago FMU

North Otago	Network	Monitoring Sites	Trends
Nitrogen (periphyton)	Low non-compliance	Moderate non-compliance	Multiple degrading trends
Phosphorus (periphyton)	Low non-compliance	Low non-compliance	Multiple improving
E.coli	High non-compliance	High non-compliance	Multiple degrading trends
Sediment	Moderate non-compliance	Full compliance	Multiple improving

Dunedin & Coast

Table 2: Results summary for the Dunedin & Coast FMU

Dunedin & Coast	Network	Monitoring Sites	Trends
Nitrogen (periphyton)	High non-compliance	High non-compliance	Mixed trend results
Phosphorus (periphyton)	Moderate non-compliance	High non-compliance	Mixed trend results
E.coli	High non-compliance	High non-compliance	Multiple degrading trends
Sediment	High non-compliance	Low non-compliance	Mixed trend results

Taieri

Table 3: Results summary for the Taieri FMU

Taieri	Network	Monitoring Sites	Trends
Nitrogen (periphyton)	Low non-compliance	Full compliance	Mixed trend results
Phosphorus (periphyton)	Moderate non-compliance	High non-compliance	Multiple improving
E.coli	High non-compliance	Moderate non-compliance	Multiple degrading trends
Sediment			

Upper Lakes Rohe

Table 4: Results summary for the Upper Lakes Rohe[1]

Upper Lakes	Network	Monitoring Sites	Trends
Nitrogen (periphyton)	Full compliance	Full compliance	
Phosphorus (periphyton)	Low non-compliance	Full compliance	
E.coli	High non-compliance	Moderate non-compliance	
Sediment			

[1] Ozanne et al., 2023 was used to provide additional monitoring site results (https://www.orc.govt.nz/media/14523/orc-river-lake-groundwater-state-and-trends-2017-2022.pdf).

Dunstan Rohe

Table 5: Results summary for the Dunstan Rohe

Dunstan	Network	Monitoring Sites	Trends
Nitrogen (periphyton)	Full compliance	Full compliance	Mixed trend results
Phosphorus (periphyton)	Low non-compliance	Full compliance	Multiple improving
E.coli	Moderate non-compliance	Low non-compliance	Multiple degrading trends
Sediment	Moderate non-compliance	Moderate non-compliance	Multiple degrading trends

Roxburgh Rohe

Table 6: Results summary for the Roxburgh Rohe[2]

Roxburgh	Network	Monitoring Sites	Trends
Nitrogen (periphyton)	Full compliance	Full compliance	
Phosphorus (periphyton)	Low non-compliance	Moderate non-compliance	
E.coli	High non-compliance	Moderate non-compliance	
Sediment	Moderate non-compliance	High non-compliance	

[2] Ozanne et al., 2023 was used to provide additional monitoring site results (https://www.orc.govt.nz/media/14523/orc-river-lake-groundwater-state-and-trends-2017-2022.pdf).

Manuherekia Rohe

Table 7: Results summary for the Manuherekia Rohe

Manuherekia	**Network**	**Monitoring Sites**	**Trends**
Nitrogen (periphyton)	Full compliance	Full compliance	Multiple degrading trends
Phosphorus (periphyton)	Moderate non-compliance	Low non-compliance	Multiple improving
E.coli	High non-compliance	High non-compliance	Multiple degrading trends
Sediment	High non-compliance	High non-compliance	Multiple degrading trends

Lower Clutha Rohe

Table 8: Results summary for the Lower Clutha Rohe

Lower Clutha	**Network**	**Monitoring Sites**	**Trends**
Nitrogen (periphyton)	High non-compliance	High non-compliance	Multiple improving
Phosphorus (periphyton)	High non-compliance	High non-compliance	Multiple improving
E.coli	High non-compliance	High non-compliance	Mixed trend results
Sediment	Moderate non-compliance	High non-compliance	Multiple improving

Catlins

Table 9: Results summary for the Catlins FMU

Catlins	Network	Monitoring Sites	Trends
Nitrogen (periphyton)	Moderate non-compliance	Full compliance	Mixed trend results
Phosphorus (periphyton)	Low non-compliance	Full compliance	Multiple improving
E.coli	High non-compliance	High non-compliance	Mixed trend results
Sediment			

Conclusion

Management implications

All FMU/Rohe have at least one category with either high non-compliance or multiple degrading trends indicating improvement is required for at least an attribute to comply with target attribute states throughout Otago.

Where network and attribute states are complied with, but trends are degrading, restrictions on activities which increase loading of the respective contaminant are likely to be required. Without these restrictions, loads may increase leading to the network or sites failing to comply.

Where sites or network fail to comply, reductions are required. Whether reductions are applied to the whole FMU, or more localized areas is ultimately a normative decision which must account for underlying uncertainty in outcomes of the interventions.

Where non-compliance is low, it may be logical to use more targeted interventions. However, in some instances, non-compliances occur in lower mainstem segments in which case reductions would be required from upstream sources. FMU level interventions may be most effective in this instance. Network modelling results may inform where this is most suitable. Where non-compliance is high, more broadly applied interventions may be appropriate.

Mitigation Scenarios

Prior modelling for nitrogen and phosphorus on instream outcomes from mitigation scenarios has indicated current mitigation suites are unlikely to result in multi-band changes but instead lead to within band improvements. For sites where trends are degrading, the within band improvement may be realised as reversing a degrading trend. For sites which are currently improving, within band or between band improvements are more likely. As a result, a reasonable interim result from a GMP/GMP+ based scenario would be improvement in trend.

References

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