2021/22 River water quality and ecology monitoring

Greater Wellington
Te Pane Matua Taiao

Contents

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For the latest available results go to the GW environmental data hub.

Overview

Greater Wellington's river water quality and ecology monitoring programme provides information on the stream condition across the Wellington Region. Water quality and ecosystem health are currently monitored at 39 hard-bottomed and 7 soft-bottomed river and stream sites within each main river catchment (Whaitua). These sites were chosen to represent the major land uses and human activities and the natural diversity of rivers and streams in the wider Wellington Region. This report contains monitoring results from 2017/18 to 2021/22.

Monitoring network

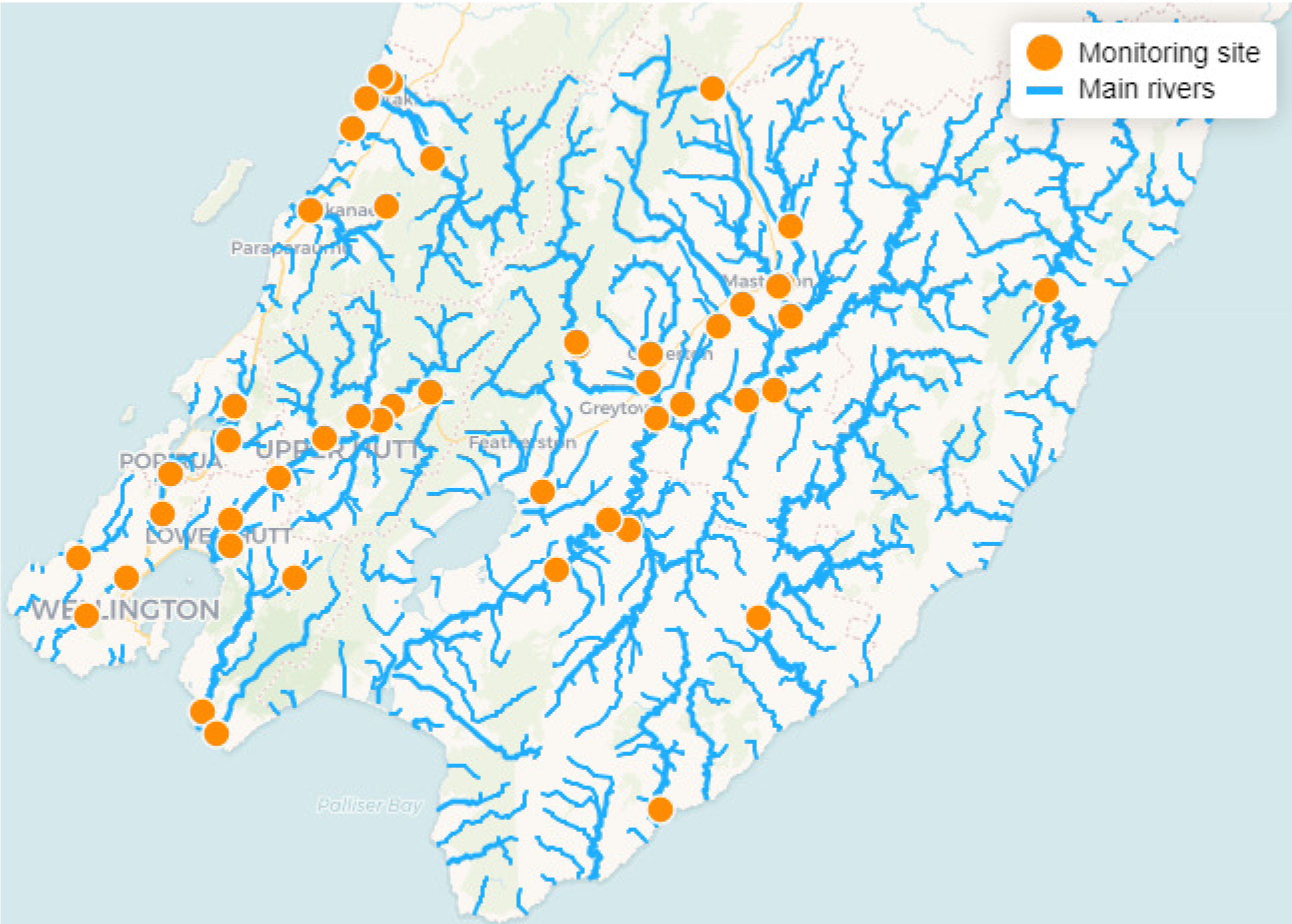

Figure 1: Locations of RWQE monitoring sites.

Water quality monitoring

River and stream water quality is assessed at monthly intervals by measuring a range of physicochemical and microbiological variables:

- Nutrients: Nitrogen & Nutrients: Phosphorus
- Metals: Copper & Zinc
- Microbiology: *E. coli*
- Sediment: Water Clarity, Suspended & Deposited Sediment
- Other Variables: Dissolved Oxygen, pH & Conductivity

Ecological monitoring

Ecological variables assessed as part of the programme include:

- Macroinvertebrates, Periphyton, Cyanobacteria & Habitat

Methods

Physicochemical and Microbiological Water Quality Sampling

Where practical, individual rivers water quality and ecology (RWQE) monitoring sites are sampled at the same time of the month (and usually at the same time of the day) and all sites on a river or stream are sampled on the same day. Field meters are calibrated on the morning of the day of sampling and on the return. Water samples are collected in mid-stream (where possible), typically in run-type habitat from a representative reach of stream. Samples requiring laboratory analysis are placed in chilly bins with ice and couriered overnight to RJ Hill Laboratories in Hamilton. Water samples for heavy metal and dissolved nutrient analysis were all laboratory filtered.

Nutrients: Nitrogen & Phosphorus

Ammoniacal- and nitrate-nitrogen are toxicants in freshwater that can cause lethal or sub-lethal effects for aquatic species. In many cases, nitrate concentrations need to be managed at considerably lower than toxic levels to avoid excessive periphyton and macroalgae growth.

Dissolved reactive phosphorus (DRP), when substantially elevated above natural reference conditions, can negatively impact ecological communities. In combination with other conditions favouring eutrophication, DRP enrichment drives excessive primary production and significant changes in macroinvertebrate and fish communities, as taxa sensitive to hypoxia are lost.

Benchmarking

Results for pH adjusted ammoniacal nitrogen, nitrate nitrogen, and dissolved reactive phosphorus are rated against the Ministry for the Environment (MfE) National Objectives Framework (NOF) guidelines. See the National Policy Statement for Freshwater Management (NPS-FM) document for more information.

Model Estimates

The predicted water quality values were generated using Random Forest (RF) models. The RF empirical modelling method predicts the values of response variables using a suite of predictor variables and a dataset of observations (the 'training data'). RF models are an advanced form of regression-tree models.

The observational data used in the RF models consisted of site median values from monthly and quarterly measurements for the period 2009-2013. These data came from 354-586 monitoring sites (depending on the variable). The sites are reasonably well distributed across the North and South Islands, with some gaps in inaccessible areas.

The RF models performed well in predicting median water quality state, based on the amount of variation in the observational data explained, the congruence between observed and predicted values, low model bias (tendency to over- or underestimate), and low prediction uncertainty. See section 4 of the Larned, S, Snelder, T, & Unwin, M (2017) for more details on the model results and performance.

Metals: Copper & Zinc

Metals can have toxicant effects on aquatic life in both a dissolved state and when attached to sediment particles. Zinc and copper have been adopted throughout the Te Awarua-o-Porirua Whaitua Implementation Plan (WIP) as proxies for the suite of other urban contaminants (e.g., polycyclic aromatic hydrocarbons, other toxic metals (such as cadmium and chromium), detergents/surfactants and other chemicals). Copper is approximately 5 to 10 times more toxic to aquatic life than zinc but occurs in lower concentrations.

Benchmarking

In the absence of NPS-FM/NOF attribute tables for zinc or copper, an interpretation table was developed for zinc and copper that follows the same rationale as the toxicity attributes in the NPS-FM, that is, it includes two sets of state band thresholds for chronic and acute exposure (see Appendix 1 of the Whaitua Implementation Plan (WIP)). The chronic exposure thresholds adopt the figures for 99%, 95% and 80% species protection given in the ANZECC (2000) guidelines.

The application of the framework is limited by not having a second set of toxicity data that enabled the acute thresholds to be derived for the NOF toxicity attributes. Instead, this table has adopted lower species protection thresholds for the A and B attribute states (i.e., 95% and 90% for A and B states respectively), while the bottom of the C attribute state is defined from United States Environmental Protection Agency (USEPA) acute toxicity thresholds (USEPA 1996, USEPA 2007).

Because these thresholds are uncertain proxies for acute toxicity thresholds, it is suggested to set objectives for 95th percentile concentrations rather than the more stringent maximum.

Microbiology: *E. coli*

Escherichia coli (*E. coli*) is a type of bacteria commonly found in the intestines of warm-blooded animals, including people. *E. coli* in river waters is one of five indicators that provide an overview of New Zealand's river water quality and how it is changing over time.

E. coli in fresh water can indicate the presence of pathogens (disease-causing organisms) from animal or human faeces. The pathogens can cause illness for anyone who ingests them. Campylobacter is one of the most common pathogens associated with animal and human faeces, but it is difficult to measure. We use *E. coli* concentrations measured as colony forming units (cfu) to infer Campylobacter infection risk in waterways.

Benchmarking

E. coli results are rated against the Ministry for the Environment (MfE) National Objectives Framework (NOF) guidelines designed to help guide decisions related to the protection of human health. See the National Policy Statement for Freshwater Management (NPS-FM) document for more information.

Model Estimates

The predicted water quality values for each of the four statistical metrics (median, 95th percentile, % >260 cfu/100ml, and % >540 cfu/100ml) were generated using Random Forest (RF) models. The RF empirical modelling method predicts the values of response variables using a suite of predictor variables and a dataset of observations (the 'training data'). RF models are an advanced form of regression-tree models.

The observational data used in the RF models consisted of State of the Environment (SoE) data from monthly and quarterly samples collected throughout New Zealand from 1990 at some sites until the end of 2013.

The RF models for median, 95th percentile and % >260 cfu/100ml had generally good performance and the model for % >540 cfu/100ml had satisfactory performance. All four models had very low bias. See section 4.2 of Snelder, T., Wood, S., Atalah, J. (2016) for more details on the model results and performance.

Modelled grades were subsequently adjusted where the predicted estimates did not accurately represent monitoring sites. These adjustments were based on:

- expert opinion from freshwater scientists.
- fact-checking with regional councils.
- actual data at a monitoring site.

See page 56 and Appendix A of MfE (2018) for further information on subsequent development.

Sediment: Suspended & Deposited, Water Clarity

Sediment discharged into rivers, streams and harbours can negatively impact a range of values, including ecosystem health and the way people use water for recreational, cultural, and spiritual purposes. Sediment affects ecosystem function in rivers and streams by:

- reducing light penetrating the water, affecting the ability of plants to grow
- impacting the health of fish by abrading skin and gills and making predators and prey difficult to see
- filling the interstitial spaces (spaces between rocks and pebbles, etc.) in stream beds, making these spaces less suitable for macroinvertebrate communities to survive and thrive.

In estuaries and harbours, sediment:

- alters and degrades habitat and the composition of ecological communities by smothering invertebrates, shellfish, and seagrass
- changes the depth of water and flow patterns.
- reduces clarity.
- changes the feel of substrate underfoot.

Benchmarking

Results for deposited fine sediment and water clarity are rated against the Ministry for the Environment (MfE) National Objectives Framework (NOF) guidelines. See the National Policy Statement for Freshwater Management (NPS-FM) document for more information.

Model Estimates

Sediment cover at each reach is estimated from a contemporary boosted regression tree (BRT) model of Clapcott and Goodwin (2017) accessed from the MfE data service. This model estimated sediment cover based on land cover (such as native vegetation, exotic vegetation, and pastoral heavy) and environmental variables (such as slope, geology, and rainfall days). Testing over observed data at 8482 sites showed fair to good model performance and effectively no bias. More details of the data and model development can be read in sections 2 and 4 of Clapcott and Goodwin (2017).

Water clarity estimates are obtained from an RF model developed by Larned et al. (2017) using data from 454 sites. This model performed well though slightly underestimates at high values and overestimates at low values.

Ecology

Macroinvertebrates

Macroinvertebrates play a central role in stream ecosystems by feeding on periphyton (algae), macrophytes, dead leaves and wood, or each other. They are extremely important for processing terrestrial and aquatic organic matter, and in turn, are an important food source for animals further up the food chain, such as wading birds and fish. When the insects become adults, they leave the water and become food for animals such as birds, bats, spiders, etc.

The Macroinvertebrate Community Index (MCI) is based on the presence or absence of invertebrate species (taxa) with different tolerances/sensitivities to organic pollution and nutrient enrichment. For this reason it is regularly used as an indicator of river or stream ecosystem health.

Sampling

A single macroinvertebrate sample is collected at RWQE water sampling sites during summer/early autumn. The timing of sampling is determined at random, although macroinvertebrate sampling is, where practicable, avoided within two weeks of any flood event (flood events are defined as flows greater than three times the median river flow).

Samples are collected with the use of a kick-net (0.5 mm mesh size) following Protocol C1 of the national macroinvertebrate sampling protocols (Stark et al. 2001) for the 39 sites with hard substrate (in riffle habitat) and Protocol C2 for the 7 sites with a soft substrate. All samples are processed in accordance with Protocol P2 (Stark et al. 2001).

Benchmarking

Macroinvertebrate Community Index (MCI) scores are assessed against quality classes recommended for the Greater Wellington Region and Greater Wellington Natural Resources Plan (NRP) plan outcomes (Clapcott and Goodwin, 2014).

These thresholds have been developed based on regional data for six Freshwater Ecosystems of New Zealand (FENZ) river classes and were defined from statistical distributions of data from a mix of:

- observed reference sites.
- modelled ‘reference’ conditions using reaches with land use restrictions that indicate low disturbance.
- all contemporary observed sites.
- all modelled contemporary conditions.

	MCI score quality class				NRP outcomes	
River class	**D**	**C**	**B**	**A**	**All rivers**	**Significant rivers**
	MCI score quality class				**NRP outcomes**	
River class	**D**	**C**	**B**	**A**	**All rivers**	**Significant rivers**
1 (Steep, hard sedimentary)	< 110	110-120	120-130	≥ 130	≥ 120	≥ 130
2 (Mid-gradient, coastal and hard sedimentary)	< 80	80-105	105-130	≥ 130	≥ 105	≥ 130
3 (Mid-gradient, soft sedimentary)	< 80	80-105	105-130	≥ 130	≥ 105	≥ 130
4 (Lowland, large, draining ranges)	< 90	90-110	110-130	≥ 130	≥ 110	≥ 130
5 (Lowland, large, draining plains and eastern Wairarapa)	< 80	80-100	100-120	≥ 120	≥ 100	≥ 120
6 (Lowland, small)	< 80	80-100	100-120	≥ 120	≥ 100	≥ 120

Table 1: MCI class and NRP outcomes for the latest three year median MCI score.

Quantitative MCI (QMCI) and Average Score Per Metric (ASPM) results are also benchmarked against Ministry for the Environment (MfE) National Objectives Framework (NOF) guidelines. See the National Policy Statement for Freshwater Management (NPS-FM) document for more information.

Model Estimates

This regional specific model estimated MCI score based on land cover and environmental variables such as slope, geology, climate. Model performance diagnostics indicated a very good predictive model, with 95th percent confidence intervals of < 29 MCI units, and effectively no bias (< 0.1 MCI unit). More details of the data and model development can be read in section 2.1.1 of Clapcott J, Goodwin E (2014).

Periphyton & Cyanobacteria

Periphyton is algae/slime that attaches to hard surfaces such as rocks and tree roots in freshwater environments. It is an important food source for invertebrates and some fish, and can absorb contaminants from water (e.g., nitrate, ammonia, phosphorus, and metals). However, too much of it can limit the food sources and/or habitat of macroinvertebrates (e.g., insects, snails, and worms), affect the ability of fish to find food, and cause harmful water quality effects such as daily fluctuations in dissolved oxygen and pH (acidity). Periphyton blooms can also be visually unappealing and can make access to streams difficult (slippery).

Cyanobacteria (commonly known as blue-green algae) are photosynthetic prokaryotic organisms that are integral parts of many terrestrial and aquatic ecosystems. In aquatic environments, under favourable conditions, cyanobacterial cells can multiply and form planktonic (suspended in the water column) blooms or dense benthic (attached to the substrate) mats. An increasing number of cyanobacterial species are known to include toxin-producing strains. These natural toxins, known as cyanotoxins, are a threat to humans and animals when consumed in drinking water or by contact during recreational activities. The mechanisms of toxicity for cyanotoxins are very diverse, ranging from acute unspecified intoxication symptoms (e.g., rapid onset of nausea and diarrhoea), to gastroenteritis and other specific effects, such as hepatotoxicity (liver damage) and possibly carcinogenesis (MfE & MoH 2009).

Sampling

Formal periphyton & cyanobacteria assessments are limited to the 39 RWQE sites with hard substrates.

Monthly Assessment of Visible Streambed Cover

Periphyton cover is determined by estimating the percentage of mat (>1 mm thick), cyanobacterial mat (>1 mm thick) and filamentous (>2 cm long) periphyton present on the stream or riverbed. Note that cover of mat and cyanobacterial mat-periphyton are mutually exclusive (ie, cyanobacterial mat cover >1 mm thick will be counted as separate from mat-periphyton). A total of 20 observations are taken at each site from two transects of ten observations, or, if the stream or river is not wide enough or too swift to wade across more than half of the river's width, four transects of five observations. Each observation is typically made with an underwater viewer and covers an approximate area of a 30 cm diameter circle.

Visible streambed periphyton cover assessments are carried out equally in both run and riffle-type habitats if these are present at a sampling site/reach.

Monthly Assessment of Biomass

Periphyton samples for quantitative biomass assessments (chlorophyll a) are collected on a monthly basis. During 2021/22, chlorophyll a samples were collected from 17 of the 39 RWQE sites with hard substrates. Sampling protocols involved collecting samples from a run habitat and following modified versions of quantitative methods 1b (QM-1b) and 3 (QM-3) as outlined by Biggs and Kilroy (2000). This involves pooling periphyton samples from 10 rocks into a single composite sample for analysis (see Greenfield (2016) for further details).

Benchmarking

Monthly observations of percent streambed periphyton cover (filamentous and mat-forming periphyton) are compared against the periphyton composite cover guidelines (Matheson et al. 2012). The threshold for nuisance mat cover is twice that for filamentous periphyton cover, so the periphyton weighted composite cover (WCC) can be defined as filamentous periphyton cover + (mat periphyton cover / 2) with a nuisance guideline of ≥ 30%.

Results for periphyton biomass are rated against the Ministry for the Environment (MfE) National Objectives Framework (NOF) guidelines. See the National Policy Statement for Freshwater Management (NPS-FM) document for more information.

Model Estimates

Periphyton biomass state has been estimated for each river reach by comparing modelled median total nitrogen (TN) and dissolved reactive phosphorus (DRP) concentrations from Larned et al. (2017) to DRP thresholds in Snelder et al. (2019) and revised TN thresholds in MfE (2019).

These nutrient thresholds relate to each NOF state where increasing levels of estimated TN and DRP (see nutrients model estimates above where TN is modelled using the same approach) correspond to higher risk of increased periphyton biomass. In the case that TN and DRP thresholds estimated different periphyton states for the same river reach the higher risk state has been used.

Habitat Quality

Habitat assessments are undertaken annually at RWQE sites during summer/early autumn when invertebrates samples are collected following the updated methods outlined in Clapcott (2015). This assessment provides an indication of the condition of the physical habitat and its ability to support stream biota, and incorporates the following variables: deposited sediment cover, invertebrate habitat abundance and diversity, fish habitat abundance and diversity, hydraulic heterogeneity, bank erosion and vegetation, and riparian width and shade. Each category is scored between 1 ('poor') and 10 ('excellent'). Summation of individual scores provides an overall total habitat quality score for each site (lowest and highest possible scores are 10 and 100, respectively).

This methodology was developed with a focus on wadeable hard-bottomed streams (Clapcott, 2015) and hence its applicability to other stream/river types has not been explored.

Note on COVID-19

Two to three field samples were missed for several of water quality variables due to lockdown periods.

Trend estimation

All trends displayed on maps and in tables use the same methodology as on the LAWA website.

Water quality results

Each section presents maps of monitoring results with assigned states and estimated trends where applicable. Full tabulated data for each variable are available in the Appendix 2 - Data tables section.

Nutrients

Total nitrogen

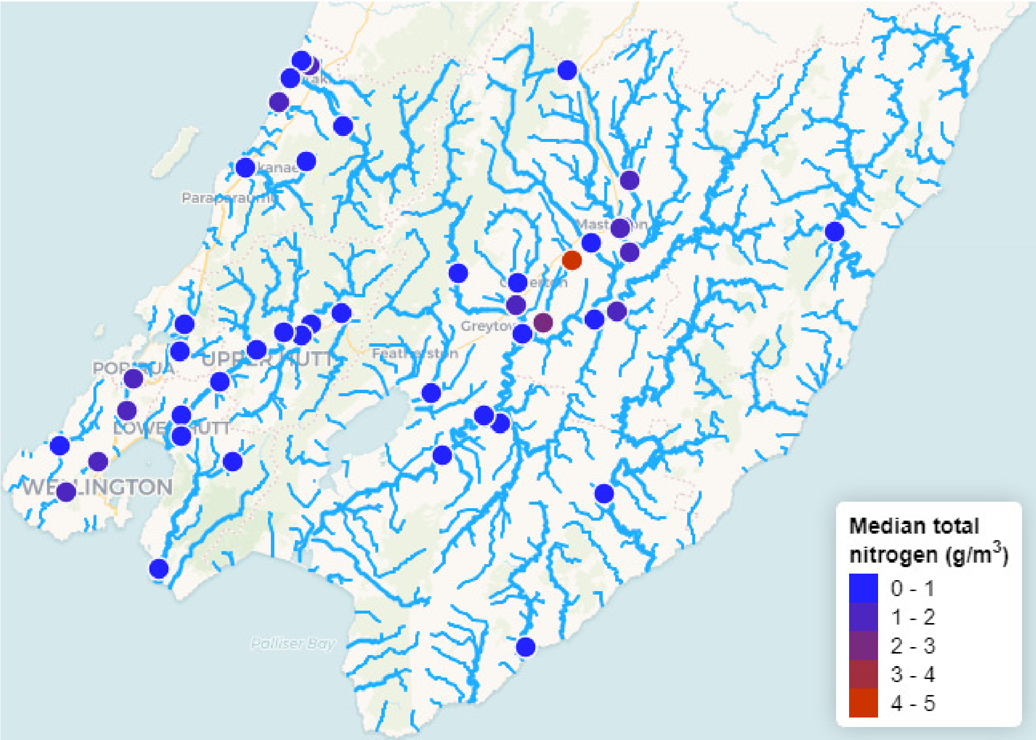

Figure 2: Total nitrogen (g/m^3) results for the period 2019/20 to 2021/22

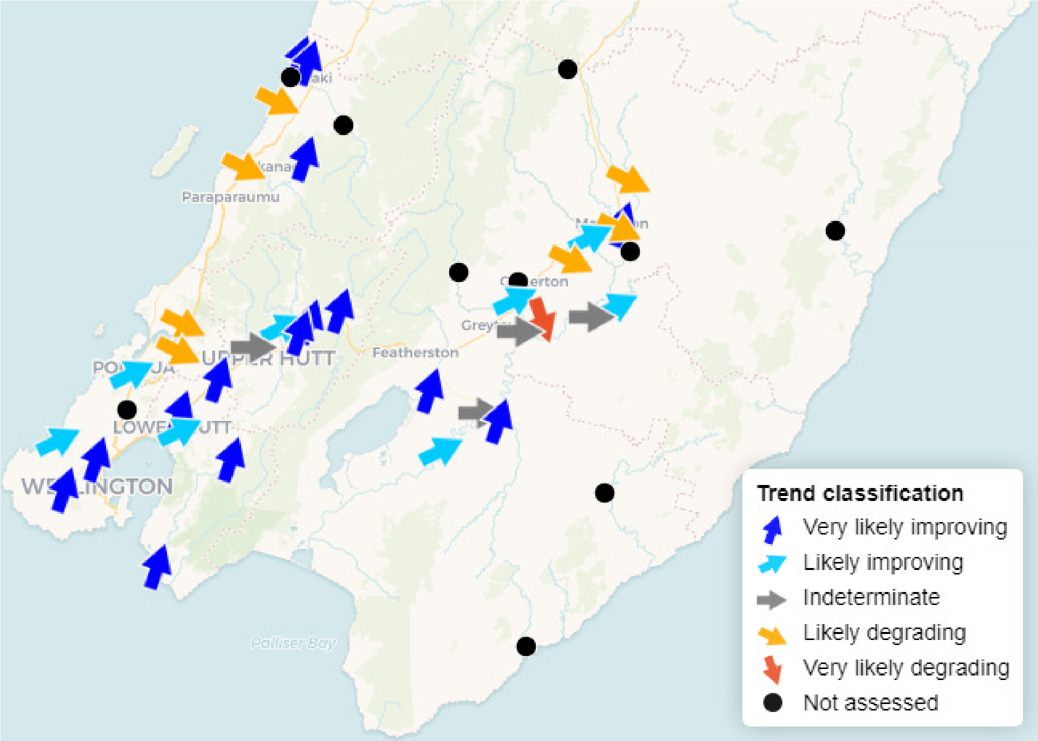

Figure 3: Total nitrogen 5-yr trends

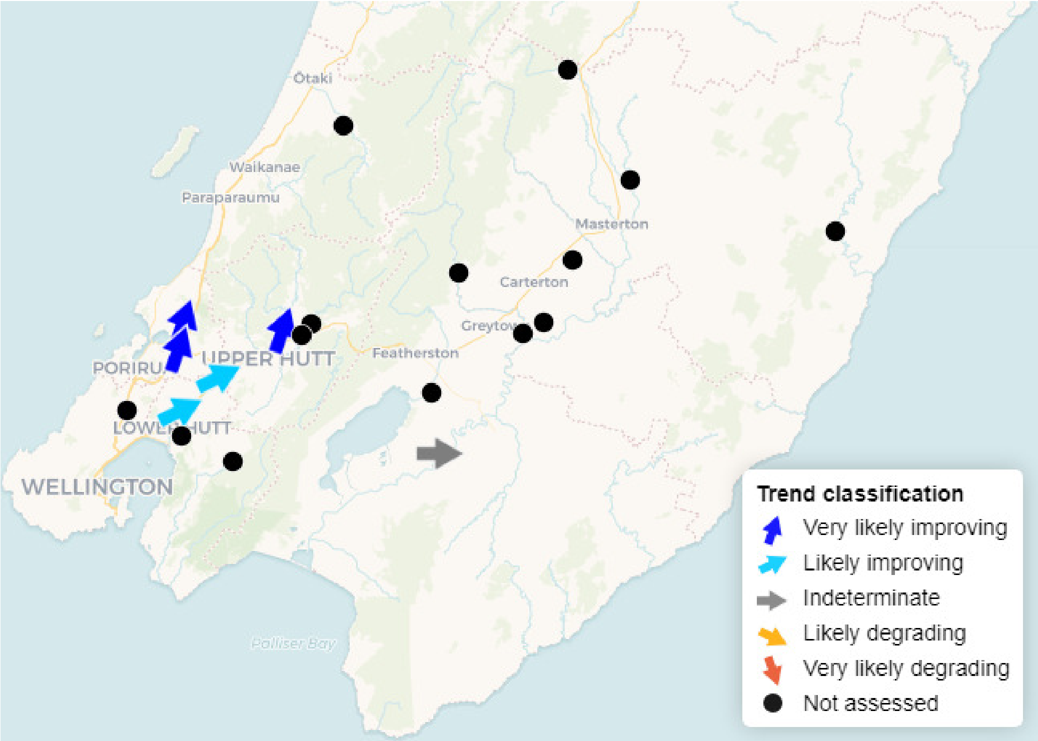

Figure 4: Total nitrogen flow adjusted 5-yr trends

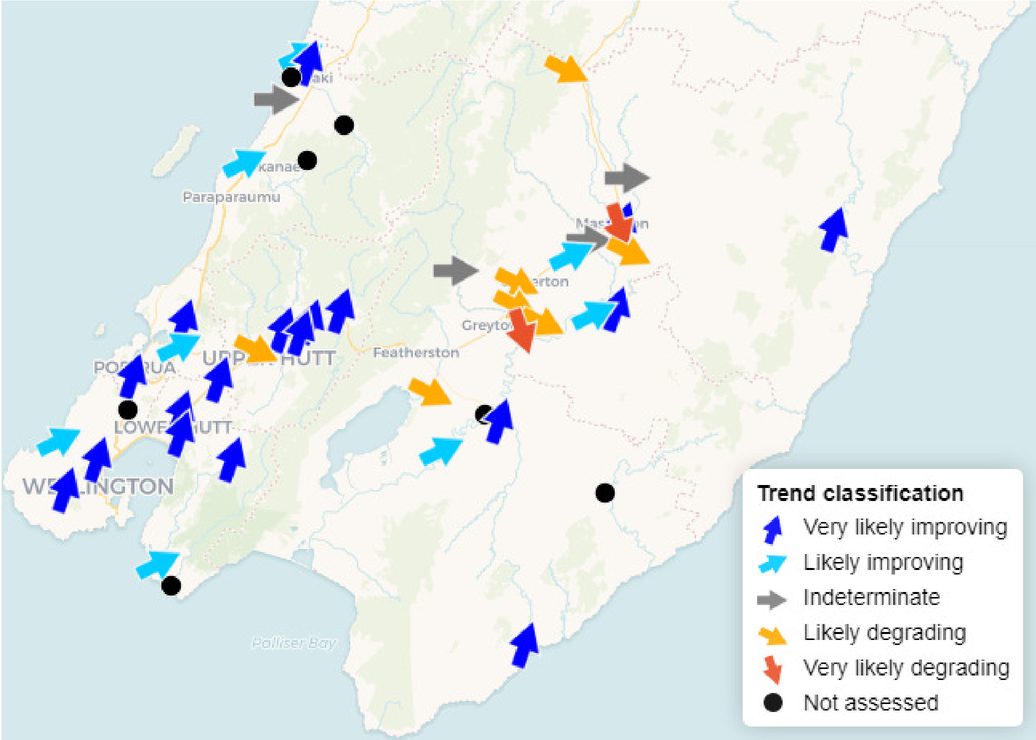

Figure 5: Total nitrogen 10-yr trends

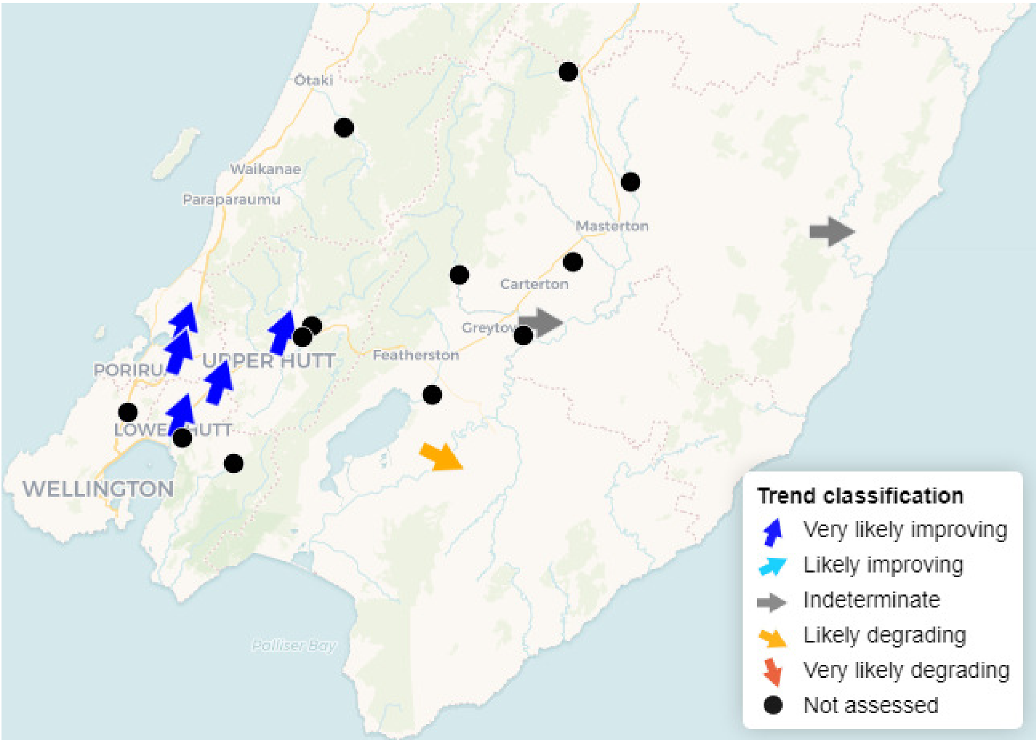

Figure 6: Total nitrogen flow adjusted 10-yr trends

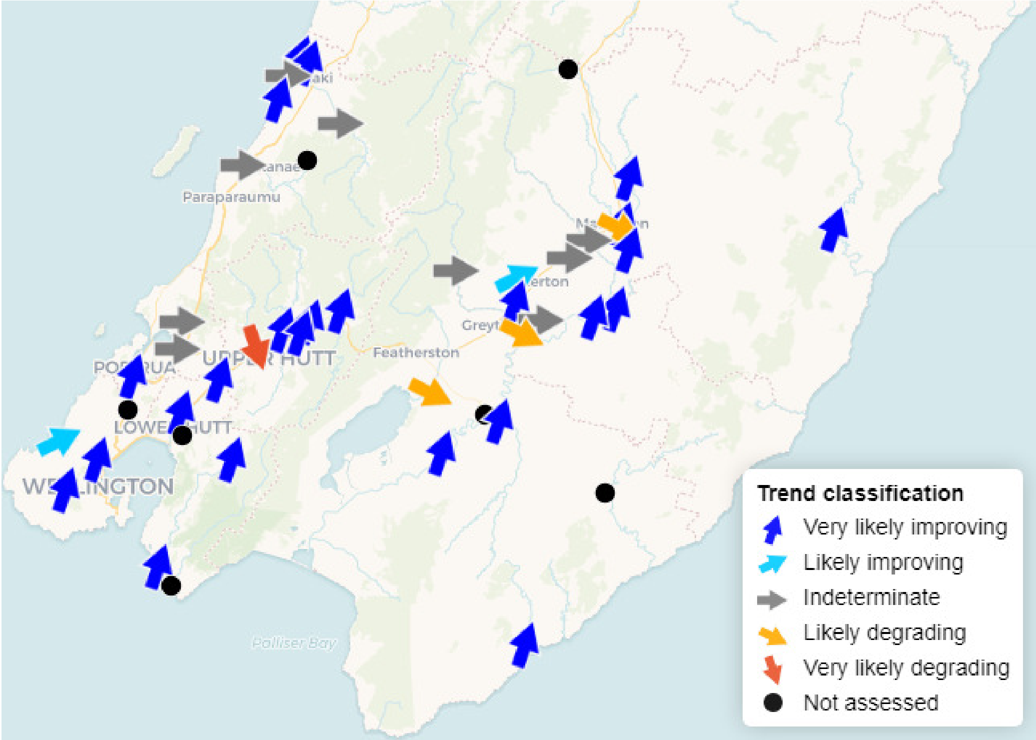

Figure 7: Total nitrogen 15-yr trends

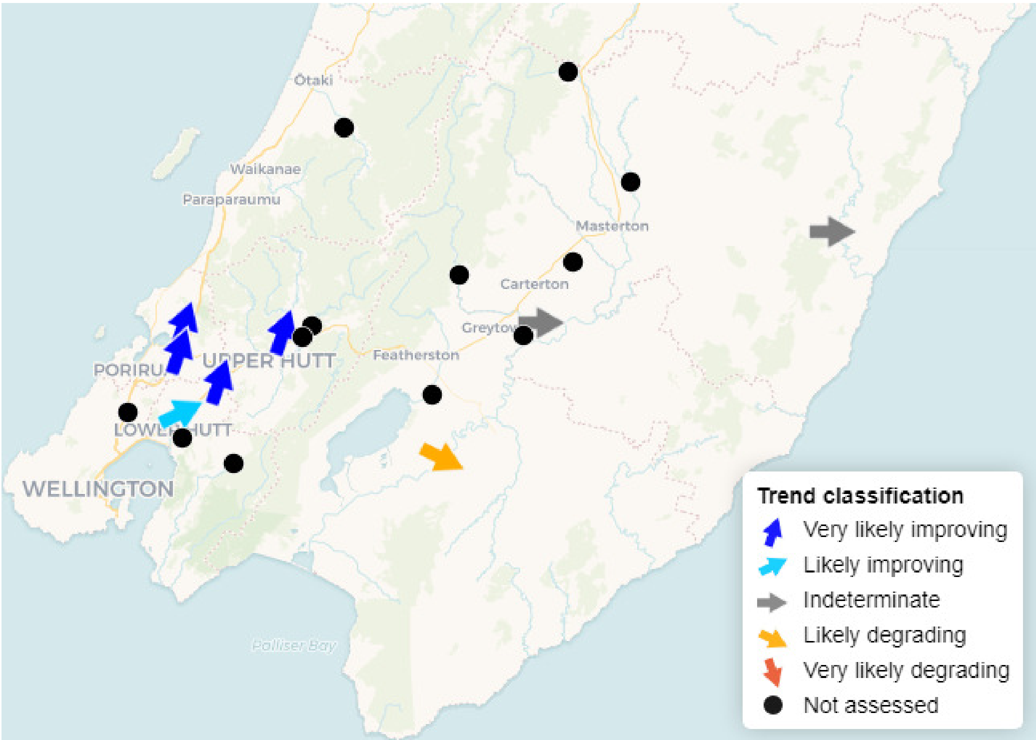

Figure 8: Total nitrogen flow adjusted 15-yr trends

Total Kjeldahl nitrogen

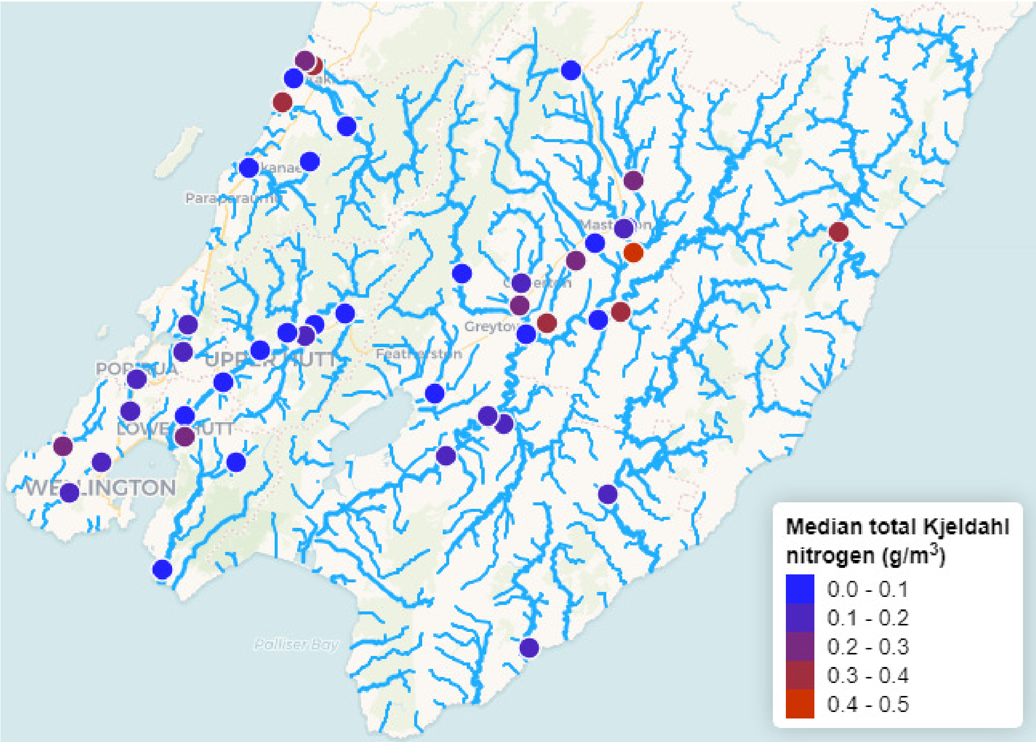

Figure 9: Total Kjeldahl nitrogen (g/m^3) results for the period 2019/20 to 2021/22

Dissolved inorganic nitrogen

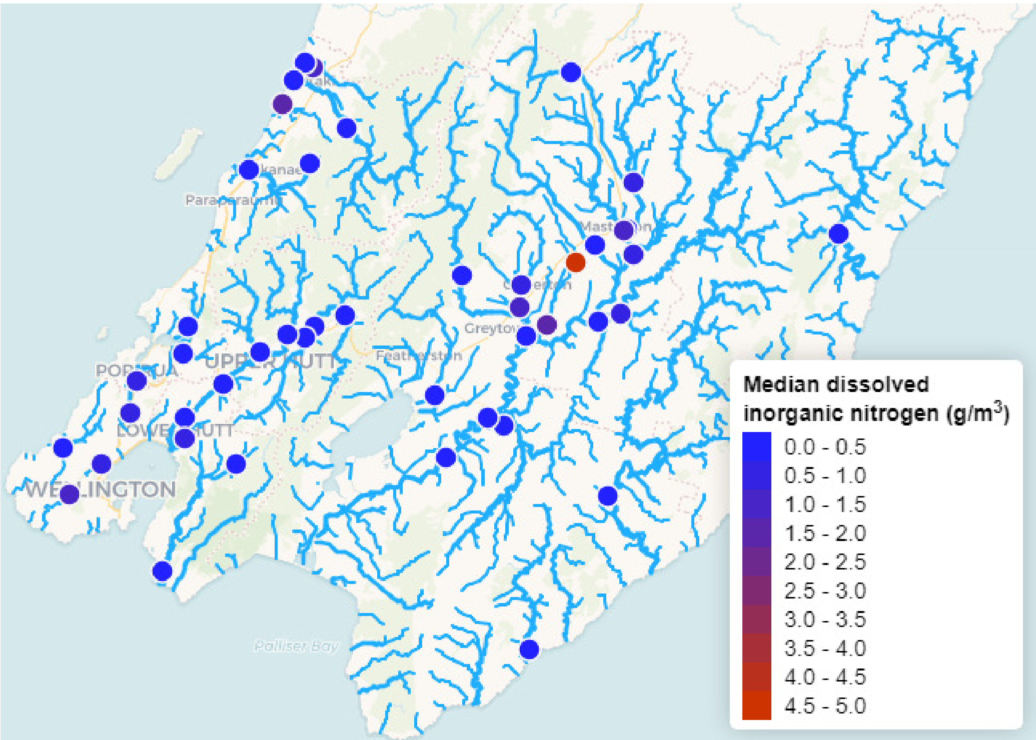

Figure 10: Dissolved inorganic nitrogen (g/m^3) results for the period 2017/18 to 2021/22

Ammoniacal nitrogen (pH adjusted)

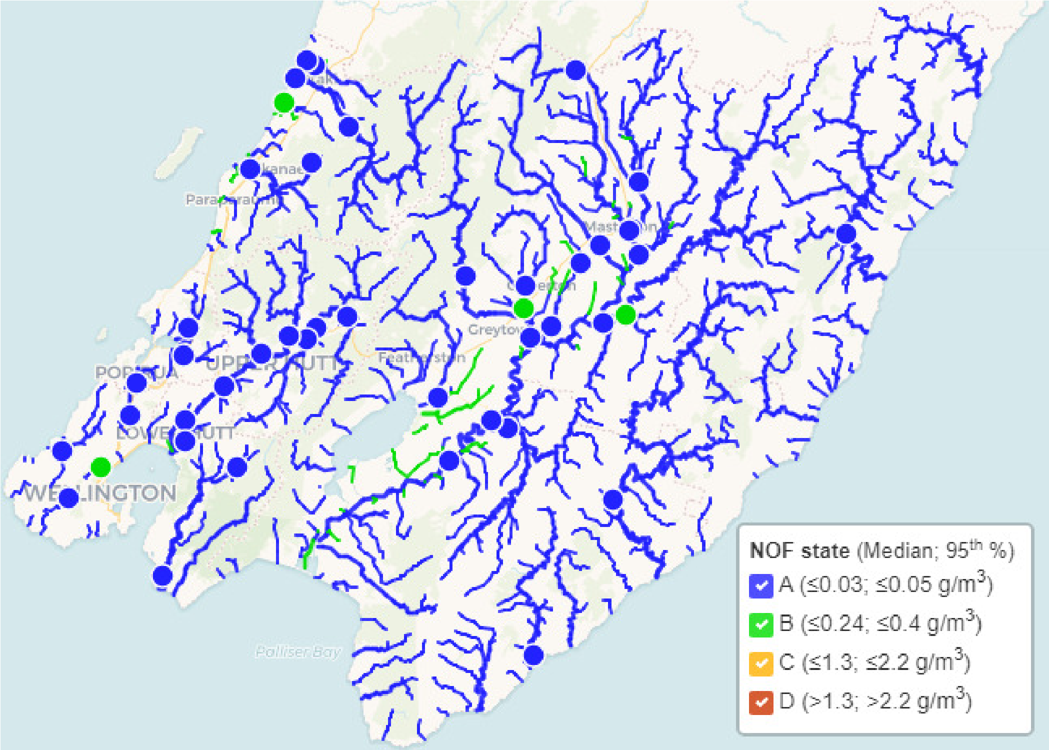

Figure 11: Ammoniacal nitrogen (pH adjusted g/m^3) NOF states for the period 2019/20 to 2021/22. See the methods nutrients benchmarking section for details.

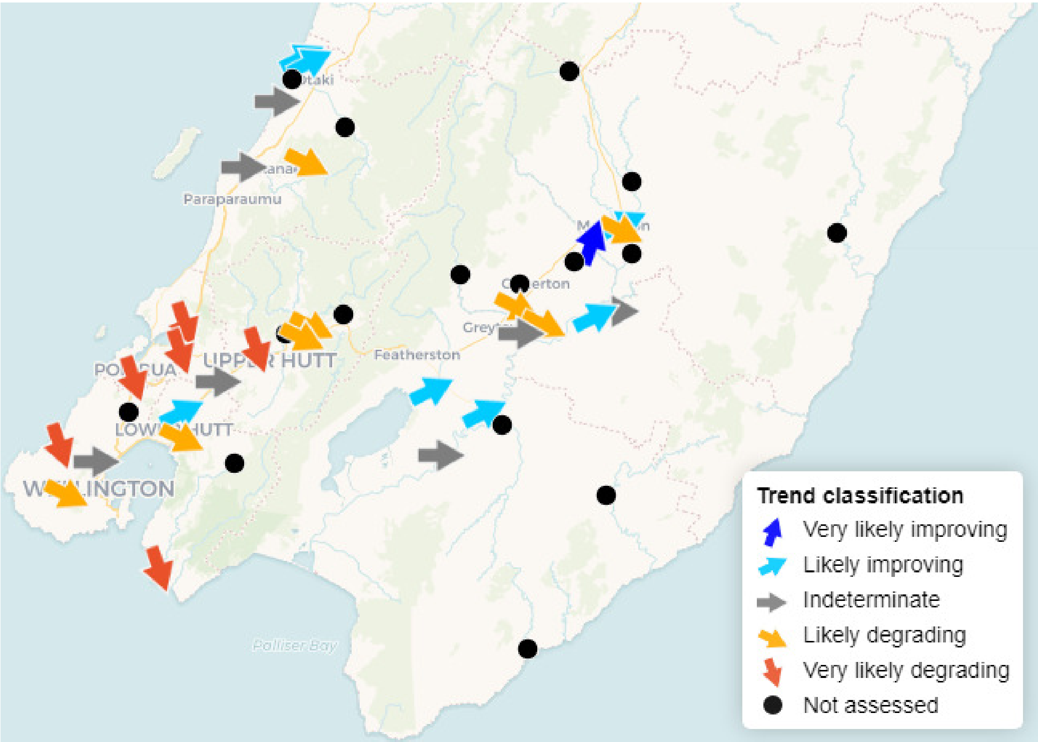

Figure 12: Ammoniacal nitrogen 5-yr trends

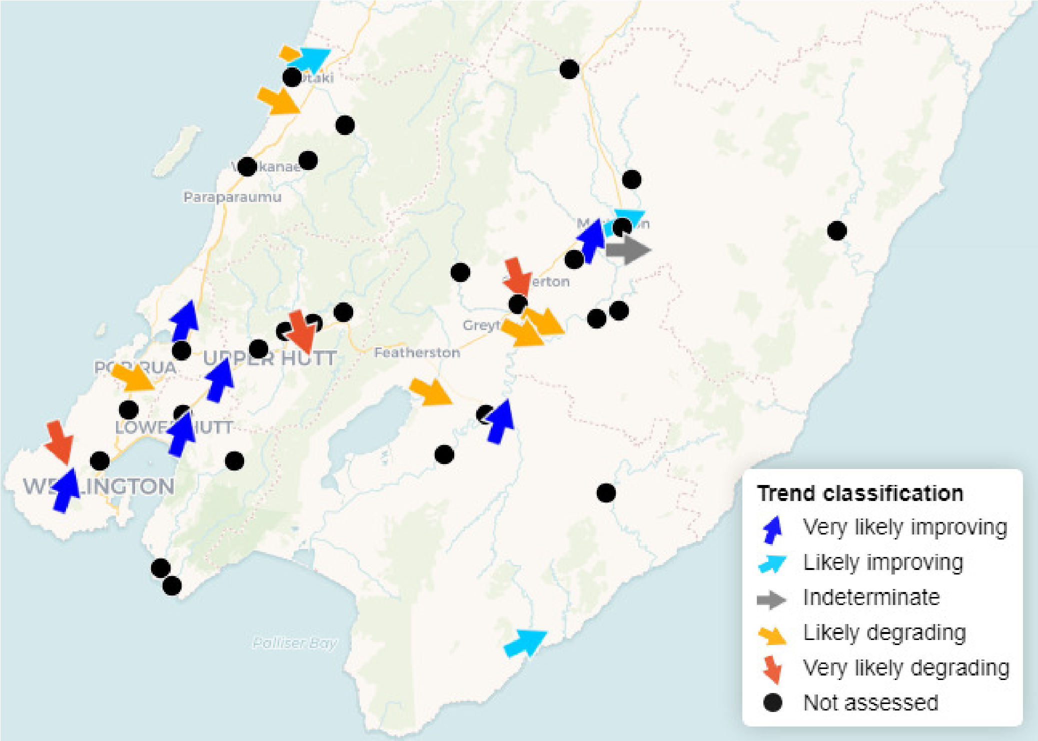

Figure 13: Ammoniacal nitrogen 10-yr trends

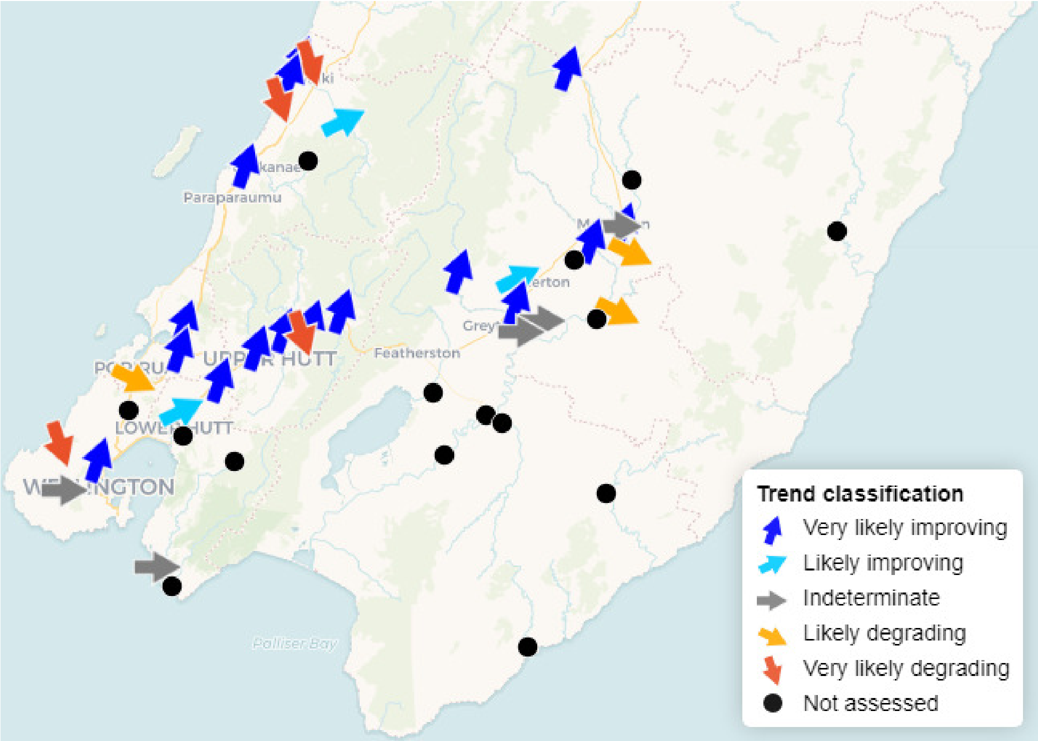

Figure 14: Ammoniacal nitrogen 15-yr trends

Nitrite nitrogen

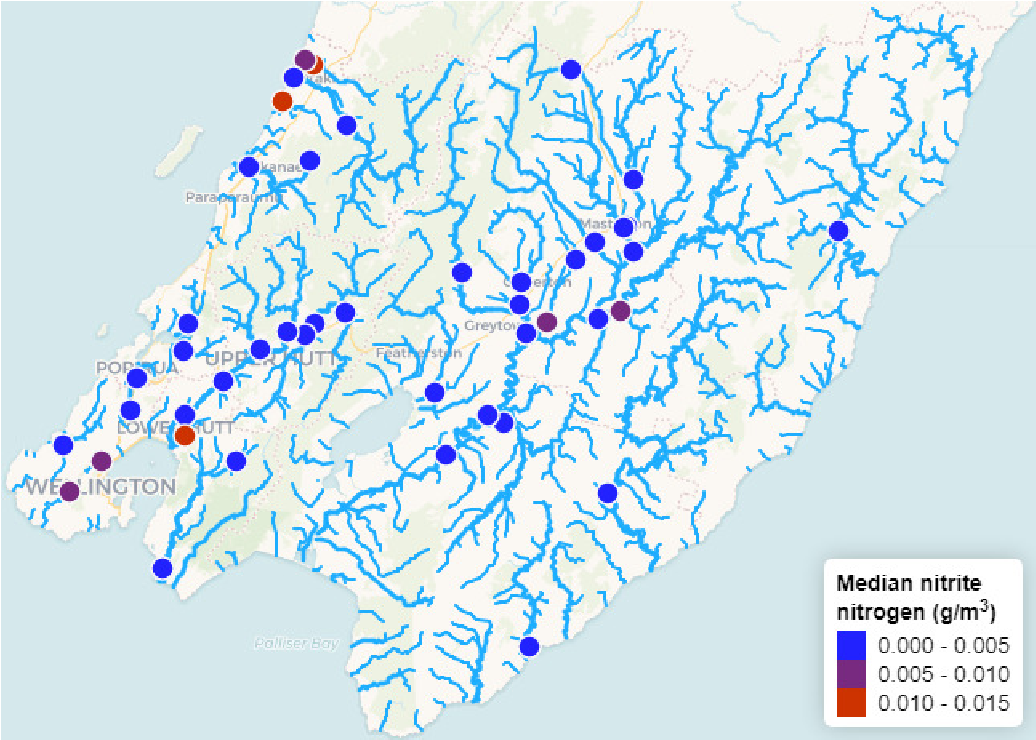

Figure 15: Nitrite nitrogen (g/m^3) results for the period 2019/20 to 2021/22

Nitrate nitrogen

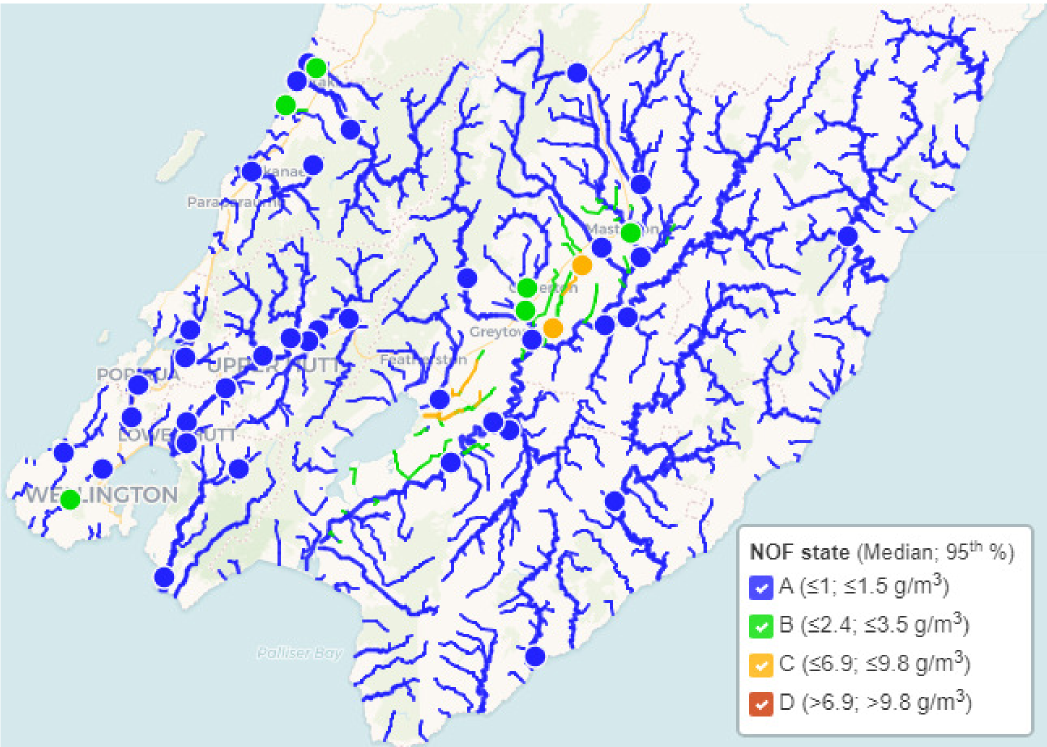

Figure 16: Nitrate nitrogen (g/m^3) NOF states for the period 2019/20 to 2021/22. See the methods nutrients benchmarking section for details.

Nitrite-nitrate nitrogen

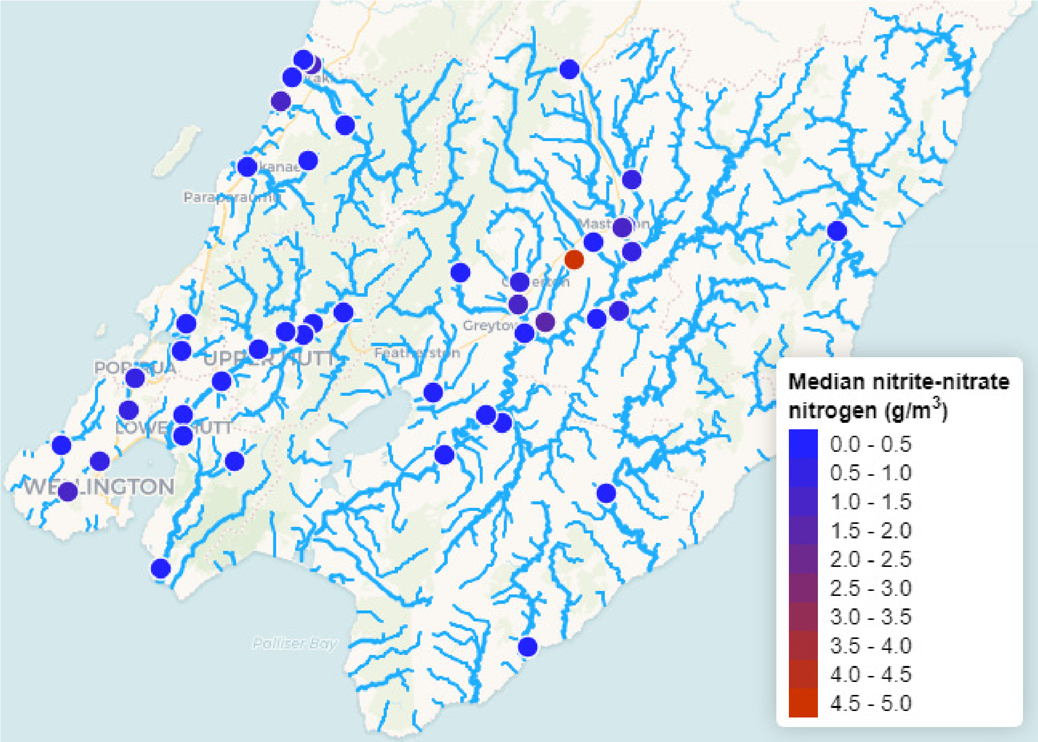

Figure 17: Nitrite-nitrate nitrogen (g/m^3) results for the period 2019/20 to 2021/22

Total phosphorus

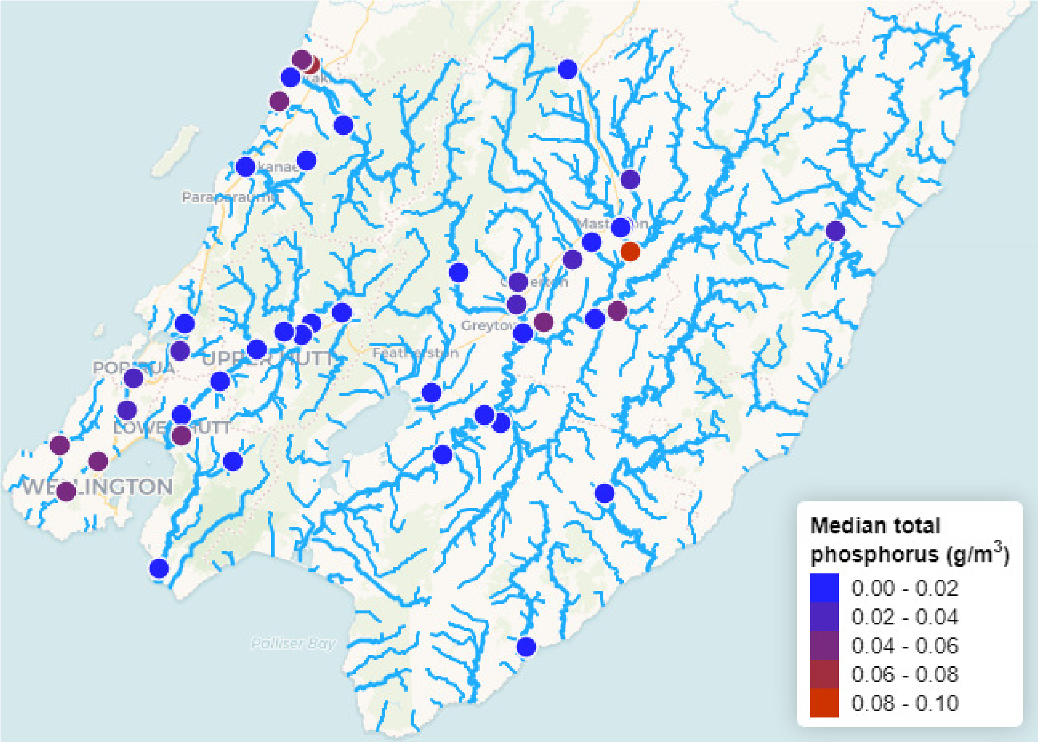

Figure 18: Total phosphorus (g/m^3) results for the period 2019/20 to 2021/22

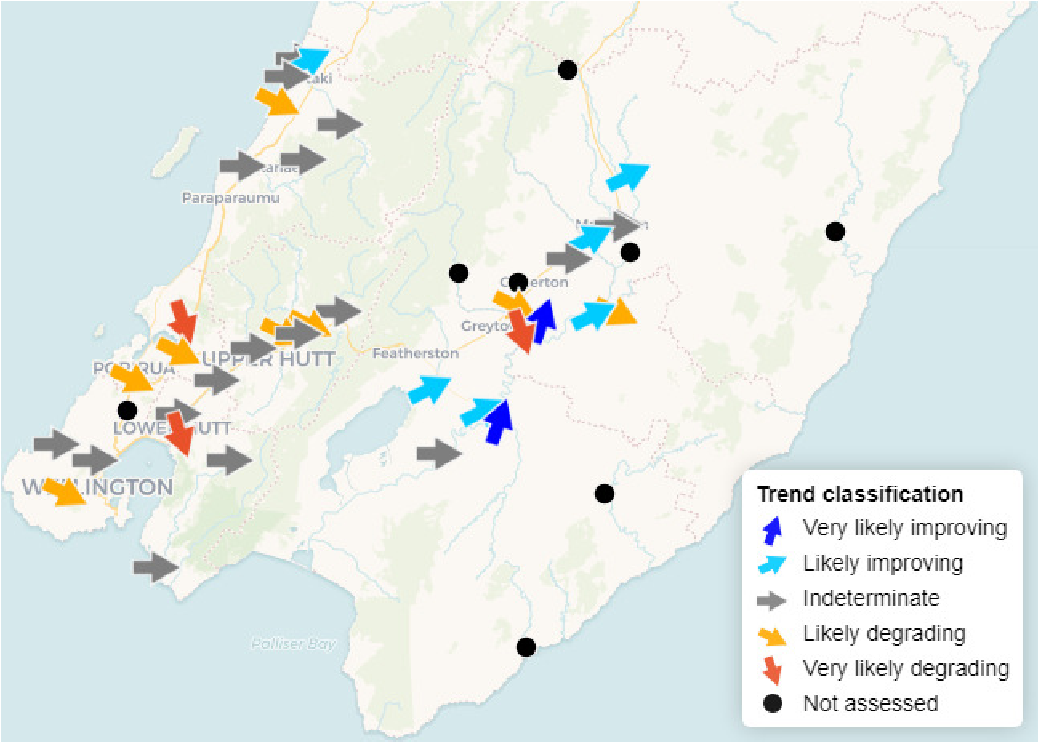

Figure 19: Total phosphorus 5-yr trends

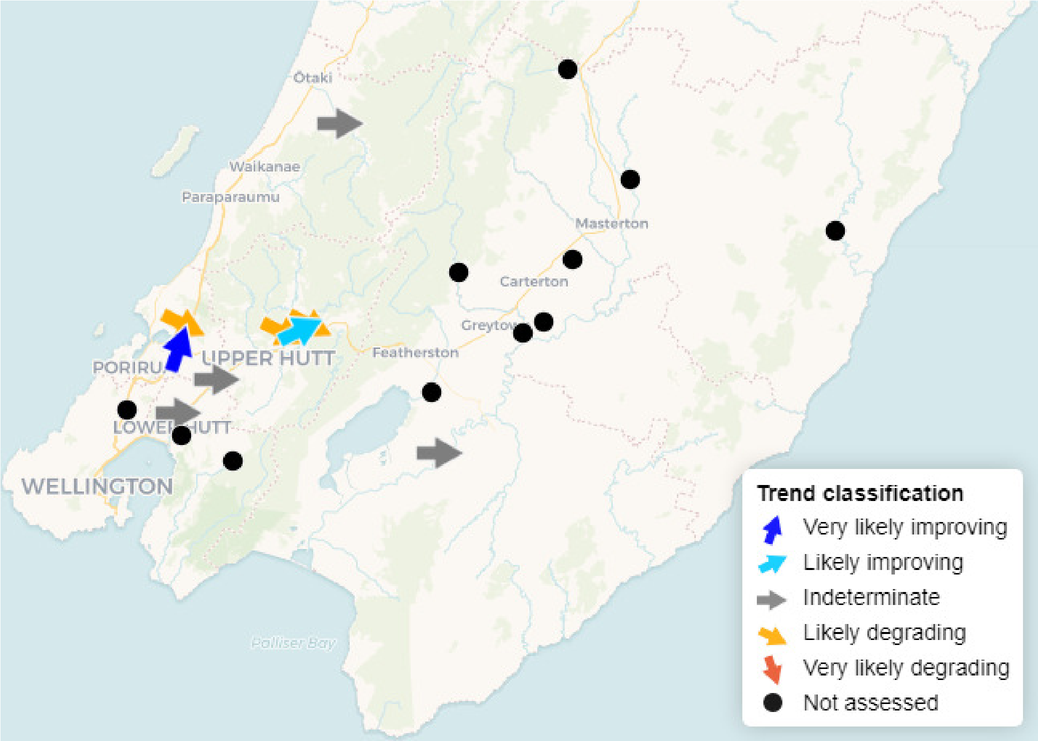

Figure 20: Total phosphorus flow adjusted 5-yr trends

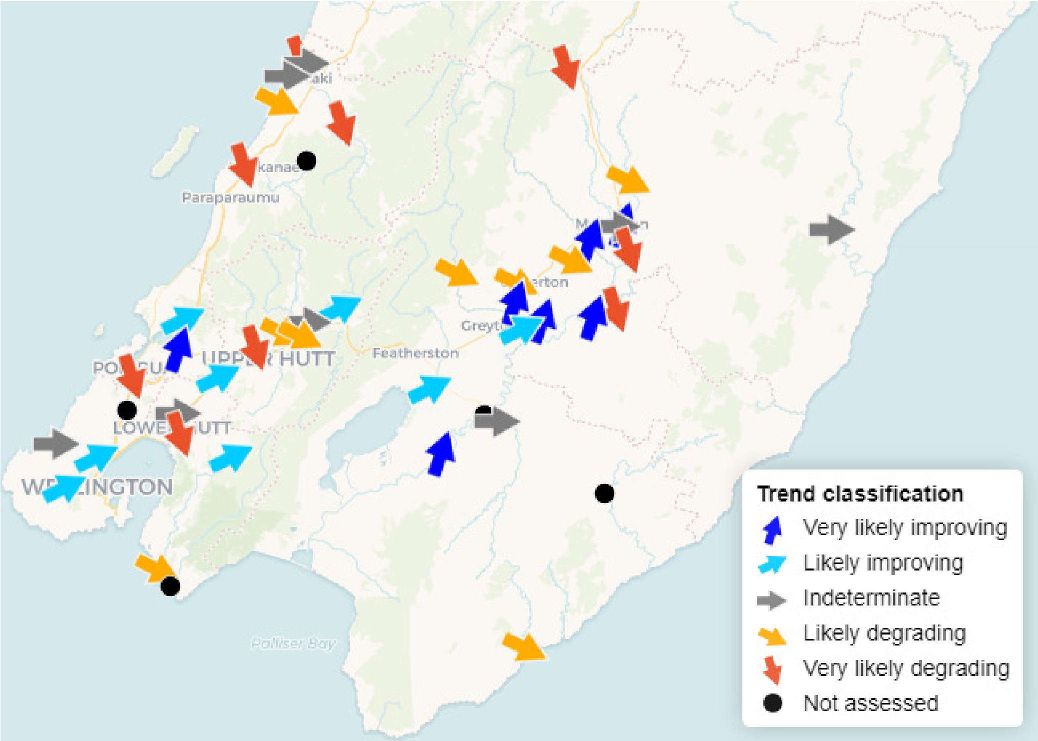

Figure 21: Total phosphorus 10-yr trends

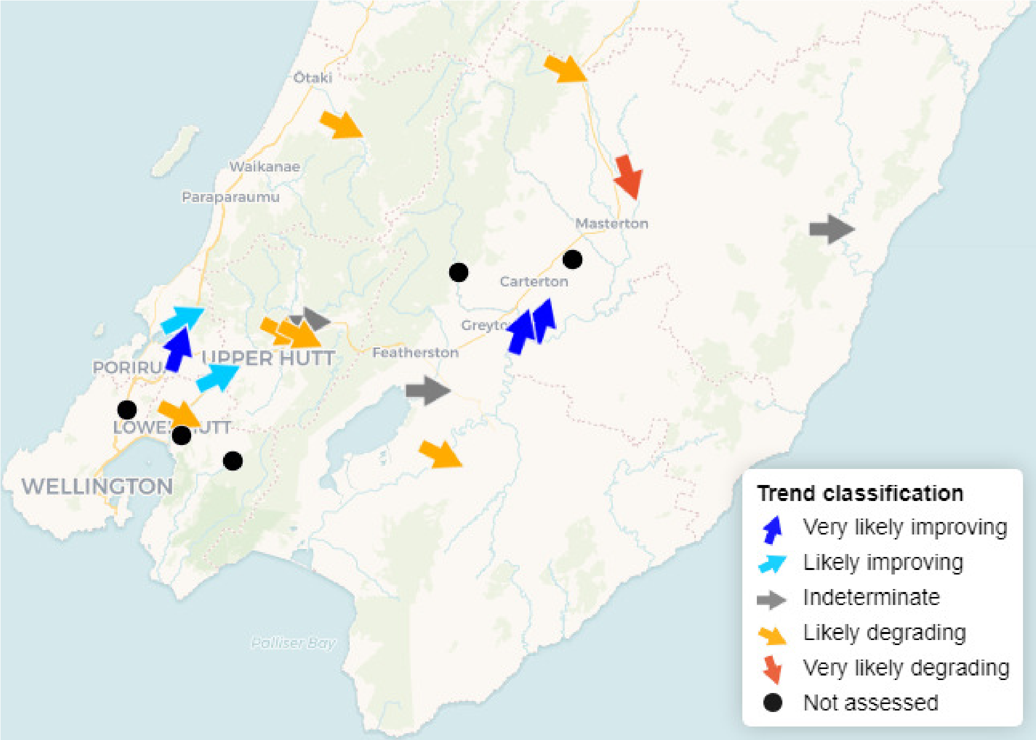

Figure 22: Total phosphorus flow adjusted 10-yr trends

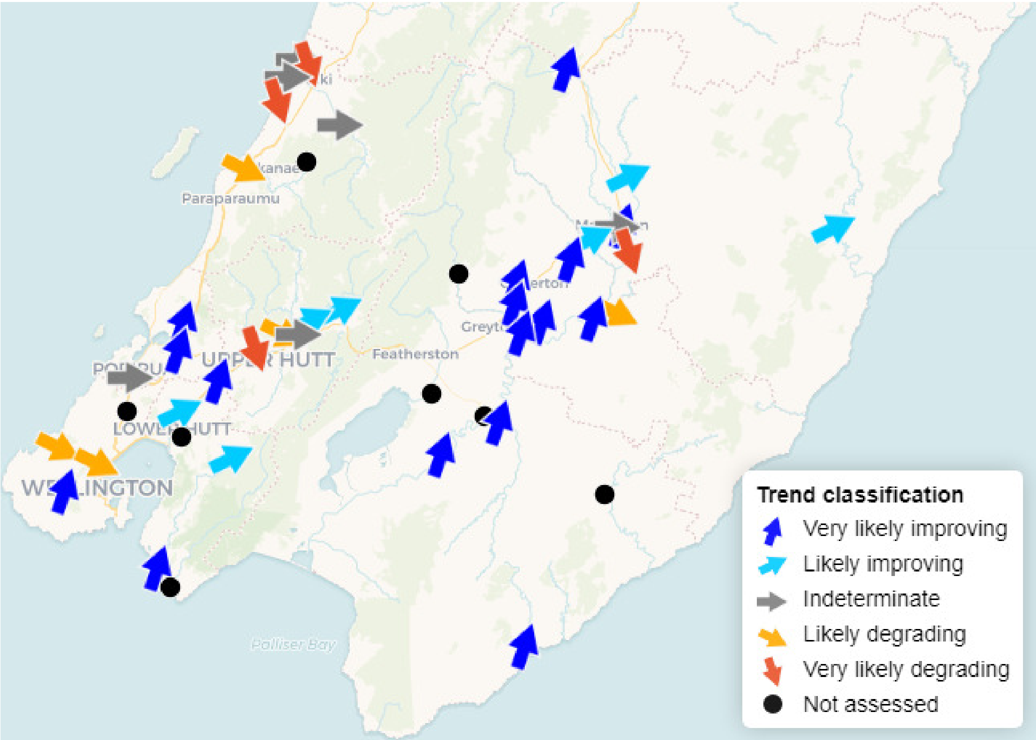

Figure 23: Total phosphorus 15-yr trends

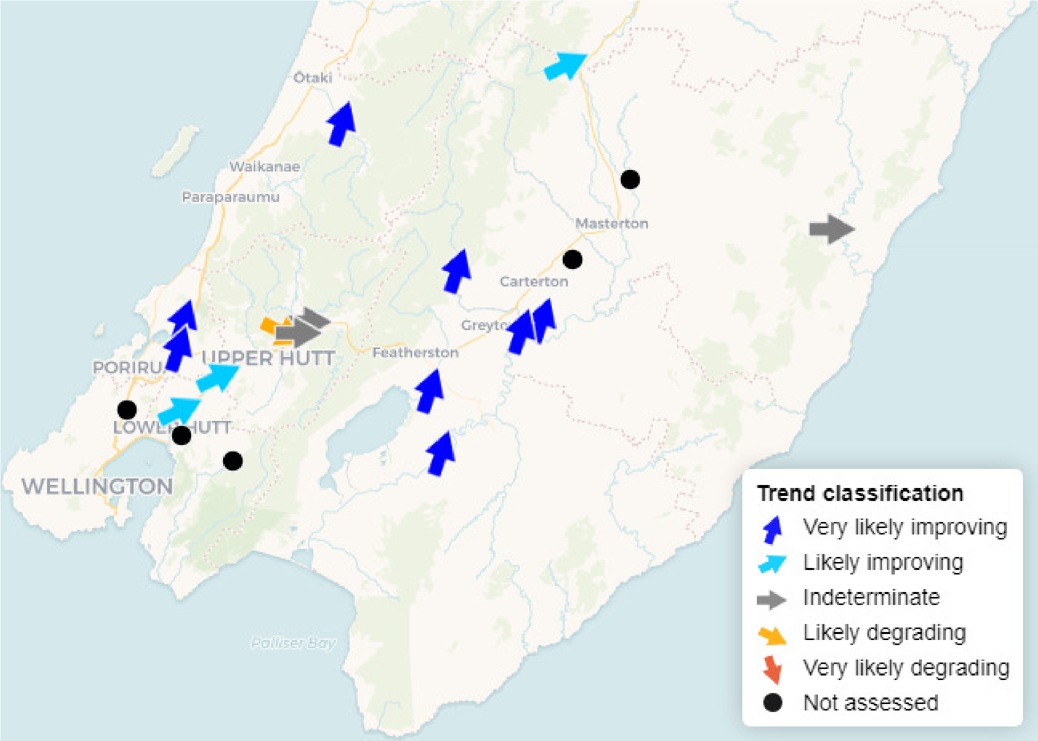

Figure 24: Total phosphorus flow adjusted 15-yr trends

Dissolved reactive phosphorus

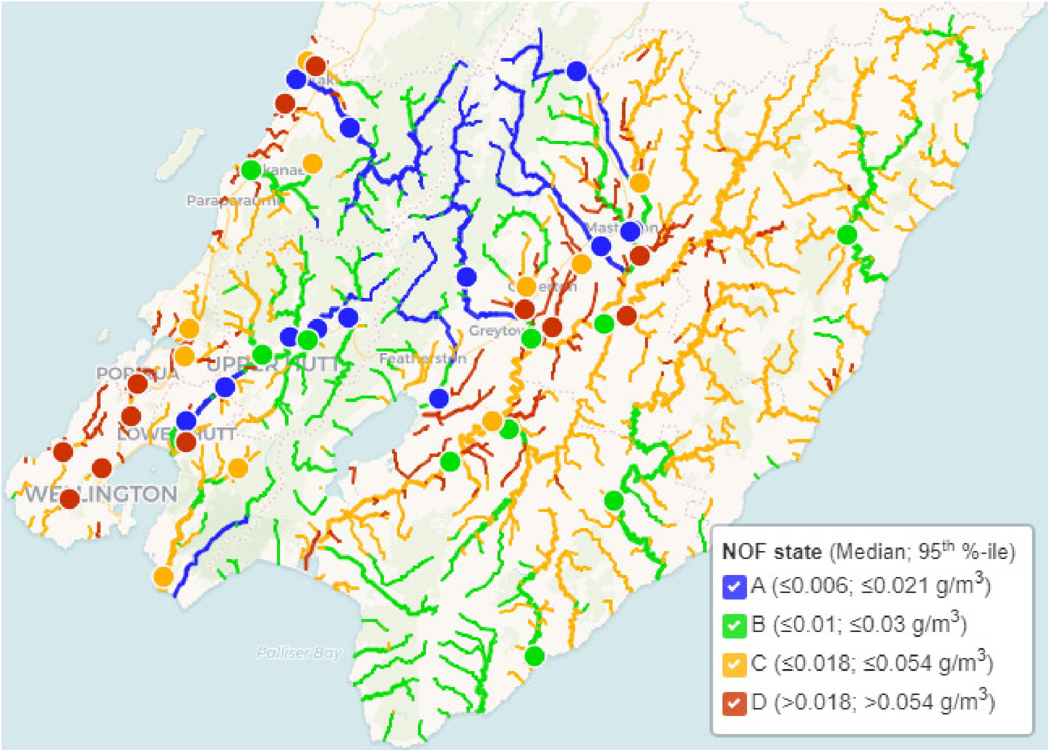

Figure 25: Dissolved reactive phosphorus (g/m^3) NOF states for the period 2017/18 to 2021/22. See the methods nutrients benchmarking section for details.

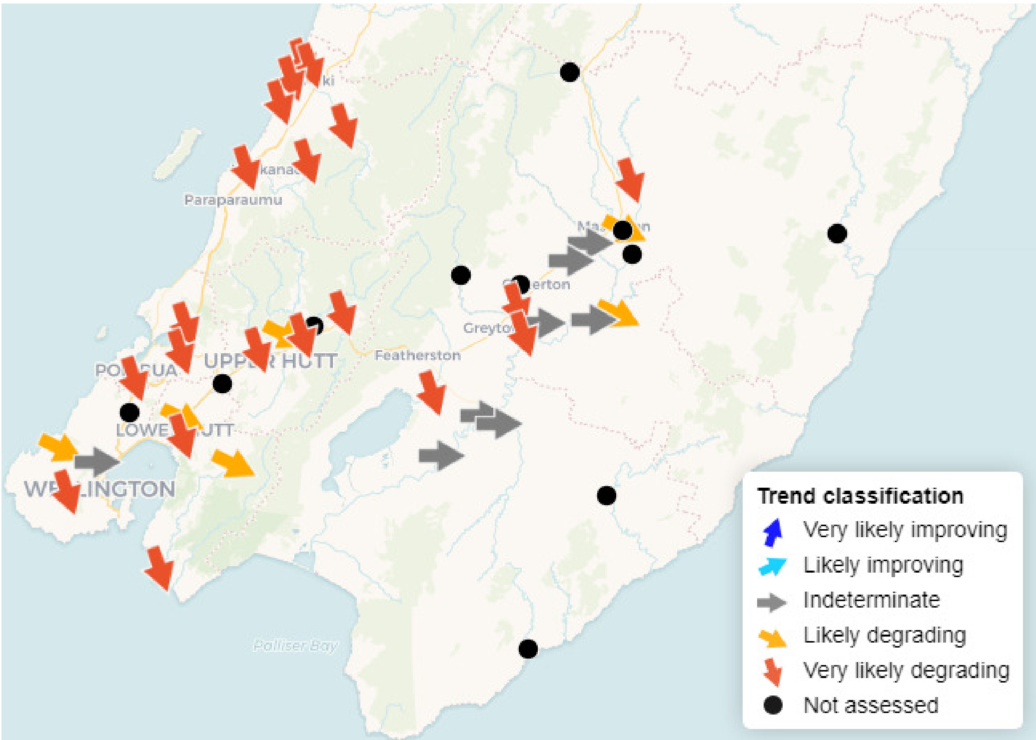

Figure 26: Dissolved reactive phosphorus 5-yr trends

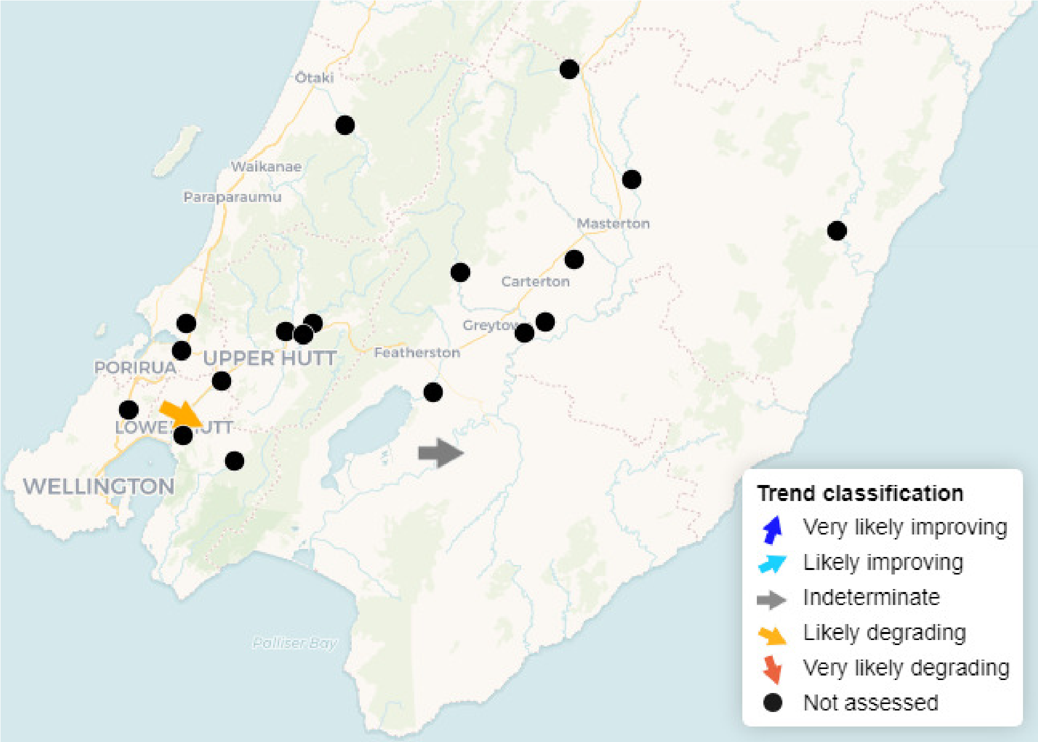

Figure 27: Dissolved reactive phosphorus flow adjusted 5-yr trends

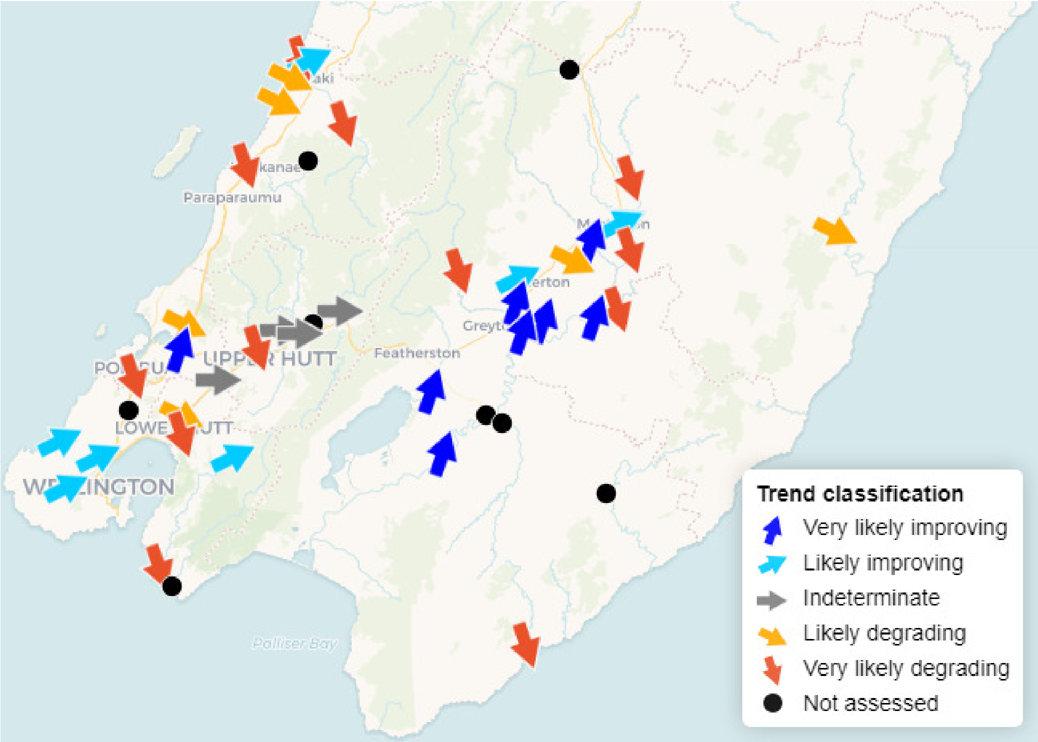

Figure 28: Dissolved reactive phosphorus 10-yr trends

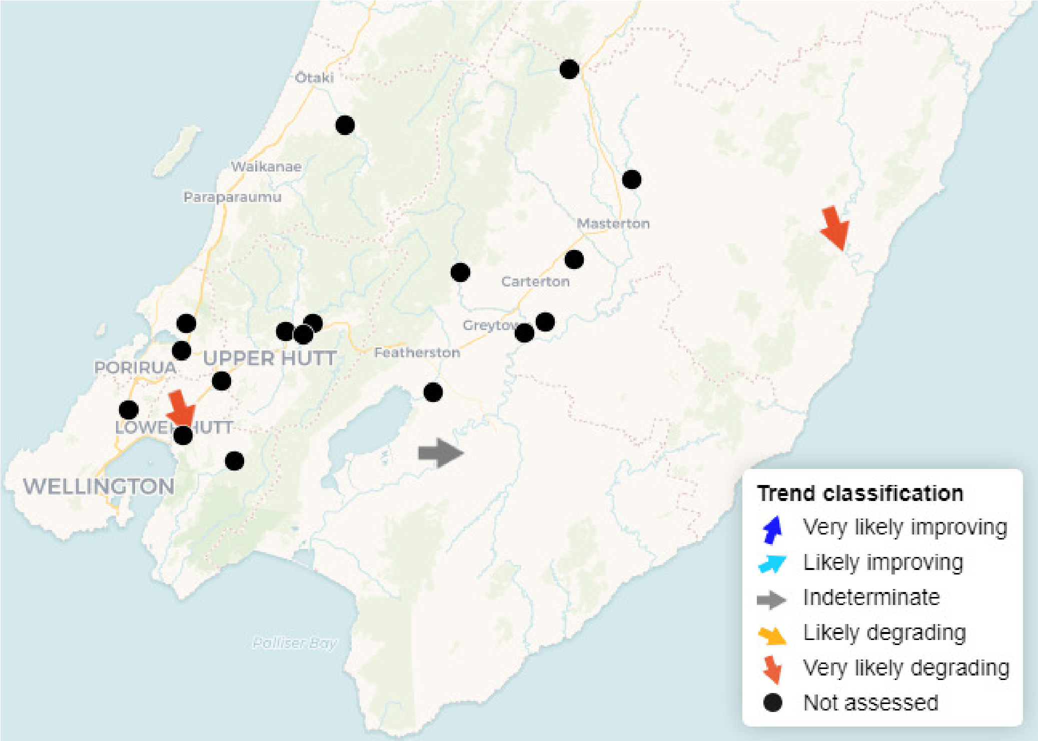

Figure 29: Dissolved reactive phosphorus flow adjusted 10-yr trends

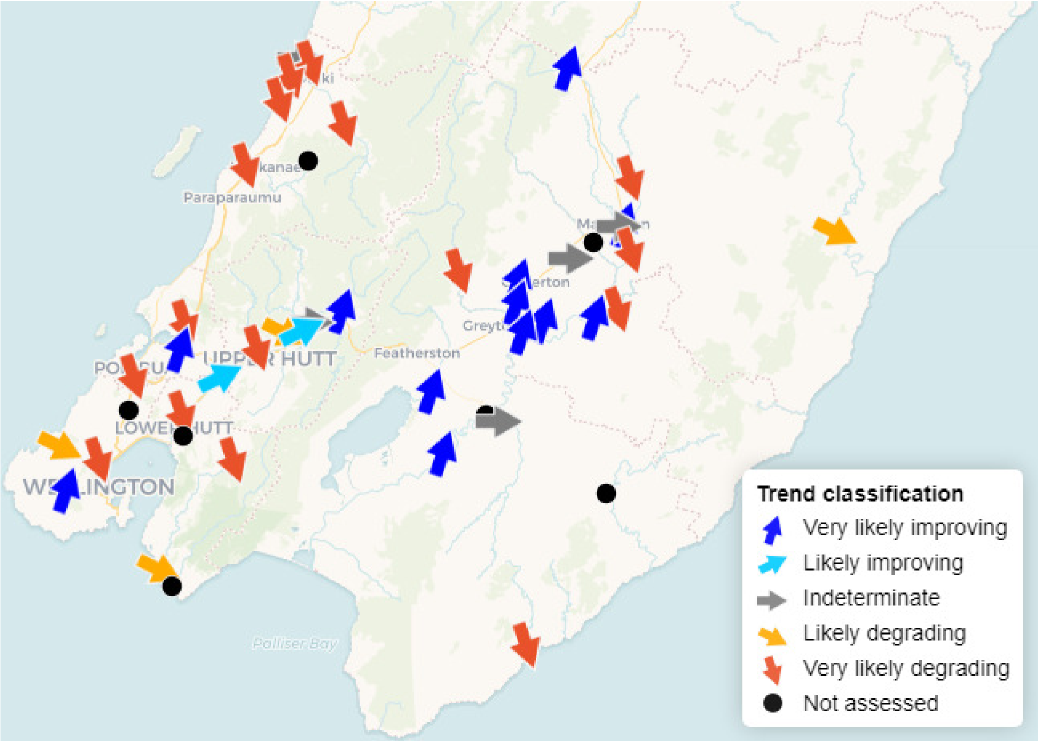

Figure 30: Dissolved reactive phosphorus 15-yr trends

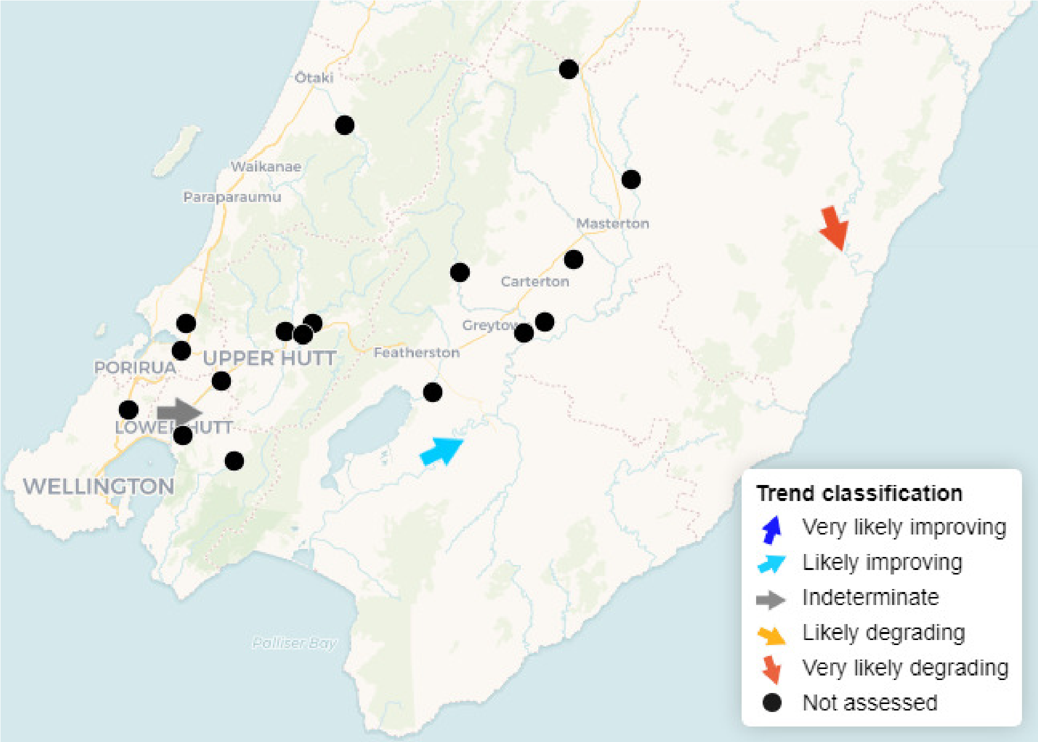

Figure 31: Dissolved reactive phosphorus flow adjusted 15-yr trends

Metals

Dissolved copper

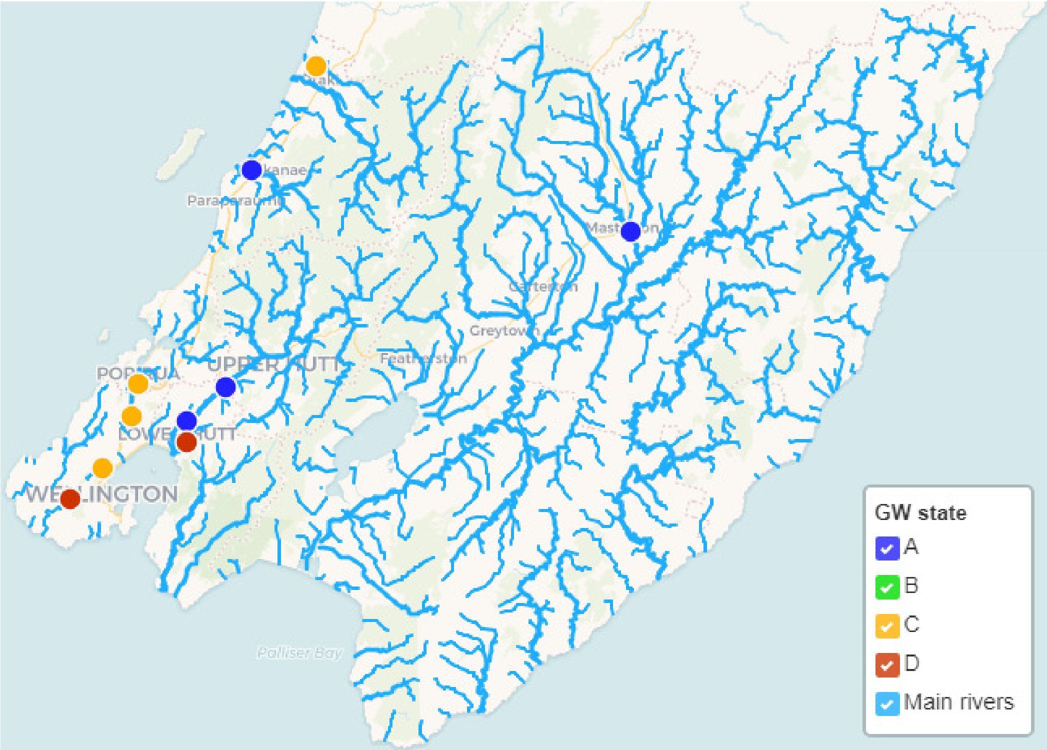

Figure 32: Dissolved copper (g/m^3) GW states for the period 2019/20 to 2021/22. See the methods metals benchmarking section for details.

Dissolved zinc

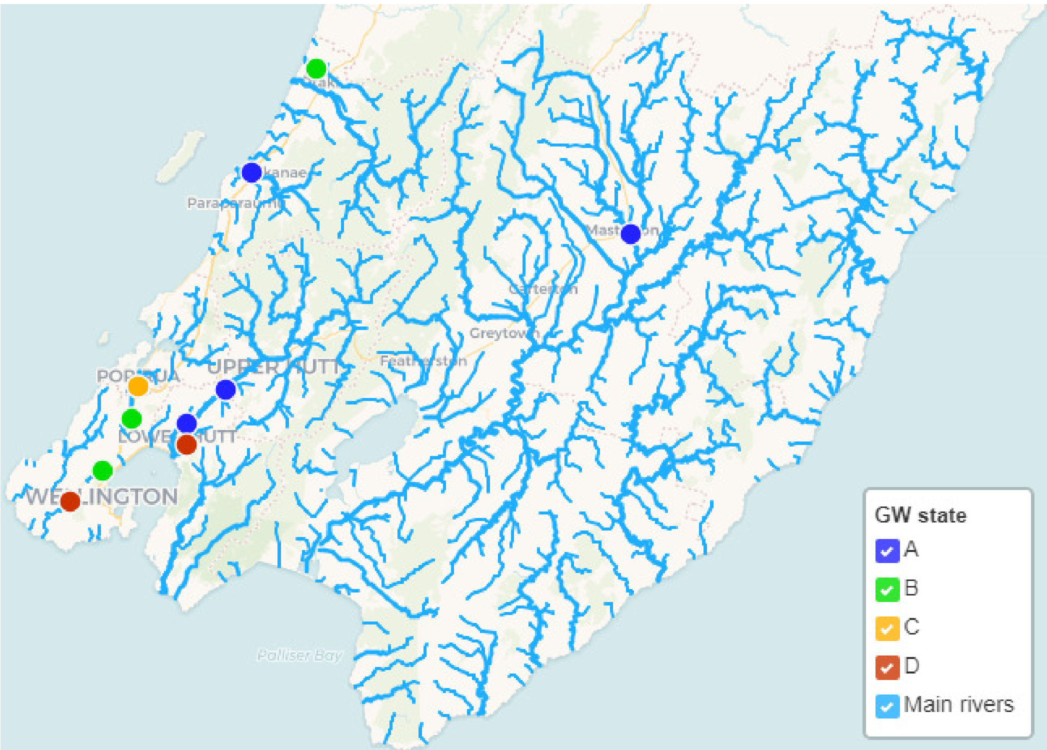

Figure 33: Dissolved copper (g/m^3) GW states for the period 2019/20 to 2021/22. See the methods metals benchmarking section for details.

Microbiology

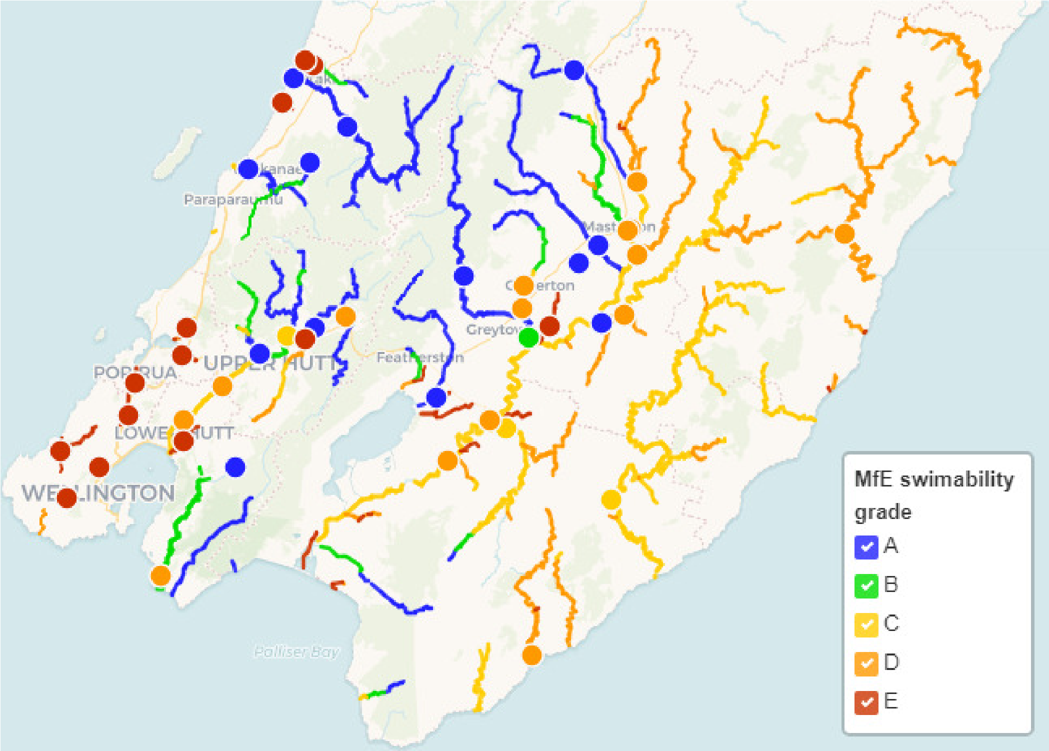

Figure 34: *E. coli* (cfu/100ml) MfE swimability grades for the period 2017/18 to 2021/22. See the methods *E. coli* benchmarking section for details.

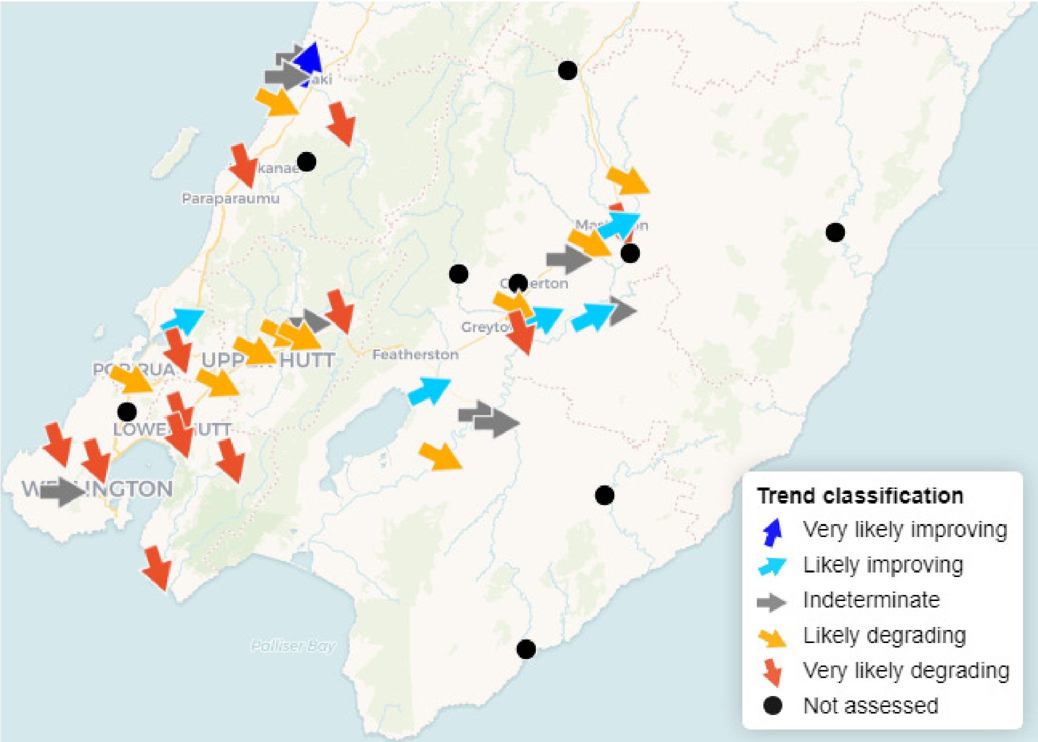

Figure 35: *E. coli* 5-yr trends

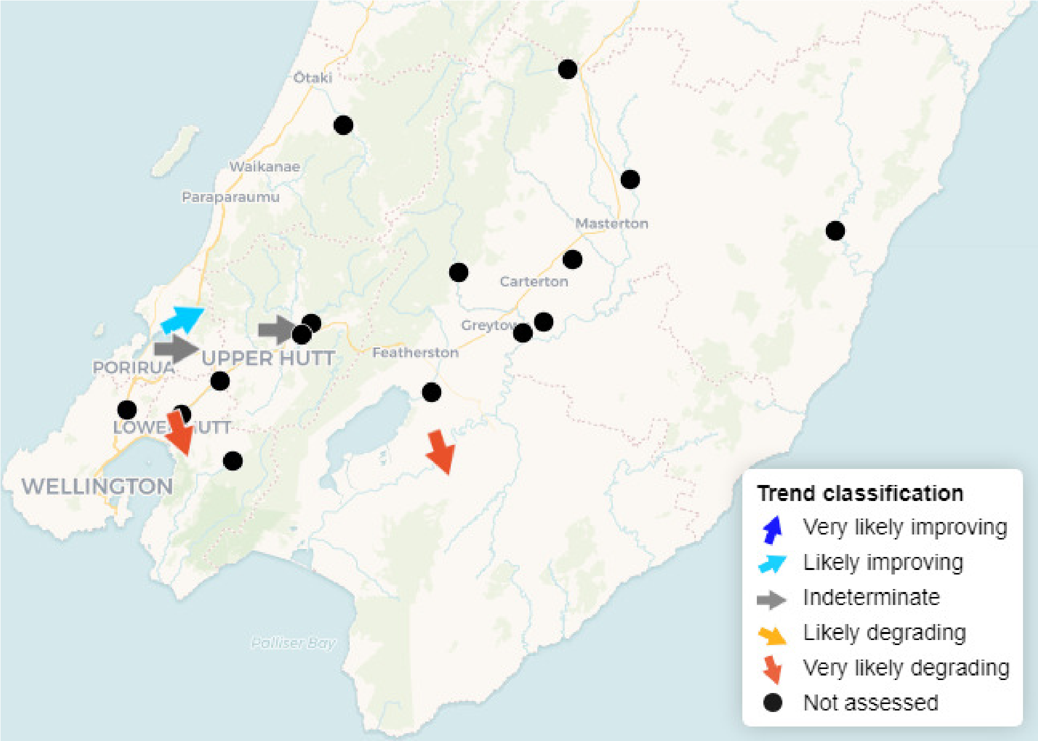

Figure 36: *E. coli* flow adjusted 5-yr trends

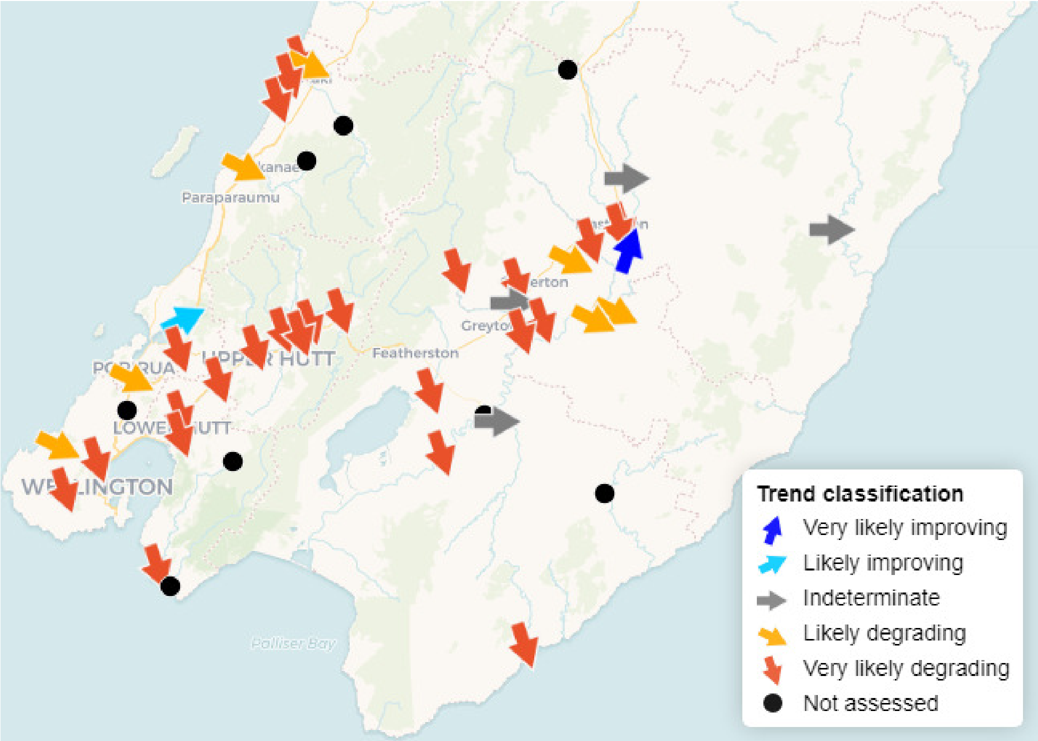

Figure 37: *E. coli* 10-yr trends

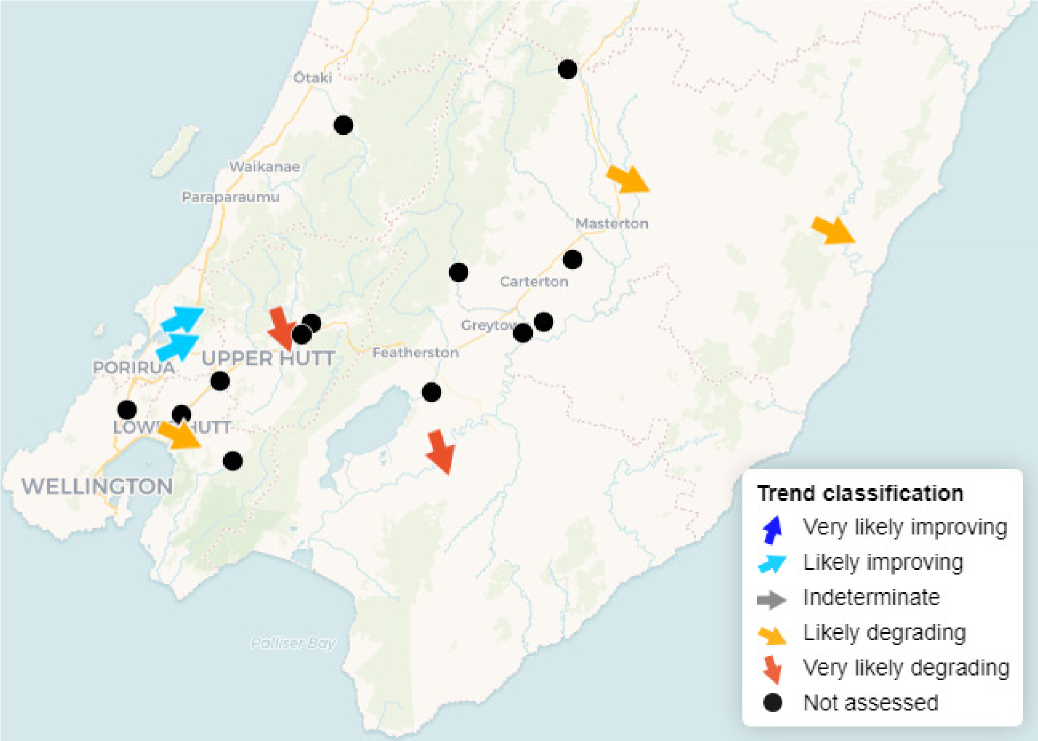

Figure 38: *E. coli* flow adjusted 10-yr trends

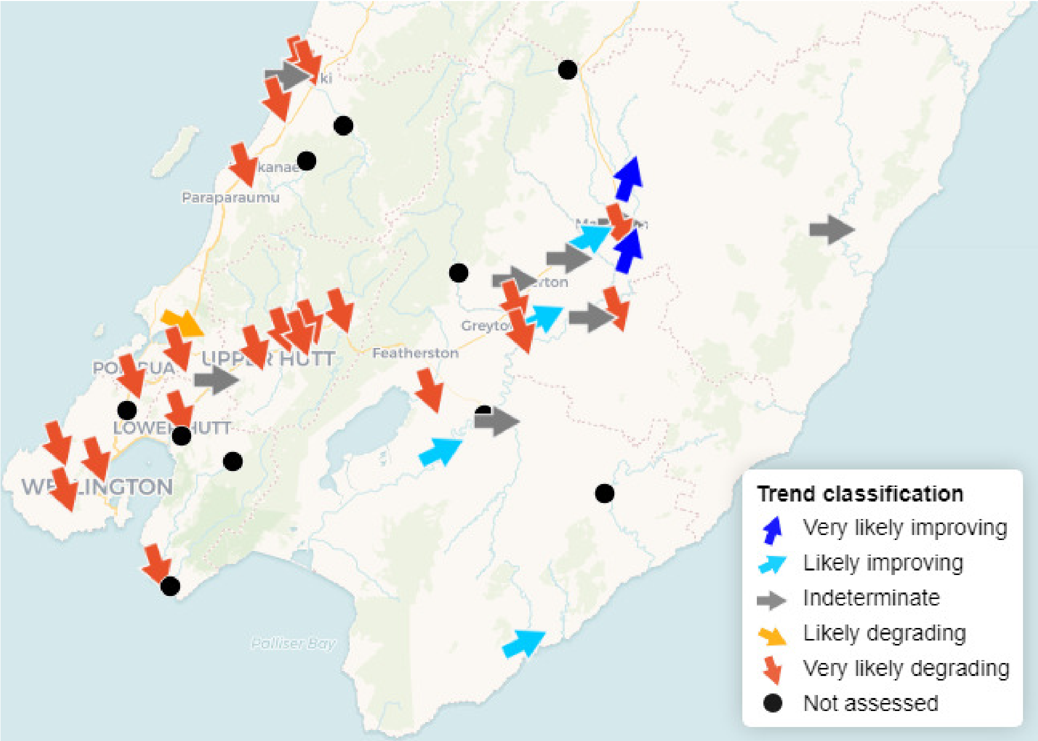

Figure 39: *E. coli* 15-yr trends

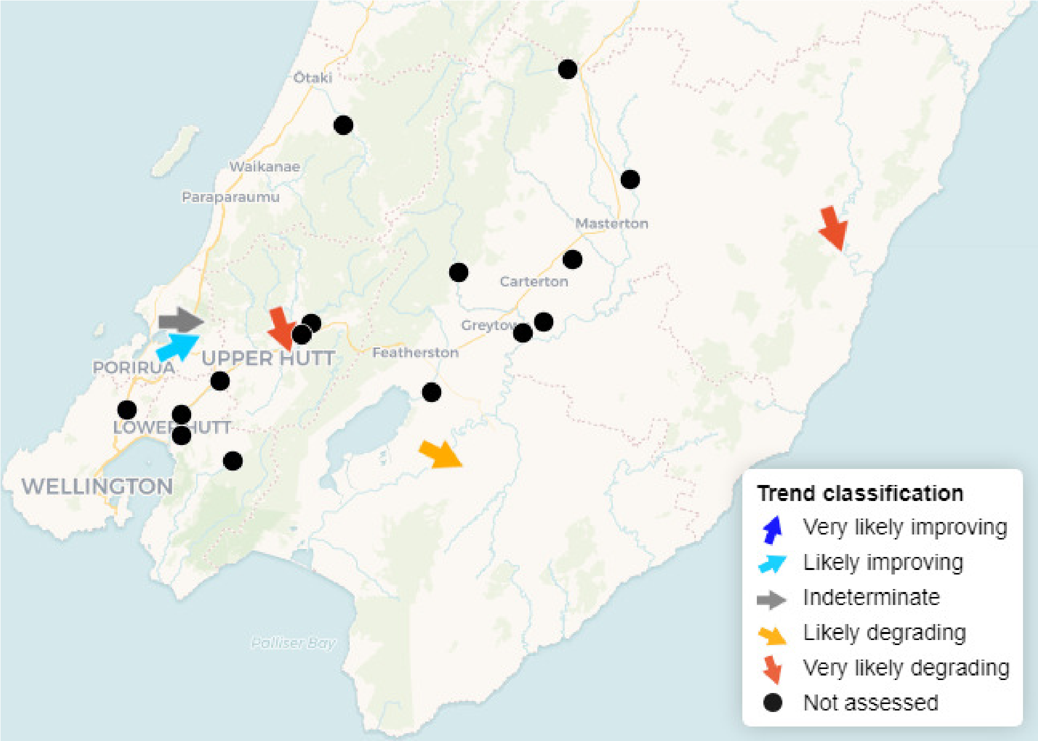

Figure 40: *E. coli* flow adjusted 15-yr trends

Sediment

Water clarity

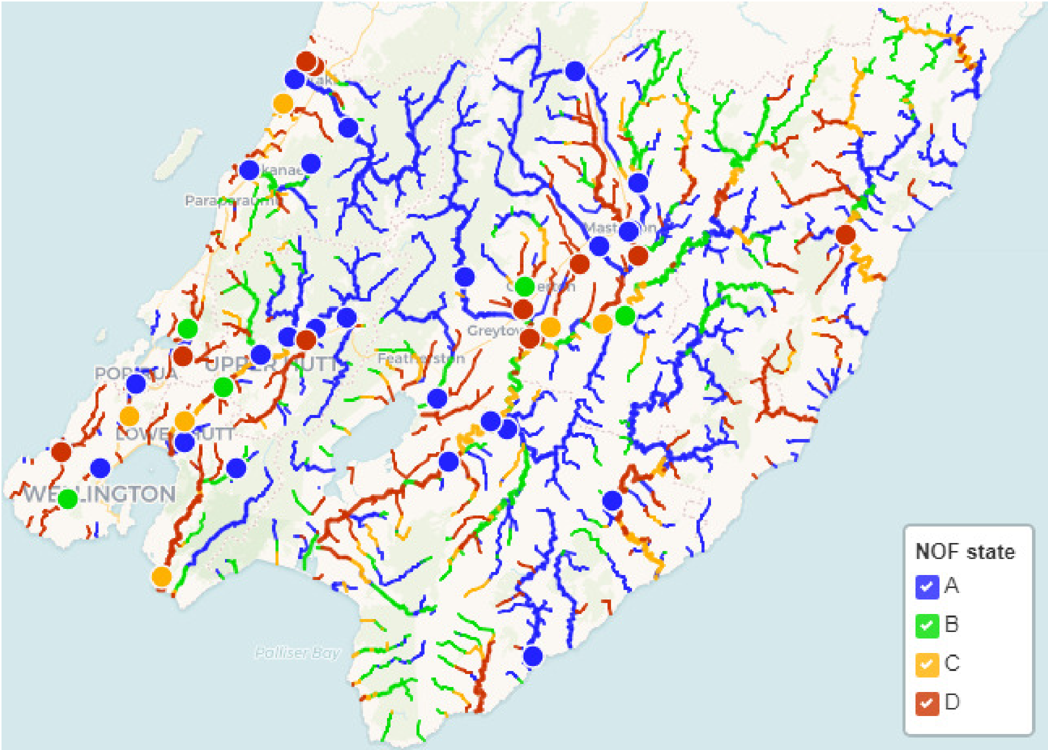

Figure 41: Water clarity (m) NOF states for the period 2017/18 to 2021/22. See the methods sediment benchmarking section for details.

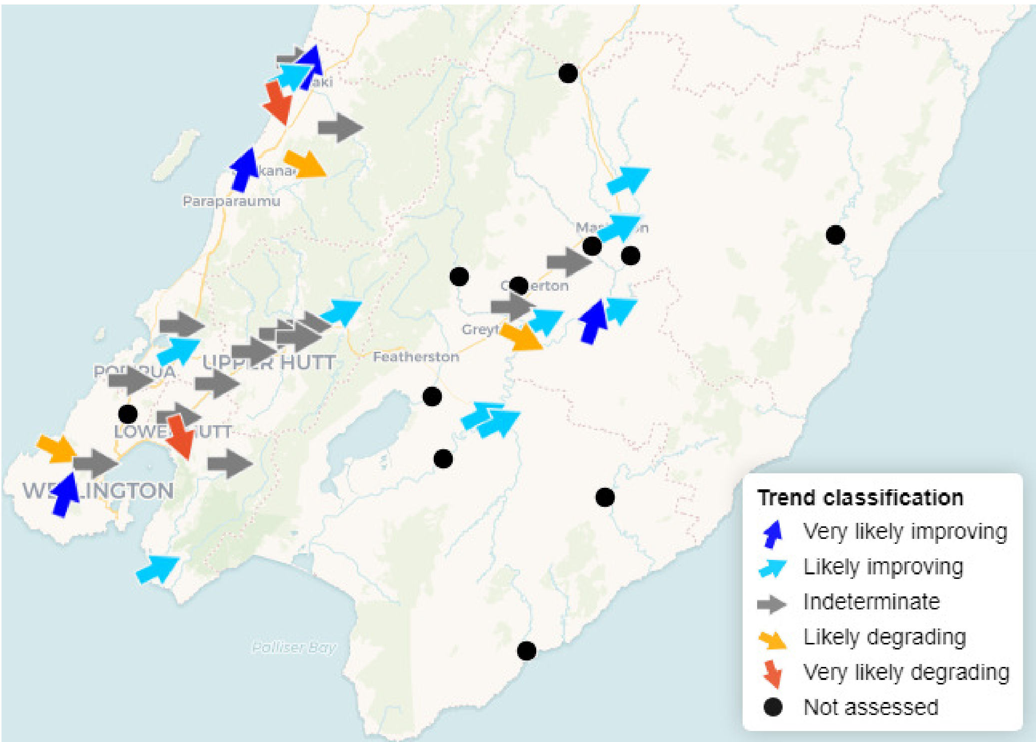

Figure 42: Water clarity 5-yr trends

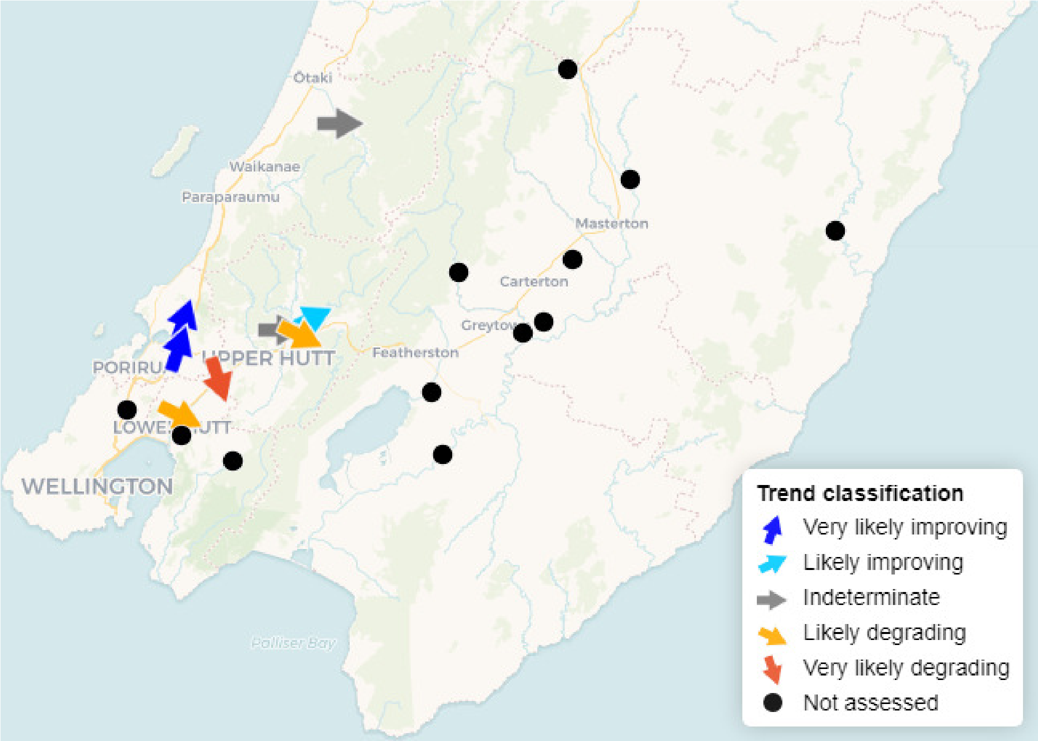

Figure 43: Water clarity flow adjusted 5-yr trends

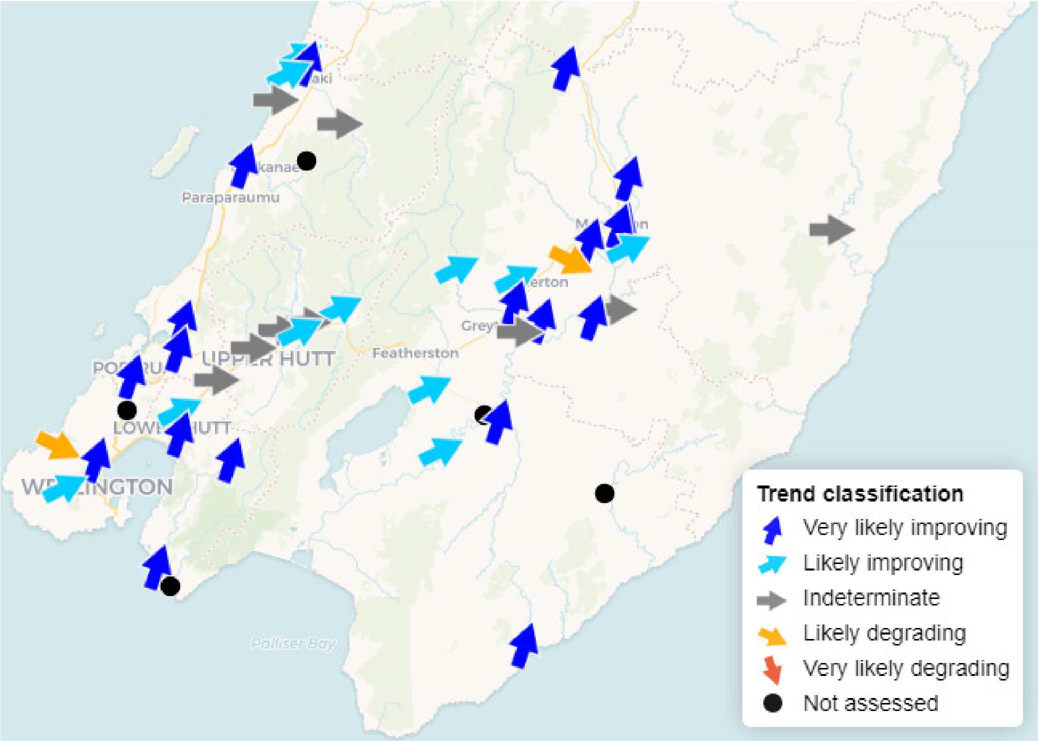

Figure 44: Water clarity 10-yr trends

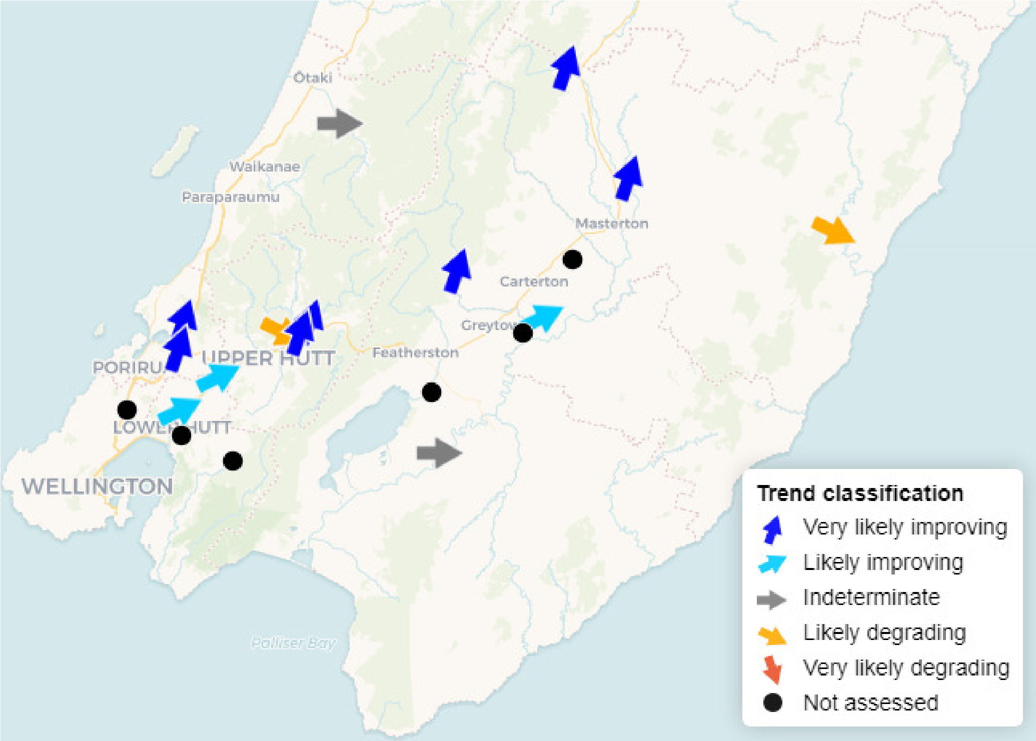

Figure 45: Water clarity flow adjusted 10-yr trends

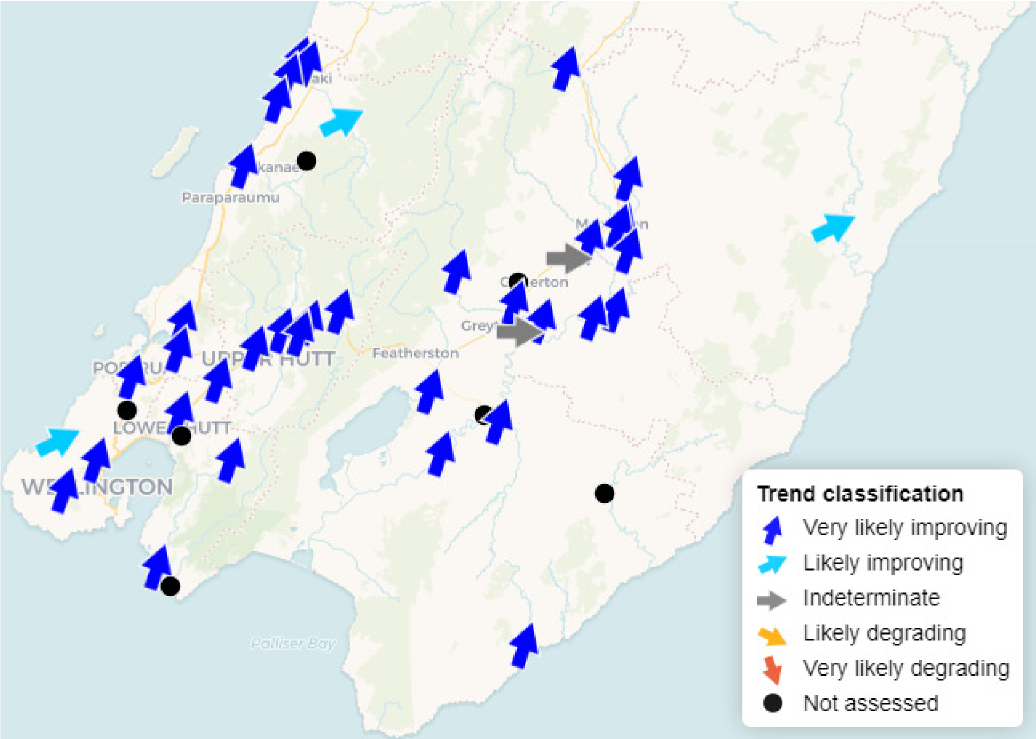

Figure 46: Water clarity 15-yr trends

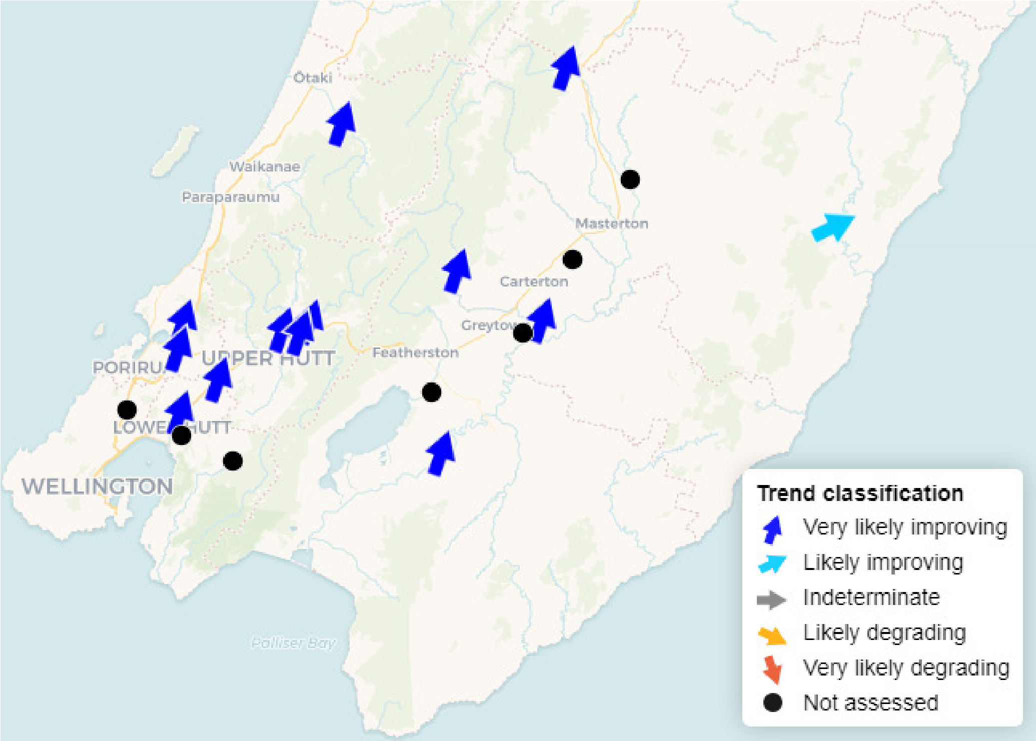

Figure 47: Water clarity flow adjusted 15-yr trends

Deposited fine sediment

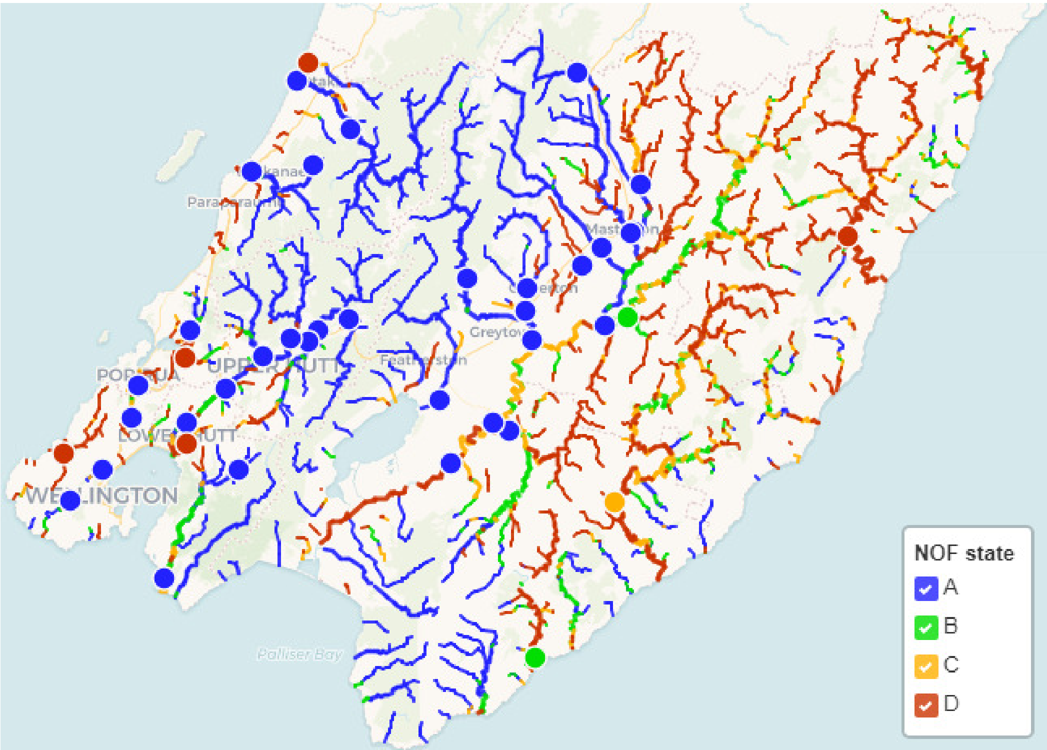

Figure 48: Deposited fine sediment (% cover) NOF states for the period 2017/18 to 2021/22. See the methods sediment benchmarking section for details.

Suspended sediment concentration

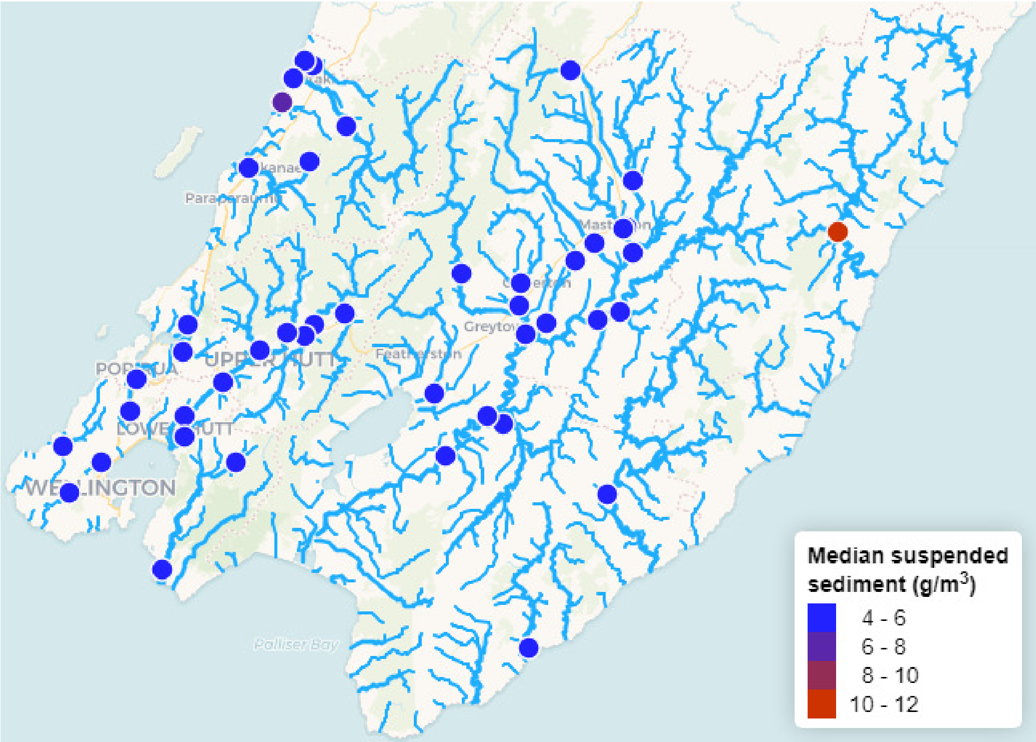

Figure 49: Suspended sediment concentration (g/m^3) results for the period 2019/20 to 2021/22

Total suspended solids

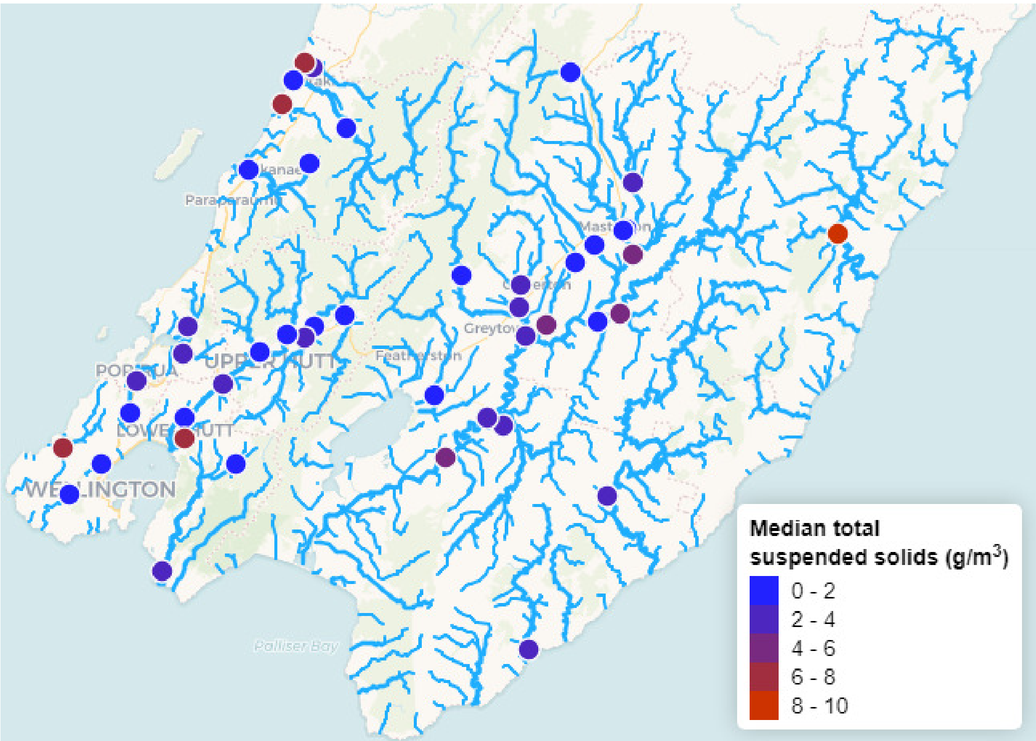

Figure 50: Total suspended solids (g/m^3) results for the period 2019/20 to 2021/22

Other water qualty variables

Dissolved oxygen

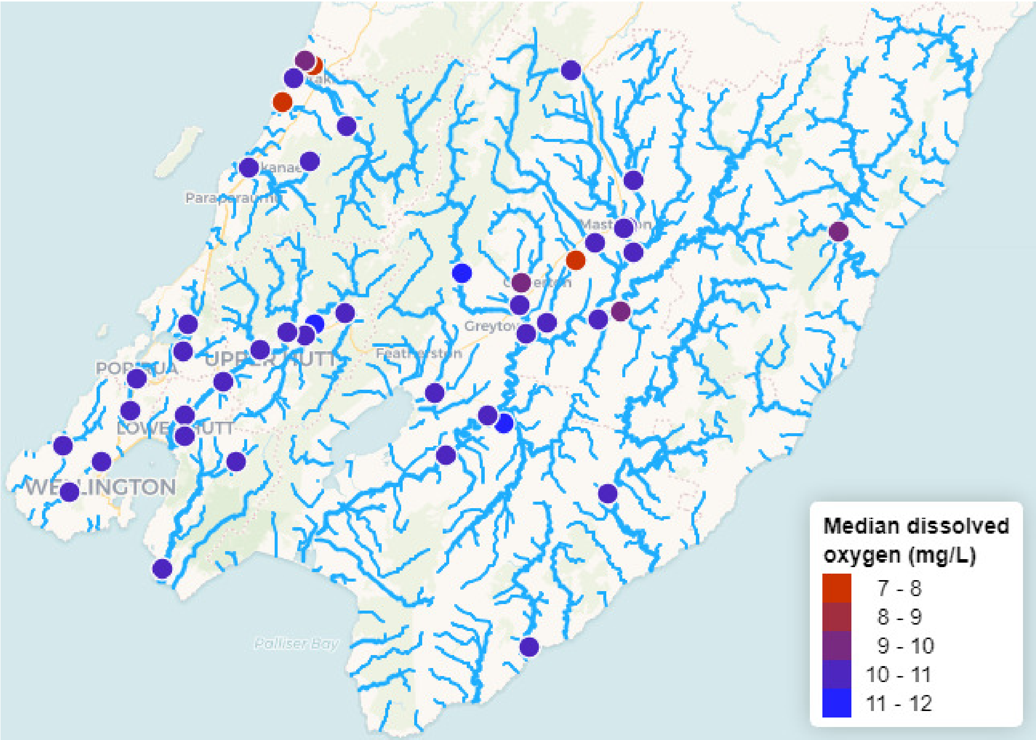

Figure 51: Dissolved oxygen (mg/L) results for the period 2019/20 to 2021/22

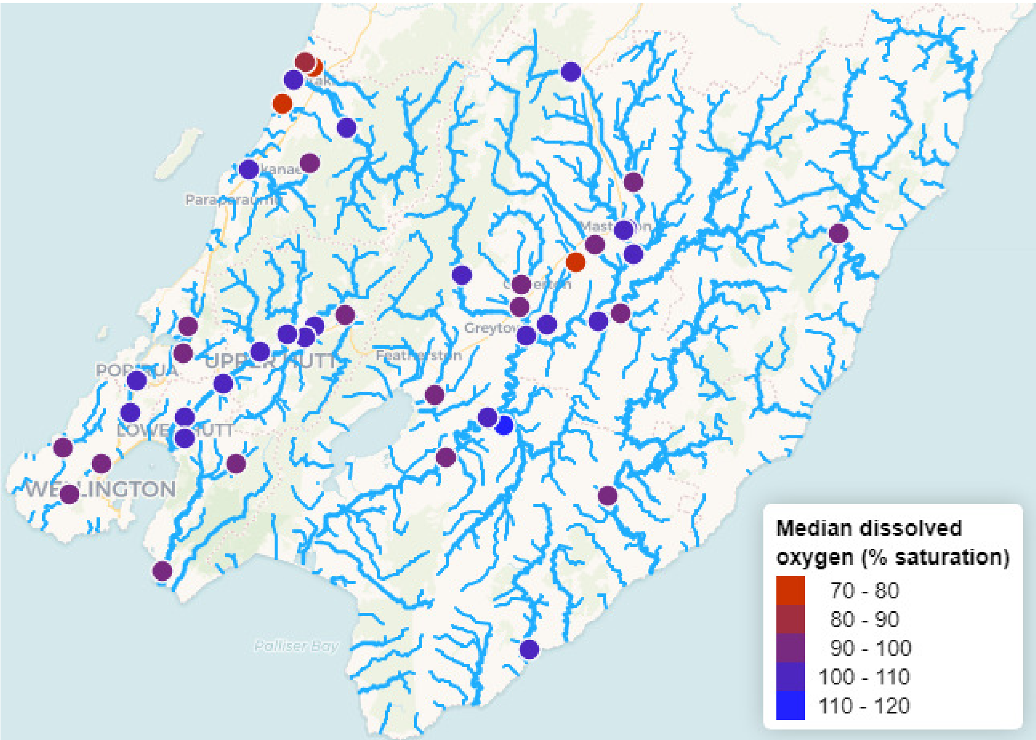

Figure 52: Dissolved oxygen (% saturation) results for the period 2019/20 to 2021/22

pH

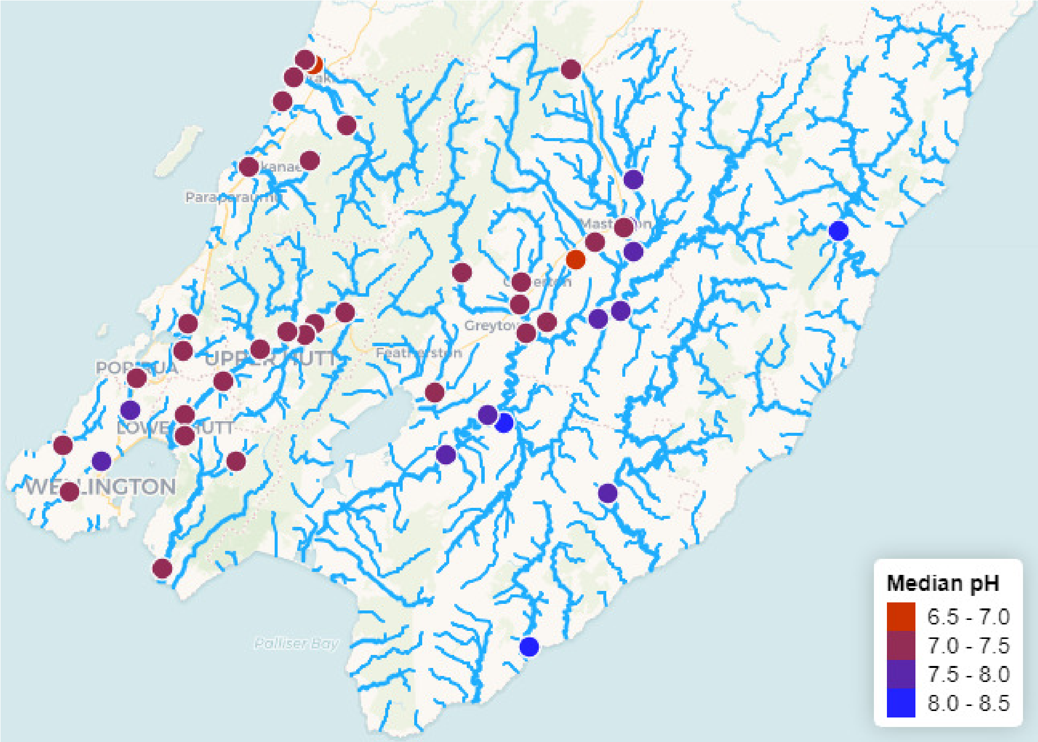

Figure 53: pH results for the period 2019/20 to 2021/22

Electrical conductivity

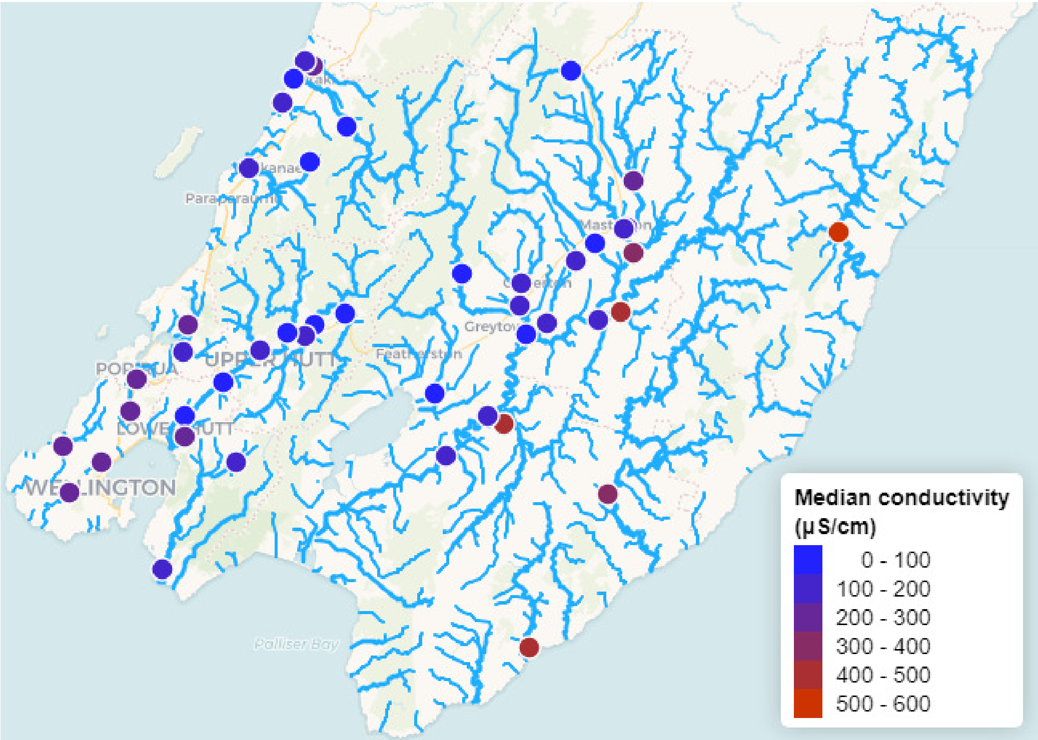

Figure 54: Electrical conductivity (μS/cm) results for the period 2019/20 to 2021/22

Ecology results

Each section presents maps of monitoring results with assigned states and estimated trends where applicable. Full tabulated data for each variable are available in the Appendix 2 - Data tables section.

Macroinvertebrates

MCI PNRP class

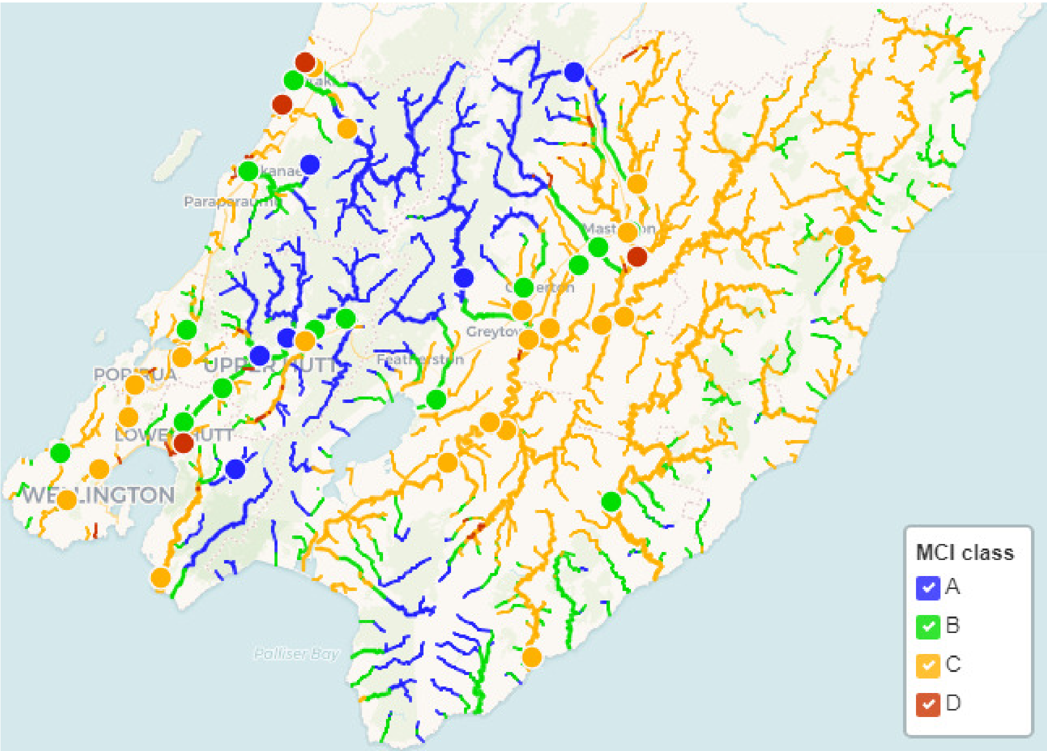

Figure 55: MCI PNRP classes for the period 2019/20 to 2021/22. See the methods macroinvertebrates benchmarking section for details.

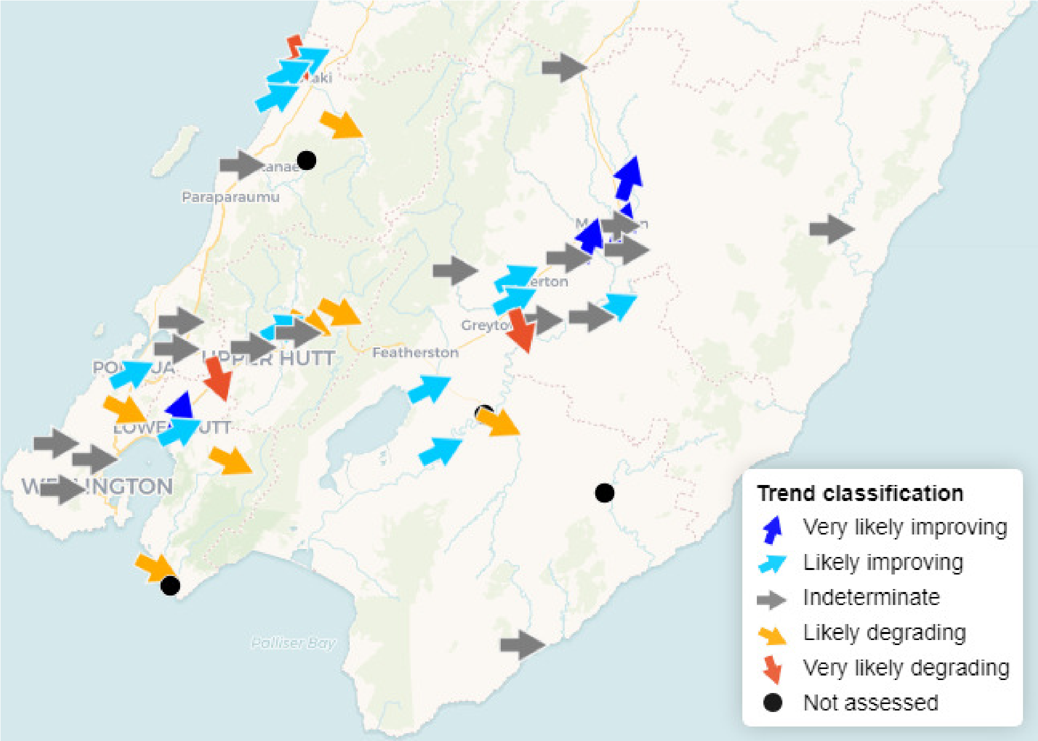

Figure 56: MCI 10-yr trends

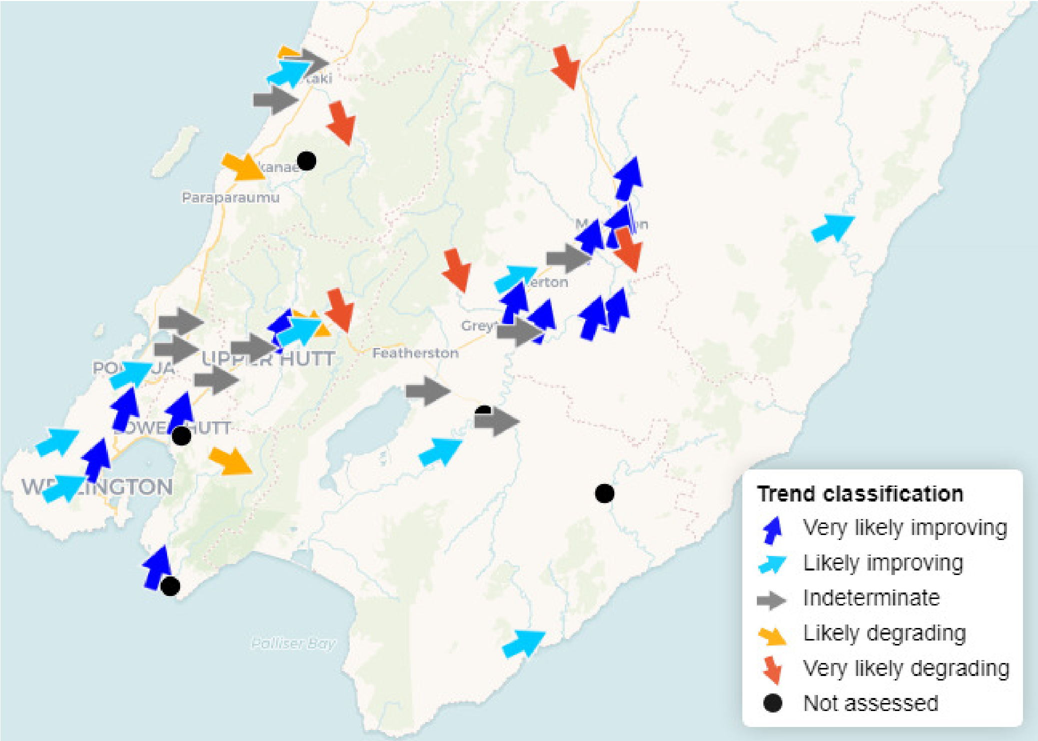

Figure 57: MCI 15-yr trends

MCI & QMCI

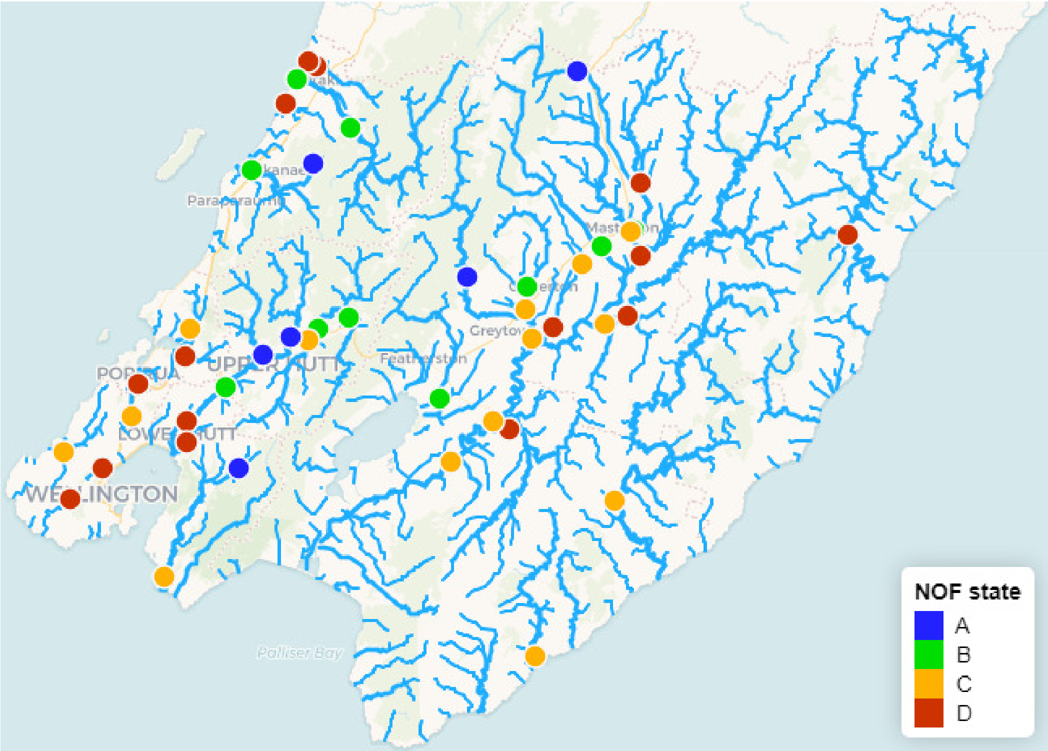

Figure 58: MCI & QMCI NOF states for the period 2017/18 to 2021/22. See the methods macroinvertebrates benchmarking section for details.

ASPM

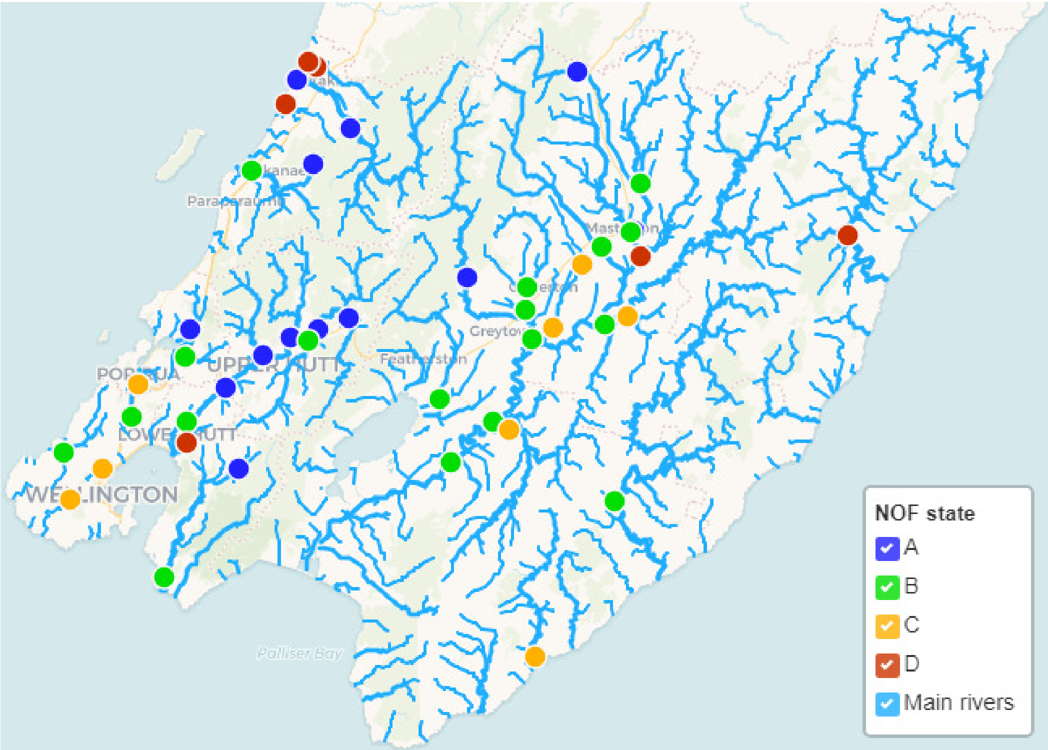

Figure 59: ASPM NOF states for the period 2017/18 to 2021/22. See the methods macroinvertebrates benchmarking section for details.

% EPT richness

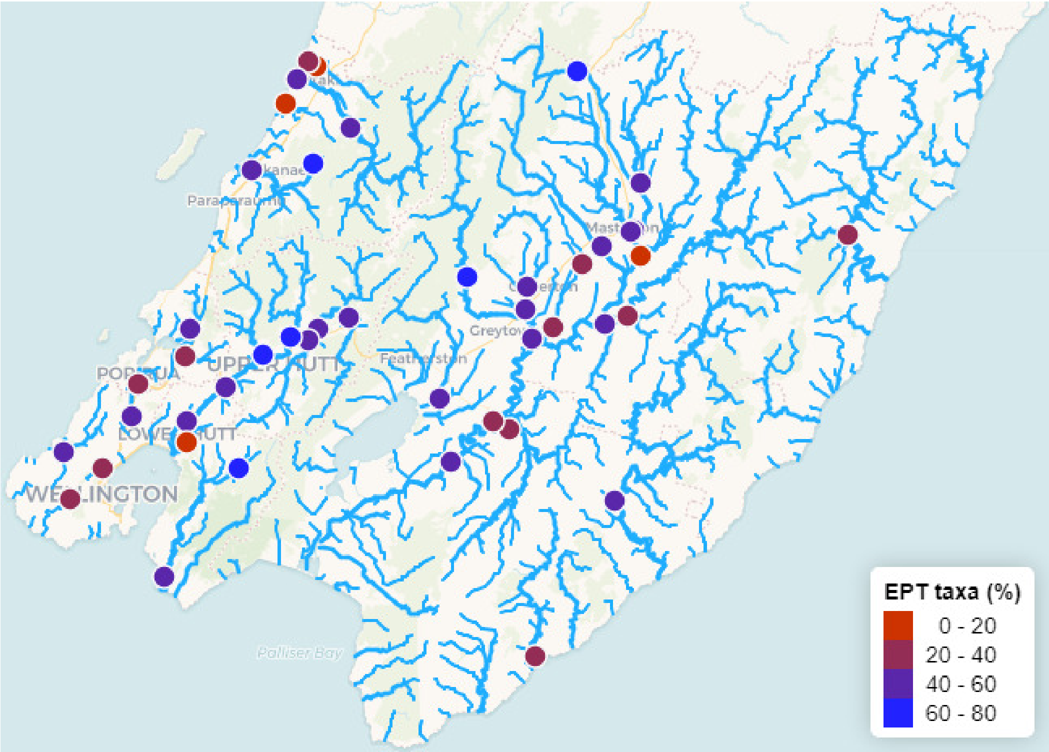

Figure 60: Percentage of (EPT) taxa that are *Ephemeroptera* (mayfly), *Plecoptera* (stonefly) and all *Trichoptera* (caddisfly) except *Hydroptilidae* results for the period 2019/20 to 2021/22

Periphyton & Cyanobacteria

Periphyton biomass

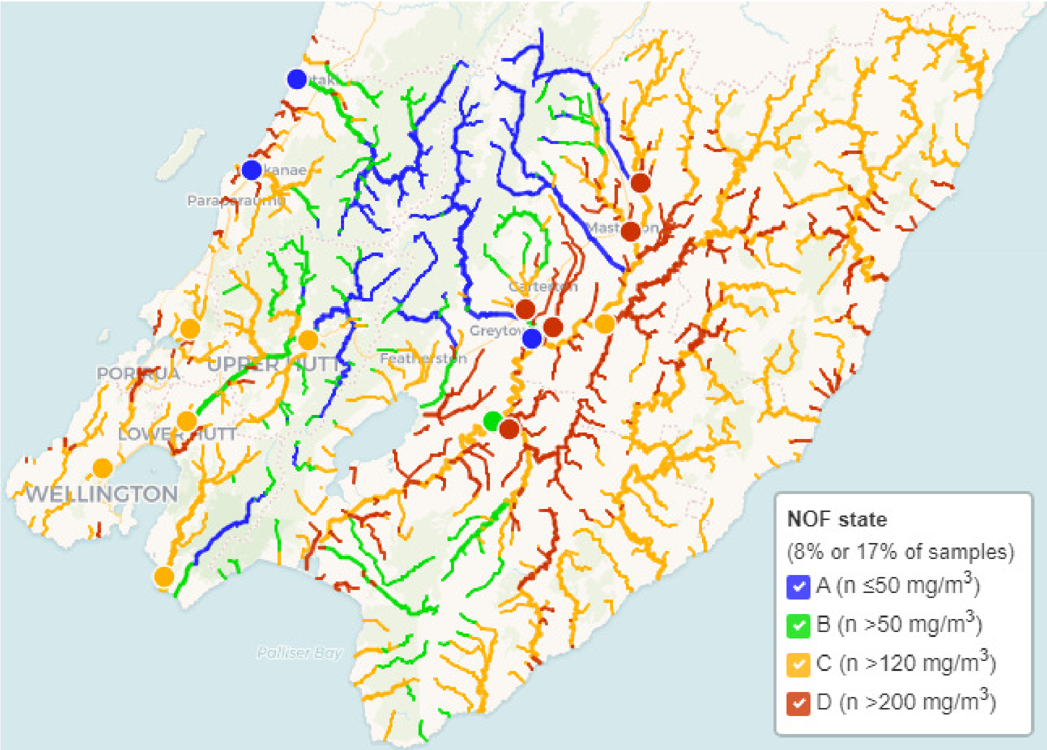

Figure 61: Periphyton biomass NOF states for the period 2019/20 to 2021/22. See the methods periphyton benchmarking section for details.

Periphyton cover

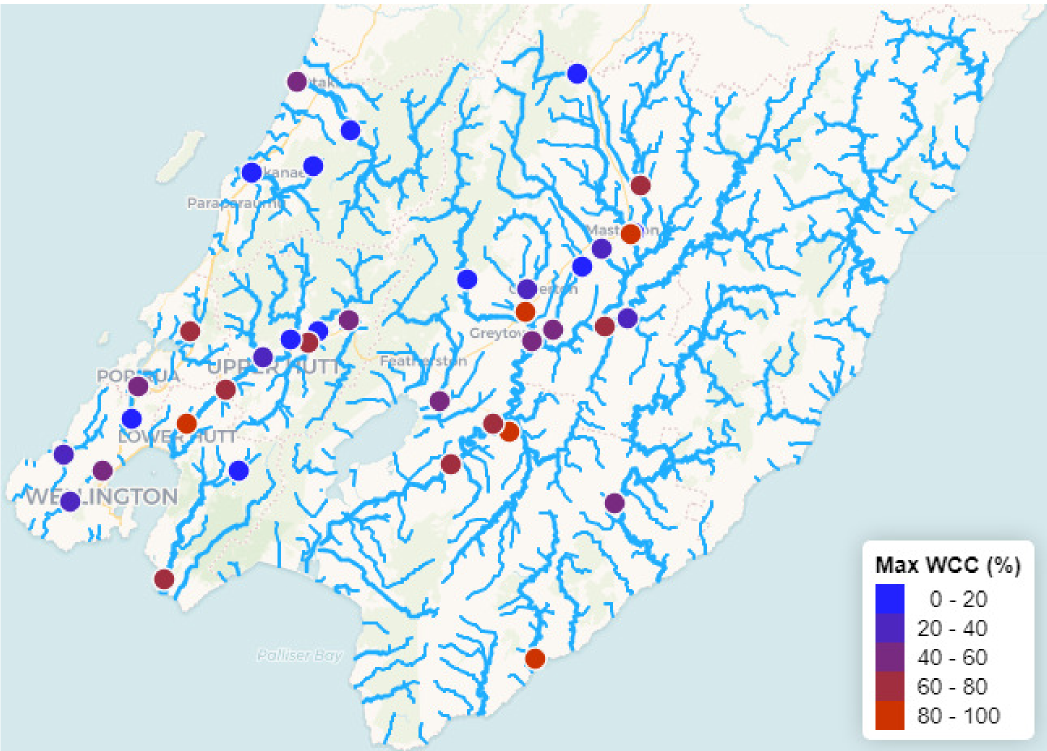

Figure 62: Periphyton weighted composite cover (WCC) results for the period 2019/20 to 2021/22. See the methods periphyton section for details.

Cyanobacteria cover

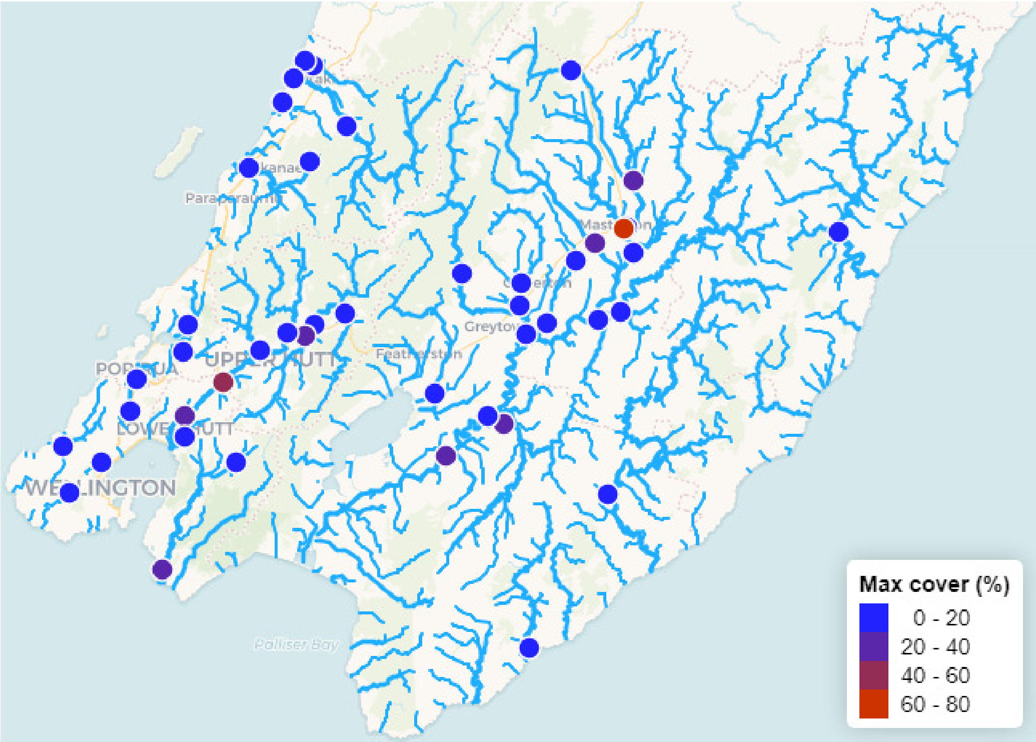

Figure 63: Cyanobacteria cover (%) results for the period 2019/20 to 2021/22

Habitat quality

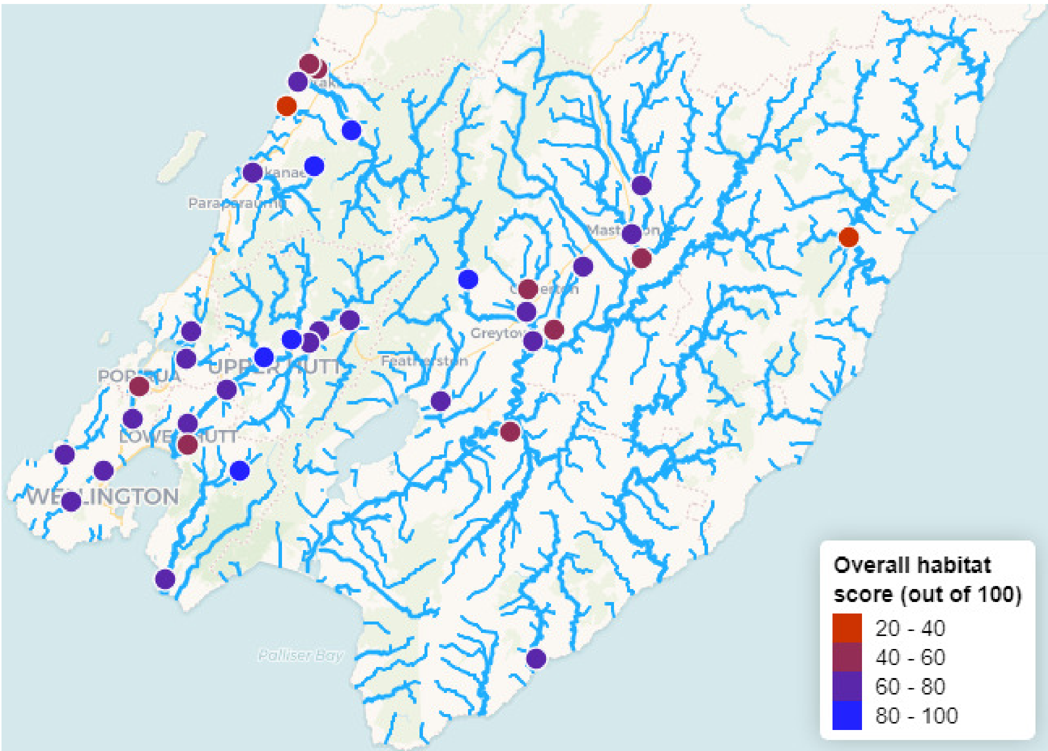

Figure 64: Habitat quality results for the period 2019/20 to 2021/22. See the methods habitat quality section for details.

Resources

Useful Links

A User Guide for the Macroinvertebrate Community Index

Protocols for sampling macroinvertebrates in wadeable streams

Australian and New Zealand Guidelines for Fresh and Marine Water Quality

Greater Wellington Natural Resources Plan

Sediment Assessment Methods – Protocols and guidelines for assessing the effects of deposited fine sediment on in-stream values

National Policy Statement for Freshwater Management

River Environment Classifications

Te Awarua-o-Porirua Whaitua Implementation Plan (WIP)

Freshwater Ecosystems of New Zealand (FENZ)

Ministry for the Environment Data Service

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Appendix 1 - Monitoring details

Table A1.1: Water quality sampling methods and detection limits.

Variable	Method	Det. limit
Water temperature	Field meter – generally YSI ProDSS	0.01 °C
Dissolved oxygen	Field meter – generally YSI ProDSS	0.01 mg/L
Visual clarity	Black disc (20 mm disc or clarity tube if clarity <0.5 m, 60 mm disc for clarity between 0.5 m and 1.5 m, 200 mm disc for clarity >1.5 m)	0.01 m
Deposited sediment	In-stream visual estimate of proportion of habitat covered by deposited sediment using the SAM2 method (Clapcott et al. 2011)	0.05
pH	Lab pH meter	0.01 units
Conductivity	Field meter – generally YSI ProDSS	0.1 µS/cm
Turbidity	Analysis using a Hach 2100N, Turbidity meter. APHA 2130 B 23rd Ed. 2017	0.05 NTU
Total suspended solids	Filtration using Whatman 934 AH, Advantec GC-50 or 1-2 equivalent filters (nominal pore size 1.2–1.5µm), gravimetric determination. APHA 2540 D 23rd Ed. 2017	2 mg/L
Suspended sediment concentration	Filtration using Advantec GC-50 or equivalent 125mm diameter filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. Entire sample filtered. No correction for density. Note: g/m^3 units are equivalent to mg/L. ASTM D3977-97 (Modified)	10 mg/L
Ammoniacal nitrogen	Filtered sample. Phenol/hyperclorite colorimetry. Discrete Analyser. (NH4-N = NH4+-N + NH3-N) APHA 4500-NH3 F (modified from manual analysis) 23rd Ed. 2017	0.005 mg/L
Nitrite nitrogen	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO3- I (Modified) 23rd Ed. 2017	0.001 mg/L
Nitrate + nitrite nitrogen	Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO3- I (Modified) 23rd Ed. 2017	0.001 mg/L
Nitrate nitrogen	Calculation: (nitrate + nitrite nitrogen) - nitrite nitrogen	0.001 mg/L
Total Kjeldahl nitrogen	Kjeldahl digestion, phenol/hyperclorite colorimetry (Discrete Analysis). APHA 4500-N Org C. (modified) 4500-NH3 F (modified) 23rd Ed. 2017	0.1 mg/L
Total nitrogen	Calculation: Total Kjeldahl nitrogen + nitrate nitrogen + nitrite nitrogen	0.11 mg/L
Total phosphorus	Total Phosphorus digestion, ascorbic acid colorimetry. Discrete Analyser. APHA 4500-P E (modified from manual analysis) 23rd Ed. 2017	0.004 mg/L
Dissolved reactive phosphorus	Filtered sample. Molybdenum blue colorimetry. Discrete Analyser. APHA 4500-P E (modified from manual analysis) 23rd Ed. 2017	0.001 mg/L
Faecal coliforms	APHA 9222D 23rd Ed. 2017	1 cfu/100mL
E. coli	APHA 9222G 23rd Ed. 2017	1 cfu/100mL
Total recoverable copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 23rd Ed. 2017	0.0005 mg/L
Total recoverable zinc	Nitric acid extraction, ICP-MS, trace level. APHA 3125 B 23rd Ed. 2017	0.001 mg/L
Dissolved copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd Ed. 2017	0.0005 mg/L
Dissolved zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd Ed. 2017	0.0010 mg/L
Dissolved calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd Ed. 2017	0.05 mg/L
Dissolved magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd Ed. 2017	0.02 mg/L
Total organic carbon	Filtered sample, supercritical persulphate oxidation. IR detection, for total carbon (TC). Acidification, purging for total inorganic carbon (TIC). TOC = TC -TIC. APHA 5310 C (modified) 23rd Ed. 2017	0.5 mg/L
Total hardness	Calculation from calcium and magnesium. APHA 2340 B 23rd Ed. 2017	1.0 mg/L as $CaCO_3$

Table A1.2: Monitoring site information.

Whaitua	Site	Site code	Substrate	River class	NZ reach	Lat	Lng
Kāpiti Coast	Mangapouri Stream at Bennetts Rd	RS02	Soft	6	9000495	-40.743	175.141
Kāpiti Coast	Waitohu Stream at Norfolk Crescent	RS04	Soft	5	9000356	-40.737	175.126
Kāpiti Coast	Otaki River at Pukehinau	RS05	Hard	1	9002382	-40.822	175.200
Kāpiti Coast	Otaki River at Mouth	RS06	Hard	4	9000731	-40.759	175.109
Kāpiti Coast	Mangaone Stream at Sims Road Bridge	RS07	Soft	5	9001470	-40.790	175.088
Kāpiti Coast	Waikanae River at Greenaway Rd	RS10	Hard	4	9003856	-40.877	175.032
Te Awarua-o-Porirua	Horokiri Stream at Snodgrass	RS13	Hard	2	9009035	-41.079	174.926
Te Awarua-o-Porirua	Pauatahanui Stream at Elmwood Bridge	RS14	Soft	2	9010034	-41.114	174.919
Te Awarua-o-Porirua	Porirua Stream at Glenside Overhead Cables	RS15	Hard	2	9011723	-41.192	174.828
Te Awarua-o-Porirua	Porirua Stream at Milk Depot	RS16	Hard	2	9010816	-41.149	174.839
Te Whanganui-a-Tara	Makara Stream at Kennels	RS17	Hard	2	9012604	-41.236	174.713
Te Whanganui-a-Tara	Karori Stream at Makara Peak Mountain Bike Park	RS18	Hard	2	9014420	-41.297	174.722
Te Whanganui-a-Tara	Kaiwharawhara Stream at Ngaio Gorge	RS19	Hard	2	9013489	-41.258	174.779
Te Whanganui-a-Tara	Hutt River at Te Marua Intake Site	RS20	Hard	1	9009042	-41.080	175.144
Te Whanganui-a-Tara	Hutt River Opposite Manor Park Golf Club	RS21	Hard	4	9010876	-41.154	174.986
Te Whanganui-a-Tara	Hutt River at Boulcott	RS22	Hard	4	9012031	-41.197	174.920
Te Whanganui-a-Tara	Pakuratahi River 50m Below Farm Creek	RS23	Hard	1	9008887	-41.064	175.197
Te Whanganui-a-Tara	Mangaroa River at Te Marua	RS24	Hard	1	9009586	-41.094	175.128
Te Whanganui-a-Tara	Akatarawa River at Hutt Confluence	RS25	Hard	1	9009342	-41.090	175.098
Te Whanganui-a-Tara	Whakatikei River at Riverstone	RS26	Hard	4	9010025	-41.112	175.052
Te Whanganui-a-Tara	Wainuiomata River at Manuka Track	RS28	Hard	1	9013597	-41.257	175.009
Te Whanganui-a-Tara	Wainuiomata River Dnstr of White Bridge	RS29	Hard	4	9016506	-41.395	174.882
Te Whanganui-a-Tara	Orongorongo River at Orongorongo Station	RS30	Hard	1	9016841	-41.418	174.902
Ruamāhanga	Ruamahanga River at McLays	RS31	Hard	1	9000758	-40.750	175.583
Ruamāhanga	Ruamahanga River at Te Ore Ore	RS32	Hard	4	9006280	-40.953	175.680
Ruamāhanga	Ruamahanga River at Gladstone Bridge	RS33	Hard	4	9009060	-41.072	175.629
Ruamāhanga	Ruamahanga River at Pukio	RS34	Hard	4	9013512	-41.249	175.370
Ruamāhanga	Taueru River at Gladstone	RS37	Hard	3	9009016	-41.063	175.668
Ruamāhanga	Kopuaranga River at Stuarts	RS38	Hard	5	9004627	-40.894	175.692
Ruamāhanga	Whangaehu River at 250m from Confluence	RS39	Soft	3	9007085	-40.985	175.690
Ruamāhanga	Waipoua River at Colombo Rd Bridge	RS40	Hard	4	9006301	-40.954	175.674
Ruamāhanga	Waingawa River at South Rd	RS41	Hard	4	9006741	-40.974	175.624
Eastern Wairarapa	Whareama River at Gauge	RS42	Soft	5	9006652	-40.960	176.043
Ruamāhanga	Parkvale tributary at Lowes Reserve	RS45	Hard	6	9007329	-40.997	175.593
Ruamāhanga	Parkvale Stream at Renalls Weir	RS46	Hard	5	9009215	-41.078	175.542
Ruamāhanga	Waiohine River at Bicknells	RS48	Hard	4	9009625	-41.091	175.508
Ruamāhanga	Mangatarere River at State Highway 2	RS50	Hard	4	9008718	-41.055	175.496
Ruamāhanga	Huangarua River at Ponatahi Bridge	RS51	Hard	4	9012636	-41.208	175.469
Eastern Wairarapa	Awhea River at Tora Rd	RS53	Hard	5	9017635	-41.496	175.512
Ruamāhanga	Tauherenikau River at Websters	RS55	Hard	4	9011002	-41.168	175.349
Te Whanganui-a-Tara	Waiwhetu Stream at Whites Line East	RS57	Soft	6	9012664	-41.225	174.921
Ruamāhanga	Ruamahanga River at Waihenga Bridge	RS58	Hard	4	9012311	-41.197	175.440
Ruamāhanga	Enaki Stream D/S site for Riparian	RS59	Hard	4	9007826	-41.025	175.497

Whaitua	Site	Site code	Substrate	River class	NZ reach	Lat	Lng
Eastern Wairarapa	Pahaoa River at Hinakura	RS60	Hard	5	9014719	-41.298	175.648
Kāpiti Coast	Waikanae River at Mangaone Walkway	RS61	Hard	2	9003697	-40.869	175.136
Ruamāhanga	Waiohine River at Gorge Rd Carpark	RS62	Hard	1	9007799	-41.012	175.396

Appendix 2 - Data tables

In the following tables, the confidence in trend direction is marked by:

- ↑↑: very likely improving
- ↑: likely improving
- →: indeterminate
- ↓: likely degrading
- ↓↓: very likely degrading

Note that series with too many censored values can still have a trend direction estimated but the rate is marked **N/A** in the tables.

Nutrients

Table A2.1: **Total nitrogen (g/m^3)** results for the period 2019/20 to 2021/22. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted. The trends columns are unit change per year.

					Raw trends			Flow adj.		
Site code	n	Min	Median	Max	5 yr	10 yr	15 yr	5 yr	10 yr	15 yr
RS02	34	0.65	1.78	3.40	↑↑ -0.132	↑↑ -0.067	↑↑ -0.081			
RS04	34	0.21	0.60	1.04	↑↑ -0.045	↑ -0.008	↑↑ -0.022			
RS05	34	0.06	0.06	0.40			→ N/A			
RS06	33	0.06	0.06	0.31			→ N/A			
RS07	34	1.19	1.77	3.80	↓ 0.035	→ -0.002	↑↑ -0.042			
RS10	34	0.12	0.27	0.52	↓ 0.005	↑ -0.002	→ N/A			
RS13	34	0.15	0.59	1.36	↓ 0.015	↑↑ -0.013	→ N/A	↑↑ -0.023	↑↑ -0.024	↑↑ -0.005
RS14	34	0.14	0.52	1.34	↓ 0.007	↑ -0.008	→ N/A	↑↑ -0.026	↑↑ -0.016	↑↑ -0.006
RS15	34	0.63	1.17	2.20						
RS16	34	0.66	1.12	1.68	↑ -0.044	↑↑ -0.016	↑↑ -0.012			
RS17	34	0.18	0.74	1.64	↑ -0.021	↑ -0.002	↑ -0.004			
RS18	34	0.55	1.30	1.65	↑↑ -0.043	↑↑ -0.034	↑↑ -0.017			
RS19	34	0.74	1.14	1.70	↑↑ -0.055	↑↑ -0.043	↑↑ -0.027			
RS20	33	0.06	0.14	1.86	↑↑ -0.010	↑↑ -0.002	↑↑ -0.001			
RS21	33	0.18	0.26	1.49	↑↑ -0.016	↑↑ -0.005	↑↑ -0.004	↑ -0.008	↑↑ -0.004	↑↑ -0.003
RS22	33	0.14	0.27	1.32	↑↑ -0.008	↑↑ -0.003	↑↑ -0.002	↑ -0.007	↑↑ -0.003	↑ -0.001
RS23	34	0.18	0.26	0.95	↑↑ -0.010	↑↑ -0.004	↑↑ -0.005			
RS24	34	0.41	0.53	0.75	↑↑ -0.026	↑↑ -0.008	↑↑ -0.010			
RS25	34	0.06	0.13	0.84	↑ N/A	↑↑ -0.004	↑↑ N/A	↑↑ N/A	↑↑ -0.002	↑↑ -0.002
RS26	32	0.12	0.21	0.51	→ -0.002	↓ 0.002	↓↓ 0.003			

					Raw trends			Flow adj.		
Site code	**n**	**Min**	**Median**	**Max**	**5 yr**	**10 yr**	**15 yr**	**5 yr**	**10 yr**	**15 yr**
RS28	34	0.06	0.08	0.32	↑↑ -0.008	↑↑ -0.007	↑↑ -0.003			
RS29	34	0.06	0.29	0.64	↑↑ -0.009	↑ N/A	↑↑ -0.006			
RS31	29	0.06	0.06	0.24		↓ N/A				
RS32	34	0.15	0.42	3.40	↑↑ -0.030	↑↑ -0.010	↑↑ -0.005			
RS33	33	0.06	0.44	1.76	→ -0.002	↑ -0.008	↑↑ -0.006			
RS34	34	0.06	0.40	1.53	↑ -0.019	↑ -0.002	↑↑ -0.006	→ N/A	↓ 0.002	↓ 0.000
RS37	32	0.79	1.15	1.83	↑ -0.021	↑↑ -0.022	↑↑ -0.010			
RS38	34	0.75	1.20	1.89	↓ 0.010	→ -0.001	↑↑ -0.008			
RS39	31	0.21	1.28	3.60		↓ 0.014	↑↑ -0.019			
RS40	34	0.45	1.23	2.70	↓ 0.057	↓↓ 0.032	↓ 0.009			
RS41	34	0.06	0.12	0.49	↑ N/A	→ N/A	→ N/A			
RS42	27	0.18	0.39	3.70		↑↑ -0.008	↑↑ -0.006		→ -0.002	→ -0.001
RS45	18	2.30	4.75	6.70	↓ 0.200	↑ -0.140	→ N/A			
RS46	34	0.30	2.40	5.10	↓↓ 0.175	↓ 0.020	→ N/A		→ 0.001	→ 0.002
RS48	34	0.16	0.47	1.23	→ N/A	↓↓ 0.009	↓ 0.004			
RS50	34	0.72	1.28	3.00	↑ -0.035	↓ 0.010	↑↑ -0.014			
RS51	32	0.06	0.30	1.46	↑↑ -0.038	↑↑ -0.010	↑↑ -0.007			
RS53	30	0.06	0.18	0.85		↑↑ -0.010	↑↑ -0.003			
RS55	32	0.06	0.12	0.34	↑↑ N/A	↓ N/A	↓ N/A			
RS57	34	0.44	0.69	1.32	↑ -0.018	↑↑ -0.010				
RS58	34	0.06	0.41	1.53	→ -0.004					
RS59	33	0.06	0.91	2.20		↓ 0.010	↑ -0.007			
RS60	27	0.11	0.21	0.84						
RS61	34	0.06	0.20	0.46	↑↑ -0.010					
RS62	32	0.06	0.06	0.33		→ N/A	→ N/A			

Table A2.2: **Total Kjeldahl nitrogen (g/m^3)** results for the period 2019/20 to 2021/22. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	34	0.25	0.39	1.20
RS04	34	0.05	0.23	0.49
RS05	34	0.05	0.05	0.32
RS06	33	0.05	0.05	0.23
RS07	34	0.16	0.37	0.83
RS10	34	0.05	0.05	0.20
RS13	34	0.05	0.11	0.62
RS14	34	0.05	0.16	0.47
RS15	34	0.05	0.17	1.60
RS16	34	0.05	0.17	0.62
RS17	34	0.13	0.25	0.65
RS18	34	0.05	0.15	0.55
RS19	34	0.05	0.15	0.57
RS20	33	0.05	0.05	1.83

Site code	n	Min	Median	Max
RS22	33	0.05	0.05	1.28
RS23	34	0.05	0.05	0.87
RS24	34	0.05	0.15	0.31
RS25	34	0.05	0.05	0.73
RS26	32	0.05	0.05	0.36
RS28	34	0.05	0.05	0.22
RS29	34	0.05	0.05	0.26
RS31	29	0.05	0.05	0.22
RS32	34	0.05	0.05	2.70
RS33	33	0.05	0.05	0.96
RS34	34	0.05	0.12	0.40
RS37	32	0.16	0.34	1.38
RS38	34	0.10	0.23	1.13
RS39	31	0.21	0.50	3.00
RS40	34	0.05	0.15	0.67
RS41	34	0.05	0.05	0.19
RS42	27	0.17	0.33	3.30
RS45	18	0.19	0.28	0.73
RS46	34	0.20	0.37	1.74
RS48	34	0.05	0.05	0.33
RS50	34	0.05	0.24	0.88
RS51	32	0.05	0.15	0.97
RS53	30	0.05	0.15	0.78
RS55	32	0.05	0.05	0.12
RS57	34	0.10	0.22	0.76
RS58	34	0.05	0.11	0.38
RS59	33	0.05	0.13	1.25
RS60	27	0.11	0.19	0.48
RS61	34	0.05	0.05	0.29
RS62	32	0.05	0.05	0.21

Table A2.3: **Dissolved inorganic nitrogen (g/m^3)** results for the period 2017/18 to 2021/22. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	34	0.42	1.39	2.80
RS04	34	0.05	0.35	0.86
RS05	34	0.01	0.04	0.16
RS06	33	0.01	0.06	0.11
RS07	34	0.84	1.52	3.40
RS10	34	0.05	0.20	0.44
RS13	34	0.07	0.48	1.03
RS14	34	0.04	0.36	1.03
RS15	34	0.51	0.92	1.41
RS16	34	0.49	0.89	1.46
RS17	34	0.02	0.48	1.28

Site code	n	Min	Median	Max
RS18	34	0.17	1.18	1.55
RS19	34	0.44	0.94	1.28
RS20	33	0.03	0.07	0.13
RS21	33	0.05	0.19	0.38
RS22	33	0.05	0.20	0.38
RS23	34	0.07	0.17	0.29
RS24	34	0.19	0.39	0.58
RS25	34	0.02	0.07	0.17
RS26	32	0.04	0.15	0.35
RS28	34	0.02	0.05	0.11
RS29	34	0.01	0.20	0.42
RS31	29	0.01	0.03	0.04
RS32	34	0.06	0.33	1.17
RS33	33	0.02	0.36	1.37
RS34	34	0.01	0.32	1.40
RS37	32	0.34	0.72	1.63
RS38	34	0.41	0.99	1.64
RS39	31	0.01	0.68	2.10
RS40	34	0.30	1.06	2.50
RS41	34	0.01	0.07	0.42
RS42	27	0.01	0.11	0.81
RS45	18	1.77	4.55	6.30
RS46	34	0.01	1.99	4.30
RS48	34	0.08	0.40	1.10
RS50	34	0.51	1.15	2.90
RS51	32	0.01	0.13	0.68
RS53	30	0.01	0.05	0.27
RS55	32	0.01	0.06	0.32
RS57	34	0.25	0.53	0.90
RS58	34	0.01	0.33	1.41
RS59	33	0.01	0.72	1.94
RS60	27	0.01	0.02	0.49
RS61	34	0.07	0.15	0.28
RS62	32	0.01	0.03	0.12

Table A2.4: **pH adjusted ammoniacal nitrogen (g/m^3)** results for the period 2019/20 to 2021/22 benchmarked against National Objectives Framework (NOF) guidelines. Modelled grades (coloured lines on the map) are shown for River Environment Classification reaches order three and above. See methods for details on modelling and benchmarks. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted. The trends columns are unit change per year.

Site code	State	n	Median	95th percentile	Raw trends		
					5 yr	10 yr	15 yr
RS02	A	34	0.02	0.05	↑ -0.0015	↑ -0.0003	↓↓ 0.0010
RS04	A	34	0.01	0.03	↑ -0.0012	↓ 0.0004	↑↑ -0.0005
RS05	A	34	0.00	0.00			↑ N/A
RS06	A	33	0.00	0.00			↑↑ N/A
RS07	B	34	0.03	0.10	→ 0.0021	↓ 0.0010	↓↓ 0.0015
RS10	A	34	0.00	0.00	→ N/A		↑↑ N/A
RS13	A	34	0.00	0.01	↓↓ N/A	↑↑ N/A	↑↑ N/A
RS14	A	34	0.00	0.01	↓↓ 0.0013		↑↑ N/A
RS15	A	34	0.00	0.02			
RS16	A	34	0.01	0.03	↓↓ 0.0018	↓ N/A	↓ N/A
RS17	A	34	0.01	0.02	↓↓ 0.0029	↓↓ 0.0003	↓↓ N/A
RS18	A	34	0.01	0.02	↓ 0.0004	↑↑ N/A	→ N/A
RS19	B	34	0.00	0.06	→ N/A		↑↑ N/A
RS20	A	33	0.00	0.00	↓ N/A		↑↑ N/A
RS21	A	33	0.00	0.01	→ N/A	↑↑ N/A	↑↑ N/A
RS22	A	33	0.00	0.01	↑ N/A		↑ N/A
RS23	A	34	0.00	0.00			↑↑ N/A
RS24	A	34	0.00	0.01	↓ N/A	↓↓ N/A	↓↓ N/A
RS25	A	34	0.00	0.00			↑↑ N/A
RS26	A	32	0.00	0.01	↓↓ N/A		↑↑ N/A
RS28	A	34	0.00	0.00			
RS29	A	34	0.01	0.01	↓↓ 0.0007		→ N/A
RS31	A	29	0.00	0.00			↑↑ N/A
RS32	A	34	0.00	0.01	↑ N/A	↑ N/A	↑↑ N/A
RS33	A	33	0.00	0.02	↑ N/A		
RS34	A	34	0.00	0.02	→ N/A		
RS37	B	32	0.01	0.06	→ N/A		↓ N/A
RS38	A	34	0.01	0.03			
RS39	A	31	0.01	0.05		→ N/A	↓ N/A
RS40	A	34	0.00	0.02	↓ N/A		→ N/A
RS41	A	34	0.00	0.00	↑↑ N/A	↑↑ N/A	↑↑ N/A
RS42	A	27	0.01	0.03			
RS45	A	18	0.00	0.00			
RS46	A	34	0.01	0.04	↓ 0.0014	↓ N/A	→ N/A
RS48	A	34	0.00	0.03	→ N/A	↓ N/A	→ N/A
RS50	B	34	0.03	0.19	↓ N/A		↑↑ -0.0012
RS51	A	32	0.00	0.01		↑↑ N/A	
RS53	A	30	0.00	0.01		↑ N/A	
RS55	A	32	0.00	0.01	↑ N/A	↓ N/A	

Site code	State	n	Median	95th percentile	Raw trends		
					5 yr	10 yr	15 yr
RS57	A	34	0.02	0.05	↓ 0.0025	↑↑ -0.0025	
RS58	A	34	0.00	0.02	↑ N/A		
RS59	A	33	0.00	0.01		↓↓ N/A	↑ N/A
RS60	A	27	0.00	0.01			
RS61	A	34	0.00	0.00	↓ N/A		
RS62	A	32	0.00	0.00			↑↑ N/A

Table A2.5: **Nitrite nitrogen (g/m^3)** results for the period 2019/20 to 2021/22. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	34	0.0066	0.0141	0.0310
RS04	34	0.0029	0.0055	0.0122
RS05	34	0.0005	0.0005	0.0018
RS06	33	0.0005	0.0005	0.0012
RS07	34	0.0062	0.0126	0.0370
RS10	34	0.0005	0.0005	0.0015
RS13	34	0.0005	0.0012	0.0044
RS14	34	0.0005	0.0016	0.0053
RS15	34	0.0013	0.0027	0.0270
RS16	34	0.0023	0.0042	0.0110
RS17	34	0.0012	0.0029	0.0089
RS18	34	0.0021	0.0051	0.0188
RS19	34	0.0015	0.0055	0.0220
RS20	33	0.0005	0.0005	0.0040
RS21	33	0.0005	0.0012	0.0028
RS22	33	0.0005	0.0011	0.0023
RS23	34	0.0005	0.0005	0.0030
RS24	34	0.0014	0.0029	0.0055
RS25	34	0.0005	0.0005	0.0020
RS26	32	0.0005	0.0005	0.0015
RS28	34	0.0005	0.0005	0.0027
RS29	34	0.0005	0.0011	0.0040
RS31	29	0.0005	0.0005	0.0014
RS32	34	0.0005	0.0015	0.0027
RS33	33	0.0005	0.0016	0.0450
RS34	34	0.0005	0.0025	0.0171
RS37	32	0.0005	0.0061	0.0178
RS38	34	0.0025	0.0045	0.0111
RS39	31	0.0005	0.0049	0.0290
RS40	34	0.0014	0.0024	0.0089
RS41	34	0.0005	0.0005	0.0005
RS42	27	0.0005	0.0021	0.0075
RS45	18	0.0005	0.0021	0.0052

Site code	n	Min	Median	Max
RS48	34	0.0005	0.0019	0.0097
RS50	34	0.0019	0.0041	0.0330
RS51	32	0.0005	0.0018	0.0071
RS53	30	0.0005	0.0005	0.0034
RS55	32	0.0005	0.0005	0.0012
RS57	34	0.0066	0.0138	0.0210
RS58	34	0.0005	0.0024	0.0157
RS59	33	0.0005	0.0015	0.0089
RS60	27	0.0005	0.0005	0.0043
RS61	34	0.0005	0.0005	0.0022
RS62	32	0.0005	0.0005	0.0022

Table A2.6: **Nitrate nitrogen (g/m^3)** results for the period 2019/20 to 2021/22 benchmarked against National Objectives Framework (NOF) guidelines. Modelled grades (coloured lines on the map) are shown for River Environment Classification reaches order three and above. See methods for details on modelling and benchmarks. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted.

Site code	State	n	Median	95th percentile
RS02	B	34	1.3	2.6
RS04	A	34	0.3	0.7
RS05	A	34	0.0	0.1
RS06	A	33	0.1	0.1
RS07	B	34	1.4	3.0
RS10	A	34	0.2	0.4
RS13	A	34	0.5	0.9
RS14	A	34	0.3	0.9
RS15	A	34	0.9	1.2
RS16	A	34	0.9	1.3
RS17	A	34	0.5	1.0
RS18	B	34	1.2	1.4
RS19	A	34	0.9	1.2
RS20	A	33	0.1	0.1
RS21	A	33	0.2	0.3
RS22	A	33	0.2	0.3
RS23	A	34	0.2	0.3
RS24	A	34	0.4	0.6
RS25	A	34	0.1	0.2
RS26	A	32	0.2	0.3
RS28	A	34	0.0	0.1
RS29	A	34	0.2	0.4
RS31	A	29	0.0	0.0
RS32	A	34	0.3	0.9
RS33	A	33	0.4	0.9
RS34	A	34	0.3	1.0

Site code	State	n	Median	95th percentile
RS38	A	34	1.0	1.5
RS39	A	31	0.7	1.5
RS40	B	34	1.1	2.0
RS41	A	34	0.1	0.2
RS42	A	27	0.1	0.7
RS45	C	18	4.5	6.1
RS46	C	34	2.0	4.2
RS48	A	34	0.3	1.0
RS50	B	34	1.1	2.4
RS51	A	32	0.1	0.6
RS53	A	30	0.0	0.2
RS55	A	32	0.1	0.2
RS57	A	34	0.5	0.7
RS58	A	34	0.3	0.9
RS59	B	33	0.7	1.9
RS60	A	27	0.0	0.4
RS61	A	34	0.1	0.2
RS62	A	32	0.0	0.1

Table A2.7: **Nitrite-nitrate nitrogen (g/m^3)** results for the period 2019/20 to 2021/22. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted. The trends columns are unit change per year.

Site code	n	Min	Median	Max	Raw trends			Flow adj.		
					5 yr	10 yr	15 yr	5 yr	10 yr	15 yr
RS02	34	0.39	1.35	2.70	↑ -0.025	↑↑ -0.039	↑↑ -0.064			
RS04	34	0.04	0.32	0.82	↑ -0.012	↑ -0.004	↑↑ -0.015			
RS05	34	0.01	0.04	0.16	→ -0.001	↓↓ 0.001	↓↓ 0.001			
RS06	33	0.01	0.06	0.11	↓ 0.002	↓↓ 0.002	↓↓ 0.001			
RS07	34	0.73	1.42	3.30	↑ -0.062	→ 0.004	↑↑ -0.037			
RS10	34	0.04	0.20	0.44	↓↓ 0.019	→ N/A	→ N/A			
RS13	34	0.07	0.47	1.02	↓↓ 0.028	↑↑ -0.016	↓ 0.003	→ 0.008	↑↑ -0.016	↑ -0.002
RS14	34	0.03	0.35	1.00	↓↓ 0.035	↓ 0.003	↓↓ 0.003	→ 0.001	↑↑ N/A	→ N/A
RS15	34	0.50	0.91	1.38						
RS16	34	0.47	0.87	1.40	↑ -0.030	↑ -0.005	↑↑ -0.007			
RS17	34	0.01	0.46	1.25	↓ 0.006	→ N/A	↑ -0.001			
RS18	34	0.16	1.16	1.53	↑↑ -0.030	↑↑ -0.027	↑↑ -0.015			
RS19	34	0.42	0.94	1.25	↑↑ -0.042	↑↑ -0.033	↑↑ -0.019			
RS20	33	0.03	0.07	0.13	↓ 0.001	↑↑ -0.001	↑↑ -0.002			
RS21	33	0.05	0.18	0.38	↓ 0.006	↑↑ -0.003	↑↑ -0.003			
RS22	33	0.04	0.20	0.38	↓ 0.002	↑ -0.001	↑↑ -0.002			
RS23	34	0.07	0.16	0.29	→ 0.001	↑↑ -0.004	↑↑ -0.005			
RS24	34	0.18	0.38	0.56	↑↑ -0.019	↑↑ -0.005	↑↑ -0.006			
RS25	34	0.01	0.07	0.17	→ 0.002	↑↑ -0.003	↑↑ -0.001	↓ N/A	↑↑ -0.002	↑↑ -0.002
RS26	32	0.03	0.15	0.35	↓↓ 0.010	↓↓ 0.003	↓↓ 0.003			

Site code	n	Min	Median	Max	Raw trends			Flow adj.		
					5 yr	10 yr	15 yr	5 yr	10 yr	15 yr
RS29	34	0.00	0.19	0.41	→ 0.000	↓ 0.002	↑ -0.001			
RS31	29	0.00	0.02	0.04		→ 0.000	↑↑ 0.000			
RS32	34	0.06	0.33	1.17	→ -0.005	↑↑ -0.007	→ 0.000			
RS33	33	0.01	0.36	1.37	→ -0.002	→ N/A	→ -0.001			
RS34	34	0.00	0.32	1.39	↓ 0.009	↑ -0.002	→ N/A			
RS37	32	0.31	0.71	1.62	↓ 0.016	↑↑ -0.020	↑ -0.006			
RS38	34	0.39	0.97	1.63	↓ 0.023	→ N/A	→ N/A			
RS39	31	0.00	0.67	2.10		↑ -0.007	↑↑ -0.017			
RS40	34	0.30	1.05	2.50	↓↓ 0.079	↓↓ 0.038	↓↓ 0.013			
RS41	34	0.01	0.07	0.42	↓↓ 0.004	→ -0.001	→ 0.000			
RS42	27	0.00	0.10	0.79		→ N/A	↓↓ N/A		↓ N/A	↓ N/A
RS45	18	1.76	4.55	6.30	↓↓ 0.192	↑ -0.147	→ N/A			
RS46	34	0.00	1.96	4.30	↓↓ 0.258	↓ 0.009	↓ 0.002		↓ 0.001	↓↓ N/A
RS48	34	0.06	0.36	1.07	↓ 0.030	↓ 0.007	↓↓ 0.007			
RS50	34	0.36	1.11	2.60	→ 0.018	↓ 0.008	↑ -0.006			
RS51	32	0.00	0.13	0.67	↑↑ -0.011	↑ -0.002	→ 0.000			
RS53	30	0.00	0.05	0.27		↑↑ -0.001	↓ 0.000			
RS55	32	0.01	0.05	0.31	↓ 0.005	↓↓ 0.002	↓↓ 0.002			
RS57	34	0.22	0.49	0.84	↑ -0.030	→ -0.002				
RS58	34	0.00	0.32	1.41	→ 0.005					
RS59	33	0.00	0.71	1.94		↓↓ 0.012	↑ -0.002			
RS60	27	0.00	0.02	0.49						
RS61	34	0.07	0.14	0.28	→ 0.001					
RS62	32	0.01	0.03	0.12		↓ 0.000	↓ 0.000			

Table A2.8: **Total phosphorus (g/m^3)** results for the period 2019/20 to 2021/22. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted. The trends columns are unit change per year.

Site code	n	Min	Median	Max	Raw trends			Flow adj.		
					5 yr	10 yr	15 yr	5 yr	10 yr	15 yr
RS02	34	0.048	0.069	0.220	↑ -0.0022	→ -0.0002	↓↓ 0.0009			
RS04	34	0.026	0.049	0.144	→ 0.0006	↓↓ 0.0012	→ N/A			
RS05	34	0.002	0.006	0.068	→ N/A	↓↓ 0.0001	→ N/A	→ N/A	↓ 0.0000	↑↑ N/A
RS06	33	0.002	0.006	0.082	→ N/A	→ N/A	→ N/A			
RS07	34	0.034	0.055	0.210	↓ 0.0014	↓ 0.0002	↓↓ 0.0007			
RS10	34	0.004	0.010	0.029	→ N/A	↓↓ 0.0001	↓ N/A			
RS13	34	0.007	0.018	0.150	↓↓ 0.0014	↑ -0.0001	↑↑ -0.0002	↓ 0.0007	↑ -0.0003	↑↑ -0.0003
RS14	34	0.014	0.023	0.100	↓ 0.0005	↑↑ -0.0004	↑↑ -0.0005	↑↑ -0.0012	↑↑ -0.0008	↑↑ -0.0008
RS15	34	0.021	0.031	0.390						
RS16	34	0.020	0.032	0.190	↓ 0.0009	↓↓ 0.0005	→ N/A			
RS17	34	0.024	0.055	0.128	→ 0.0006	→ N/A	↓ 0.0002			
RS18	34	0.030	0.047	0.230	↓ 0.0012	↑ -0.0002	↑↑ -0.0004			
RS19	34	0.031	0.047	0.240	→ -0.0009	↑ -0.0002	↓ 0.0001			

Site code	n	Min	Median	Max	Raw trends			Flow adj.		
					5 yr	10 yr	15 yr	5 yr	10 yr	15 yr
RS21	33	0.002	0.008	0.260	→ N/A	↑ N/A	↑↑ -0.0002	→ 0.0000	↑ -0.0001	↑ -0.0001
RS22	33	0.002	0.009	0.240	→ N/A	→ N/A	↑ N/A	→ -0.0001	↓ 0.0000	↑ 0.0000
RS23	34	0.004	0.008	0.190	→ N/A	↑ N/A	↑ N/A			
RS24	34	0.012	0.017	0.063	→ N/A	↓ N/A	→ N/A	↑ -0.0003	↓ 0.0001	→ 0.0000
RS25	34	0.003	0.007	0.030	↓ N/A	↓ N/A	↓ N/A	↓ 0.0000	↓ N/A	↓ 0.0000
RS26	32	0.005	0.012	0.026	→ N/A	↓↓ 0.0003	↓↓ 0.0001			
RS28	34	0.008	0.014	0.036	→ N/A	↑ N/A	↑ N/A			
RS29	34	0.009	0.020	0.076	→ N/A	↓ 0.0001	↑↑ -0.0001			
RS31	29	0.001	0.003	0.048		↓↓ N/A	↑↑ N/A		↓ N/A	↑ N/A
RS32	34	0.004	0.010	0.126	→ N/A	↑↑ -0.0004	↑↑ -0.0005			
RS33	33	0.002	0.014	0.158	↑ -0.0009	↑↑ -0.0012	↑↑ -0.0020			
RS34	34	0.006	0.019	0.113	→ N/A	↑↑ -0.0004	↑↑ -0.0011	→ 0.0003	↓ 0.0000	↑↑ -0.0005
RS37	32	0.010	0.054	0.300	↓ 0.0020	↓↓ 0.0009	↓ 0.0003			
RS38	34	0.016	0.031	0.250	↑ -0.0006	↓ 0.0003	↑ -0.0002		↓↓ 0.0007	
RS39	31	0.036	0.086	0.670		↓↓ 0.0030	↓↓ 0.0012			
RS40	34	0.003	0.009	0.086	→ N/A	→ N/A	→ N/A			
RS41	34	0.002	0.006	0.040	↑ N/A	↑↑ N/A	↑ N/A			
RS42	27	0.011	0.029	1.230		→ N/A	↑ -0.0001		→ 0.0001	→ 0.0000
RS45	18	0.007	0.021	0.077	→ N/A	↓ 0.0002	↑↑ -0.0004			
RS46	34	0.020	0.042	0.320	↑↑ -0.0027	↑↑ -0.0012	↑↑ -0.0023		↑↑ -0.0013	↑↑ -0.0024
RS48	34	0.006	0.017	0.066	↓↓ 0.0008	↑ -0.0003	↑↑ -0.0006		↑↑ -0.0006	↑↑ -0.0005
RS50	34	0.009	0.036	0.189	↓ 0.0018	↑↑ -0.0032	↑↑ -0.0065			
RS51	32	0.004	0.015	0.145	↑↑ -0.0010	→ N/A	↑↑ -0.0004			
RS53	30	0.007	0.013	1.210		↓ 0.0003	↑↑ -0.0004			
RS55	32	0.002	0.005	0.054	↑ N/A	↑ N/A			→ N/A	↑↑ -0.0001
RS57	34	0.026	0.052	0.136	↓↓ 0.0038	↓↓ 0.0007				
RS58	34	0.005	0.019	0.081	↑ -0.0009					
RS59	33	0.005	0.023	0.520		↓ N/A	↑↑ -0.0004			
RS60	27	0.005	0.015	0.071						
RS61	34	0.008	0.017	0.045	→ N/A					
RS62	32	0.001	0.006	0.038		↓ N/A				↑↑ N/A

Table A2.9: **Dissolved reactive phosphorus (g/m³)** results for the period 2017/18 to 2021/22 benchmarked against National Objectives Framework (NOF) guidelines. Modelled grades (coloured lines on the map) are shown for River Environment Classification reaches order three and above. See methods for details on modelling and benchmarks. **n** refers to the number of samples and units are **g/m³** unless otherwise noted. The trends columns are unit change per year.

Site code	State	n	Median	95th percentile	Raw trends 5 yr	Raw trends 10 yr	Raw trends 15 yr	Flow adj. 5 yr	Flow adj. 10 yr	Flow adj. 15 yr
RS02	D	58	0.036	0.064	↓↓ 0.0020	↑ -0.0002	↓↓ 0.0003			
RS04	C	58	0.018	0.036	↓↓ 0.0015	↓↓ 0.0004	→ N/A			
RS05	A	58	0.005	0.007	↓↓ 0.0001	↓↓ N/A	↓↓ 0.0000			
RS06	A	57	0.005	0.007	↓↓ 0.0002	↓ N/A	↓↓ N/A			
RS07	D	58	0.028	0.053	↓↓ 0.0023	↓ 0.0003	↓↓ 0.0004			
RS10	B	58	0.008	0.012	↓↓ 0.0004	↓↓ 0.0001	↓↓ 0.0002			
RS13	C	58	0.012	0.020	↓↓ 0.0022	↓ 0.0001	↓↓ 0.0001			
RS14	C	58	0.013	0.019	↓↓ 0.0010	↑↑ -0.0002	↑↑ -0.0002			
RS15	D	46	0.024	0.033						
RS16	D	58	0.023	0.035	↓↓ 0.0017	↓↓ 0.0005	↓↓ 0.0004			
RS17	D	58	0.025	0.053	↓ 0.0006	↑ -0.0002	↓ N/A			
RS18	D	58	0.032	0.051	↓↓ 0.0012	↑ -0.0001	↑↑ -0.0003			
RS19	D	58	0.036	0.058	→ 0.0001	↑ -0.0002	↓↓ 0.0003			
RS20	A	57	0.004	0.006			→ N/A			
RS21	A	57	0.005	0.008		→ N/A	↑ N/A			
RS22	A	57	0.005	0.008	↓ N/A	↓ N/A	↓↓ N/A	↓ 0.0001	↓↓ N/A	→ N/A
RS23	A	58	0.005	0.007	↓↓ 0.0005	→ N/A	↑↑ 0.0000			
RS24	B	57	0.010	0.015	↓↓ 0.0005	→ N/A	↑ 0.0000			
RS25	A	58	0.004	0.006	↓ N/A	→ N/A	↓ N/A			
RS26	B	56	0.008	0.012	↓↓ 0.0005	↓↓ 0.0001	↓↓ 0.0001			
RS28	C	58	0.011	0.015	↓ 0.0002	↑ 0.0000	↓↓ 0.0001			
RS29	C	58	0.012	0.020	↓↓ 0.0006	↓↓ 0.0002	↓ 0.0001			
RS31	A	49	0.002	0.004			↑↑ N/A			
RS32	A	58	0.006	0.016	↓ 0.0004	↑ N/A	↑↑ -0.0001			
RS33	B	57	0.009	0.030	→ -0.0001	↑↑ -0.0007	↑↑ -0.0012			
RS34	B	55	0.009	0.028	→ 0.0001	↑↑ -0.0003	↑↑ -0.0003	→ N/A	→ N/A	↑ N/A
RS37	D	54	0.021	0.052	↓ 0.0013	↓↓ 0.0006	↓↓ 0.0004			
RS38	C	55	0.017	0.037	↓↓ 0.0010	↓↓ 0.0004	↓↓ 0.0001			
RS39	D	53	0.043	0.101		↓↓ 0.0020	↓↓ 0.0010			
RS40	A	58	0.004	0.012		↑ N/A	→ N/A			
RS41	A	58	0.003	0.005	→ N/A	↑↑ N/A				
RS42	B	50	0.005	0.029		↓ N/A	↓ N/A		↓↓ N/A	↓↓ N/A
RS45	C	39	0.014	0.036	→ -0.0001	↓ 0.0001	→ N/A			
RS46	D	57	0.023	0.089	→ 0.0001	↑↑ -0.0007	↑↑ -0.0010			
RS48	B	56	0.010	0.022	↓↓ 0.0008	↑↑ -0.0003	↑↑ -0.0004			
RS50	D	57	0.022	0.081	↓↓ 0.0027	↑↑ -0.0029	↑↑ -0.0050			
RS51	B	54	0.007	0.030	→ 0.0000		→ N/A			
RS53	B	51	0.010	0.026		↓↓ 0.0004	↓↓ 0.0003			
RS55	A	54	0.003	0.004	↓↓ N/A	↑↑ N/A	↑↑ N/A			

Site code	State	n	Median	95th percentile	Raw trends			Flow adj.		
					5 yr	10 yr	15 yr	5 yr	10 yr	15 yr
RS57	D	58	0.027	0.049	↓↓ 0.0023	↓↓ 0.0005				
RS58	C	58	0.011	0.028	→ -0.0001					
RS59	C	53	0.015	0.030		↑ -0.0001	↑↑ -0.0002			
RS60	B	49	0.006	0.026						
RS61	C	58	0.014	0.017	↓↓ 0.0004					
RS62	A	51	0.003	0.006		↓↓ N/A	↓↓ N/A			

Metals

Table A2.10: **Dissolved copper (g/m^3)** results for the period 2019/20 to 2021/22 benchmarked against GWRC toxicity guidelines. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted.

Site code	State	n	Median	95th percentile
RS02	C	34	0.9	2.8
RS10	A	34	0.3	0.3
RS15	C	34	1.0	2.7
RS16	C	34	1.2	3.1
RS18	D	34	1.4	4.8
RS19	C	34	1.4	3.2
RS21	A	33	0.3	0.6
RS22	A	33	0.3	0.7
RS40	A	34	0.3	0.6
RS57	D	34	1.1	4.6

Table A2.11: **Dissolved zinc (g/m^3)** results for the period 2019/20 to 2021/22 benchmarked against GWRC toxicity guidelines. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted.

Site code	State	n	Median	95th percentile
RS02	B	34	2.6	8.5
RS10	A	34	0.5	0.5
RS15	B	34	3.4	11.7
RS16	C	34	7.3	34.2
RS18	D	34	18.5	44.2
RS19	B	34	5.7	11.9
RS21	A	33	0.5	1.7
RS22	A	33	0.5	2.6
RS40	A	34	0.5	0.9
RS57	D	34	15.0	51.6

Microbiology

Table A2.12: ***E. coli* (cfu/100ml)** results for the period 2017/18 to 2021/22 benchmarked against MfE swimming risk guidelines. Modelled grades (coloured lines on the map) are shown for River Environment Classification reaches order three and above. See methods for details on modelling and benchmarks. **n** refers to the number of samples and units are **cfu/100ml** unless otherwise noted. The trends columns are unit change per year.

Site code	State	n	% > 540 cfu/100ml	% > 260 cfu/100ml	Median	95th percentile	Raw trends			Flow adj.		
							5 yr	10 yr	15 yr	5 yr	10 yr	15 yr
RS02	E	58	86	100	1,350	9,000	↑↑ -126.2	↓ 16.7	↓↓ 55.8			
RS04	E	58	78	95	1,050	4,460	→ N/A	↓↓ 50.0	↓↓ 49.1			
RS05	A	58	0	0	10	130	↓↓ 2.4					
RS06	A	57	2	4	30	190	→ N/A	↓↓ 0.6	→ N/A			
RS07	E	58	90	100	1,500	11,400	↓ 92.5	↓↓ 85.4	↓↓ 80.0			
RS10	A	58	2	3	34	214	↓↓ 3.0	↓ 0.9	↓↓ 1.0			
RS13	E	58	26	55	275	1,620	↑ -13.8	↑ -6.0	↓ 4.2	↑ -49.3	↑ -10.8	→ 0.4
RS14	E	58	34	66	325	2,340	↓↓ 64.0	↓↓ 14.7	↓↓ 7.1	→ -2.1	↑ -6.9	↑ -4.9
RS15	E	46	50	76	525	10,400						
RS16	E	58	90	98	1,300	14,200	↓ 70.6	↓ 28.3	↓↓ 57.4			
RS17	E	58	38	60	345	4,120	↓↓ 53.4	↓ 6.7	↓↓ 9.6			
RS18	E	58	95	98	2,000	10,600	→ 44.4	↓↓ 79.5	↓↓ 72.9			
RS19	E	58	67	88	1,200	11,200	↓↓ 239.9	↓↓ 101.7	↓↓ 40.2			
RS20	A	57	2	11	34	307	→ 1.9	↓↓ 2.4	↓↓ 0.6			
RS21	D	57	19	30	100	2,080	↓ 10.8	↓↓ 6.0	→ N/A			
RS22	D	57	16	32	140	2,655	↓↓ 20.3	↓↓ 8.2	↓↓ 2.3			
RS23	D	58	12	22	135	1,520	↓↓ 10.0	↓↓ 6.7	↓↓ 3.1			
RS24	E	57	37	58	330	5,740	↓ 32.5	↓↓ 16.7	↓↓ 10.0			
RS25	C	58	10	16	100	1,200	↓ 10.0	↓↓ 6.6	↓↓ 2.6	→ 6.4	↓↓ 6.9	↓↓ 5.4
RS26	A	56	5	7	36	486	↓ 4.6	↓↓ 1.8	↓↓ 0.8			
RS28	A	58	0	2	10	149	↓↓ N/A					
RS29	D	58	19	36	210	1,800	↓↓ 26.7	↓↓ 17.1	↓↓ 6.9			
RS31	A	49	0	2	10	111						
RS32	D	58	10	17	95	1,600	↓↓ 14.6	↓↓ 5.1	→ N/A			
RS33	A	57	4	12	60	400	↑ -2.0	↓ 1.0	→ N/A			
RS34	D	55	7	25	60	1,600	↓ 4.9	↓↓ 2.5	↑ -0.5	↓↓ 16.8	↓↓ 5.9	↓ 3.6
RS37	D	55	22	27	130	4,000	→ N/A	↓ 3.2	↓↓ 3.0			
RS38	D	55	16	31	200	2,900	↓ 10.0	→ N/A	↑↑ -3.3		↓ 2.7	
RS39	D	52	19	27	135	7,580		↑↑ -11.3	↑↑ -10.5			
RS40	D	57	9	23	90	1,710	↑ -5.7	↓↓ 5.2	↓↓ 2.0			
RS41	A	58	2	7	29	366	↓ 0.9	↓↓ 1.0	↑ N/A			

Site code	State	n	% > 540 cfu/100ml	% > 260 cfu/100ml	Median	95th percentile	Raw trends			Flow adj.		
							5 yr	10 yr	15 yr	5 yr	10 yr	15 yr
RS45	A	39	0	5	20	307	→ -1.0	↓ 1.3	→ N/A			
RS46	E	57	47	67	500	11,550	↑ -29.0	↓↓ 18.3	↑ -4.4			
RS48	B	56	7	18	110	810	↓↓ 12.0	↓↓ 8.0	↓↓ 2.4			
RS50	D	57	16	32	130	3,925	↓ 5.0	→ 1.3	↓↓ 2.0			
RS51	C	54	7	15	100	1,178	→ -1.8	→ N/A	→ N/A			
RS53	D	51	6	18	110	2,207		↓↓ 3.1	↑ -1.2			
RS55	A	54	0	4	29	214	↑ -0.8	↓↓ 1.5	↓↓ 0.5			
RS57	E	58	67	84	900	15,300	↓↓ 222.8	↓↓ 73.2		↓↓ 340.3	↓ 63.4	
RS58	D	58	10	21	70	1,640	→ N/A					
RS59	D	51	18	31	170	6,980		↓↓ 13.6	→ 2.6			
RS60	C	50	14	28	95	1,200						
RS61	A	58	0	3	21	218						
RS62	A	51	2	4	10	178		↓↓ N/A				

Sediment

Table A2.13: **Water clarity (m)** results for the period 2017/18 to 2021/22 benchmarked against National Objectives Framework (NOF) guidelines. Modelled grades (coloured lines on the map) are shown for River Environment Classification reaches order three and above. See methods for details on modelling and benchmarks. The trends columns are unit change per year.

					Raw trends			Flow adj.		
Site code	**Class**	**State**	**n**	**Median (m)**	**5 yr**	**10 yr**	**15 yr**	**5 yr**	**10 yr**	**15 yr**
RS02	1	D	59	0.92	↑↑ 0.11	↑↑ 0.05	↑↑ 0.04			
RS04	3	D	59	0.85	→ 0.00	↑ 0.01	↑↑ 0.02			
RS05	3	A	59	4.15	→ -0.14	→ 0.03	↑ 0.03	→ -0.05	→ 0.00	↑↑ 0.07
RS06	3	A	58	3.40	↑ 0.13	↑ 0.11	↑↑ 0.11			
RS07	2	C	59	0.67	↓↓ -0.08	→ 0.00	↑↑ 0.02			
RS10	3	A	59	5.07	↑↑ 0.29	↑↑ 0.21	↑↑ 0.20			
RS13	3	B	59	2.70	→ 0.00	↑↑ 0.09	↑↑ 0.06	↑↑ 0.10	↑↑ 0.09	↑↑ 0.06
RS14	3	D	59	2.14	↑ 0.07	↑↑ 0.10	↑↑ 0.06	↑↑ 0.13	↑↑ 0.12	↑↑ 0.09
RS15	3	C	47	2.31						
RS16	2	A	59	2.21	→ 0.03	↑↑ 0.09	↑↑ 0.05			
RS17	3	D	59	1.42	↓ -0.05	↓ -0.02	↑ 0.01			
RS18	3	B	59	2.93	↑↑ 0.23	↑ 0.04	↑↑ 0.06			
RS19	3	A	59	3.48	→ 0.05	↑↑ 0.08	↑↑ 0.13			
RS20	3	A	58	3.72	→ -0.08	→ 0.02	↑↑ 0.11	↑ 0.07	↑↑ 0.05	↑↑ 0.08
RS21	3	B	59	2.57	→ -0.08	→ 0.04	↑↑ 0.08	↓↓ -0.12	↑ 0.02	↑↑ 0.07
RS22	3	C	59	2.43	→ 0.01	↑ 0.06	↑↑ 0.07	↓ -0.08	↑ 0.03	↑↑ 0.06
RS23	3	A	59	4.08	↑ 0.20	↑ 0.07	↑↑ 0.13			
RS24	3	D	58	1.41	→ -0.01	↑ 0.03	↑↑ 0.03	↓ -0.04	↑↑ 0.03	↑↑ 0.03
RS25	3	A	59	3.75	→ 0.05	→ 0.01	↑↑ 0.08	→ 0.00	↓ -0.02	↑↑ 0.10
RS26	3	A	59	3.33	→ -0.04	→ -0.01	↑↑ 0.07			
RS28	3	A	59	3.94	→ 0.00	↑↑ 0.20	↑↑ 0.11			
RS29	3	C	59	2.23	↑ 0.06	↑↑ 0.09	↑↑ 0.11			
RS31	3	A	58	6.39		↑↑ 0.19	↑↑ 0.26		↑↑ 0.12	↑↑ 0.12
RS32	4	A	59	3.27	↑ 0.17	↑↑ 0.16	↑↑ 0.13			
RS33	3	C	58	2.51	↑↑ 0.21	↑↑ 0.15	↑↑ 0.10			
RS34	4	A	58	1.91		↑ 0.02	↑↑ 0.05		→ 0.00	↑↑ 0.02
RS37	2	B	59	0.92	↑ 0.04	→ N/A	↑↑ 0.02			
RS38	4	A	58	2.00	↑ 0.07	↑↑ 0.08	↑↑ 0.07		↑↑ 0.08	
RS39	1	D	56	0.98		↑ 0.02	↑↑ 0.02			
RS40	3	A	59	4.04	↑ 0.14	↑↑ 0.14	↑↑ 0.10			
RS41	3	A	59	5.22		↑↑ 0.32	↑↑ 0.18			
RS42	2	D	55	0.58		→ 0.00	↑ 0.01		↓ -0.01	↑ 0.01
RS45	3	D	54	2.07	→ -0.14	↓ -0.09	→ -0.03			
RS46	1	C	58	1.50	↑ 0.04	↑↑ 0.05	↑↑ 0.07		↑ 0.04	↑↑ 0.07
RS48	3	D	57	1.71	↓ -0.07	→ -0.01	→ 0.00			
RS50	3	D	58	2.10	→ 0.04	↑↑ 0.07	↑↑ 0.05			
RS51	2	A	58	2.72	↑ 0.09	↑↑ 0.08	↑↑ 0.11			
RS53	2	A	57	2.30		↑↑ 0.06	↑↑ 0.06			

Site code	Class	State	n	Median (m)	Raw trends			Flow adj.		
					5 yr	10 yr	15 yr	5 yr	10 yr	15 yr
RS57	2	A	59	1.24	↓↓ -0.15	↑↑ 0.04				
RS58	4	A	59	1.96	↑ 0.08					
RS59	3	B	57	2.64		↑ 0.03				
RS60	4	A	57	1.87						
RS61	3	A	59	3.43	↓ -0.11					
RS62	3	A	55	4.66		↑ 0.13	↑↑ 0.06		↑↑ 0.26	↑↑ 0.09

Table A2.14: **Deposited fine sediment (% cover)** results for the period 2017/18 to 2021/22 benchmarked against National Objectives Framework (NOF) guidelines. Modelled grades (coloured lines on the map) are shown for River Environment Classification reaches order three and above. See methods for details on modelling and benchmarks.

Site code	Class	State	n	Median (% cover)
RS04	4	D	59	100
RS05	4	A	59	1
RS06	4	A	58	4
RS10	4	A	59	12
RS13	4	A	59	10
RS14	4	D	59	70
RS15	4	A	47	6
RS16	2	A	59	4
RS17	4	D	59	60
RS18	4	A	59	9
RS19	4	A	59	7
RS20	4	A	58	1
RS21	4	A	59	3
RS22	4	A	59	10
RS23	4	A	59	3
RS24	4	A	58	2
RS25	4	A	59	5
RS26	4	A	59	5
RS28	4	A	59	2
RS29	4	A	59	6
RS31	4	A	58	1
RS32	2	A	59	4
RS33	4	A	58	3
RS34	2	A	58	0
RS37	3	B	59	13
RS38	2	A	58	3
RS40	4	A	59	0
RS41	4	A	59	0
RS42	3	D	55	65
RS45	2	A	54	2
RS48	4	A	58	0

Site code	Class	State	n	Median (% cover)
RS51	3	A	58	1
RS53	3	B	57	11
RS55	4	A	58	4
RS57	2	D	58	60
RS58	2	A	59	4
RS59	4	A	57	3
RS60	2	C	57	27
RS61	4	A	59	1
RS62	4	A	56	0

Table A2.15: **Suspended sediment concentration (g/m^3)** results for the period 2019/20 to 2021/22. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	23	5.0	5.0	72.0
RS04	23	5.0	5.5	60.0
RS05	23	5.0	5.5	40.0
RS06	23	5.0	5.0	73.0
RS07	23	5.5	6.0	81.0
RS10	32	2.0	5.0	43.0
RS13	34	2.0	5.0	75.0
RS14	34	2.0	5.0	142.0
RS15	34	2.0	5.0	480.0
RS16	34	2.0	5.0	109.0
RS17	34	5.0	5.3	34.0
RS18	23	5.0	5.0	51.0
RS19	23	5.0	5.0	320.0
RS20	22	5.0	5.0	18.0
RS21	33	5.0	5.0	460.0
RS22	33	5.0	5.0	460.0
RS23	34	5.0	5.0	280.0
RS24	34	5.0	5.5	66.0
RS25	34	5.0	5.0	42.0
RS26	32	5.0	5.0	5.5
RS28	23	5.0	5.0	5.5
RS29	23	5.0	5.0	36.0
RS31	29	5.0	5.0	65.0
RS32	33	2.0	5.0	650.0
RS33	33	5.0	5.5	440.0
RS34	34	5.0	5.5	210.0
RS37	32	2.0	5.5	230.0
RS38	34	2.0	5.5	230.0
RS39	31	5.0	5.5	550.0
RS40	34	2.0	5.0	76.0
RS41	34	2.0	5.5	210.0
RS42	27	2.0	11.0	1880.0

Site code	n	Min	Median	Max
RS45	18	5.0	5.5	102.0
RS46	34	5.0	5.5	96.0
RS48	34	4.0	5.3	93.0
RS50	34	2.0	5.0	192.0
RS51	32	5.0	5.5	62.0
RS53	30	5.0	5.5	1560.0
RS55	32	5.0	5.3	280.0
RS57	22	5.0	5.3	26.0
RS58	34	2.0	5.3	320.0
RS59	33	2.0	5.5	480.0
RS60	27	2.0	5.5	90.0
RS61	23	5.0	5.0	27.0
RS62	32	4.0	5.0	43.0

Table A2.16: **Total suspended solids (g/m^3)** results for the period 2019/20 to 2021/22. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	23	1.0	3.0	75.0
RS04	23	1.0	6.0	55.0
RS05	23	1.0	1.0	47.0
RS06	23	1.0	1.0	59.0
RS07	23	1.0	6.0	83.0
RS10	34	1.0	1.0	27.0
RS13	34	1.0	2.0	67.0
RS14	34	1.0	2.0	133.0
RS15	34	1.0	1.5	480.0
RS16	34	1.0	2.0	102.0
RS17	34	1.0	6.0	35.0
RS18	23	1.0	1.0	51.0
RS19	23	1.0	1.0	191.0
RS20	22	1.0	1.0	21.0
RS21	33	1.0	2.0	390.0
RS22	33	1.0	1.0	400.0
RS23	34	1.0	1.0	240.0
RS24	34	1.0	2.0	41.0
RS25	34	1.0	1.0	36.0
RS26	33	1.0	1.0	13.0
RS28	23	1.0	1.0	7.0
RS29	23	1.0	2.0	36.0
RS31	21	1.0	1.0	69.0
RS32	34	1.0	1.0	660.0
RS33	33	1.0	1.5	450.0
RS34	34	1.0	4.0	220.0
RS37	32	1.0	5.5	240.0
RS38	34	1.0	3.0	260.0

Site code	n	Min	Median	Max
RS39	31	1.0	4.0	590.0
RS40	34	1.0	1.0	80.0
RS41	34	1.0	1.0	76.0
RS42	27	1.0	10.0	770.0
RS45	18	1.0	1.5	76.0
RS46	34	1.0	5.0	93.0
RS48	34	1.0	3.5	93.0
RS50	34	1.0	3.0	180.0
RS51	32	1.0	2.5	62.0
RS53	30	1.0	3.0	1600.0
RS55	32	1.0	1.0	120.0
RS57	22	1.0	6.0	25.0
RS58	34	1.0	3.0	360.0
RS59	33	1.0	2.0	400.0
RS60	27	1.0	3.0	90.0
RS61	23	1.0	1.0	28.0
RS62	32	1.0	1.0	47.0

Other water quality variables

Table A2.17: **Dissolved oxygen (mg/L)** summer (1-Nov to 30-Apr) sampling results for the period 2019/20 to 2021/22. **n** refers to the number of samples and units are **mg/L** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	35	3.4	7.3	10.4
RS04	35	5.7	9.0	10.9
RS05	35	9.5	11.0	12.7
RS06	34	9.7	10.9	12.4
RS07	35	4.3	7.9	9.6
RS10	35	8.9	10.3	11.7
RS13	35	9.1	10.6	13.3
RS14	35	7.7	10.0	12.8
RS15	35	9.2	10.6	12.5
RS16	35	9.5	10.6	12.5
RS17	35	8.5	10.4	13.2
RS18	35	9.2	10.3	11.4
RS19	35	9.4	10.3	11.9
RS20	34	9.8	11.2	12.4
RS21	35	9.8	10.8	12.3
RS22	35	9.2	10.6	13.3
RS23	35	7.4	10.4	11.7
RS24	35	9.5	10.9	11.8
RS25	35	9.6	10.8	12.6
RS26	35	9.6	10.9	12.6
RS28	35	9.4	10.8	11.9
RS29	35	8.8	10.3	11.3
RS31	35	9.2	10.9	12.3
RS32	35	8.8	10.6	11.8
RS33	34	9.3	10.4	15.4
RS34	35	9.4	10.5	13.0
RS37	35	6.8	9.9	12.8
RS38	35	8.1	10.6	14.6
RS39	33	1.0	10.8	17.9
RS40	35	8.9	10.9	11.9
RS41	35	8.5	10.1	11.5
RS42	31	7.9	9.5	11.5
RS45	33	6.4	7.3	8.5
RS46	35	6.5	10.8	12.4
RS48	35	8.7	10.4	12.4
RS50	35	8.5	10.0	13.6
RS51	34	8.8	11.4	15.3
RS53	34	4.2	10.8	14.3
RS55	34	7.8	10.6	12.6
RS57	35	7.8	10.0	16.8
RS58	35	9.5	11.0	12.6
RS59	35	1.4	9.3	13.0

Site code	n	Min	Median	Max
RS60	33	5.1	10.4	13.2
RS61	35	9.7	10.8	12.2
RS62	35	9.6	11.1	12.4

Table A2.18: **Dissolved oxygen (% saturation)** results for the period 2019/20 to 2021/22. **n** refers to the number of samples and units are **% saturation** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	35	35.2	72.7	95.0
RS04	35	57.9	86.2	97.1
RS05	35	97.8	100.2	102.8
RS06	34	98.7	101.8	115.9
RS07	35	45.6	78.1	93.1
RS10	35	96.3	100.0	107.5
RS13	35	94.8	99.9	109.9
RS14	35	82.4	95.3	101.0
RS15	35	96.6	102.3	116.3
RS16	35	96.5	101.5	116.4
RS17	35	89.2	98.1	123.5
RS18	35	93.6	99.3	108.5
RS19	35	93.3	99.3	113.4
RS20	34	99.7	101.5	107.1
RS21	35	98.9	102.9	152.4
RS22	35	90.9	100.6	160.2
RS23	35	77.4	98.1	115.8
RS24	35	96.4	101.2	118.4
RS25	35	100.1	101.3	106.7
RS26	35	100.3	102.1	109.6
RS28	35	96.0	99.1	102.9
RS29	35	91.3	97.3	123.6
RS31	35	97.9	100.5	102.7
RS32	35	98.1	100.5	120.8
RS33	34	95.1	100.5	168.8
RS34	35	94.5	99.6	136.5
RS37	35	68.9	91.7	134.7
RS38	35	81.4	98.3	161.9
RS39	33	10.4	100.4	206.2
RS40	35	95.4	103.6	125.9
RS41	35	76.5	99.8	112.2
RS42	31	83.2	93.5	115.6
RS45	33	62.1	70.8	77.1
RS46	35	76.6	101.1	126.3
RS48	35	88.6	100.9	126.4
RS50	35	88.5	95.9	140.3
RS51	34	93.7	113.2	154.4
RS53	34	45.0	105.3	168.5

Site code	n	Min	Median	Max
RS55	34	86.2	99.5	109.8
RS57	35	78.0	105.4	181.0
RS58	35	96.9	103.7	142.6
RS59	35	14.4	91.1	111.5
RS60	33	52.2	99.5	144.1
RS61	35	97.7	99.9	100.6
RS62	35	96.9	100.1	102.4

Table A2.19: **pH** results for the period 2019/20 to 2021/22. **n** refers to the number of samples and units are **measured pH** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	34	6.7	6.9	7.5
RS04	34	6.6	7.0	7.6
RS05	34	6.8	7.3	7.6
RS06	33	6.7	7.3	7.8
RS07	34	6.7	7.0	7.5
RS10	34	6.8	7.3	7.6
RS13	34	7.0	7.4	7.8
RS14	34	6.8	7.3	7.6
RS15	34	6.7	7.5	8.2
RS16	34	6.8	7.5	8.1
RS17	34	6.9	7.4	8.0
RS18	34	7.1	7.3	7.9
RS19	34	7.1	7.6	8.0
RS20	33	6.4	7.3	7.9
RS21	33	6.5	7.3	8.9
RS22	33	6.5	7.2	9.3
RS23	34	6.5	7.1	7.5
RS24	34	6.3	7.1	7.6
RS25	34	6.5	7.3	7.8
RS26	32	6.8	7.4	7.8
RS28	34	6.3	7.2	7.7
RS29	34	6.5	7.3	7.7
RS31	29	6.7	7.4	7.9
RS32	34	6.9	7.7	8.3
RS33	33	6.9	7.5	8.8
RS34	34	6.9	7.6	8.3
RS37	32	6.9	7.9	8.2
RS38	34	7.3	7.9	8.5
RS39	31	7.1	7.5	8.3
RS40	34	6.8	7.5	8.2
RS41	34	6.7	7.4	7.8
RS42	27	7.4	8.0	8.3
RS45	18	6.6	6.7	7.3
RS46	34	6.8	7.4	8.8

Site code	n	Min	Median	Max
RS48	34	6.8	7.1	7.7
RS50	34	6.6	7.1	7.6
RS51	32	7.3	8.1	8.6
RS53	30	7.5	8.2	8.5
RS55	32	6.6	7.3	7.8
RS57	34	6.4	7.0	7.5
RS58	34	7.0	7.6	8.8
RS59	33	6.6	7.1	7.5
RS60	27	7.3	7.9	8.3
RS61	34	6.7	7.3	7.6
RS62	32	6.7	7.3	7.7

Table A2.20: **Electrical conductivity (µS/cm)** results for the period 2019/20 to 2021/22. **n** refers to the number of samples and units are **µS/cm** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	35	136	200	226
RS04	35	95	149	238
RS05	35	43	65	78
RS06	34	48	68	81
RS07	35	122	188	246
RS10	35	87	103	157
RS13	35	157	206	1,004
RS14	35	143	175	207
RS15	35	106	234	262
RS16	35	120	243	270
RS17	35	225	263	317
RS18	35	43	216	230
RS19	35	126	260	291
RS20	34	35	71	84
RS21	35	44	90	125
RS22	35	44	92	114
RS23	35	53	85	92
RS24	35	82	106	118
RS25	35	62	82	92
RS26	35	88	112	124
RS28	35	76	109	120
RS29	35	117	142	155
RS31	35	20	57	69
RS32	35	43	132	206
RS33	34	45	118	167
RS34	35	43	143	203
RS37	35	216	419	567
RS38	35	128	283	395
RS39	33	194	381	468
RS40	35	67	110	143

Site code	n	Min	Median	Max
RS41	35	35	62	77
RS42	31	245	571	728
RS45	33	149	170	188
RS46	35	121	148	184
RS48	35	37	76	95
RS50	35	78	112	149
RS51	34	264	419	493
RS53	34	366	466	534
RS55	34	44	70	93
RS57	35	84	224	257
RS58	35	44	138	206
RS59	35	101	115	167
RS60	33	177	342	454
RS61	35	69	87	96
RS62	35	29	58	70

Macroinvertebrates

Table A2.21: **Macroinvertebrate community index (MCI)** results for the period 2019/20 to 2021/22 with the three year median scores benchmarked against GWRC MCI class and Proposed Natural Resource Plan (PNRP) guidelines. Modelled grades (coloured lines on the map) are shown for River Environment Classification reaches order three and above. See methods for details on modelling and benchmarks. The trends columns are unit change per year.

Site code	Latest MCI (2021/22)	Median MCI (3-yr)	n (3-yr)	MCI class	PNRP objective	State	Raw trends	
							10 yr	15 yr
RS02	83	89	3	C	Not meeting	C	↑ 1.4	→ 0.0
RS04	78	78	3	D	Not meeting	D	↓↓ -0.7	↓ -0.4
RS05	114	117	3	C	Not meeting	C	↓ -0.8	↓↓ -1.2
RS06	125	125	3	B	Not meeting	B	↑ 1.4	↑ 0.9
RS07	65	65	3	D	Not meeting	D	↑ 0.3	→ 0.0
RS10	113	116	3	B	Not meeting	B	→ 0.5	↓ -0.1
RS13	107	107	3	B	Meeting	B	→ -0.5	→ 0.0
RS14	99	104	3	C	Not meeting	C	→ 0.0	→ 0.0
RS15	90	102	3	C	Not meeting	C	↓ -0.7	↑↑ 0.9
RS16	91	94	3	C	Not meeting	C	↑ 0.7	↑ 0.4
RS17	110	110	3	B	Meeting	B	→ 0.1	↑ 0.6
RS18	94	91	3	C	Not meeting	C	→ -0.2	↑ 0.6
RS19	97	85	3	C	Not meeting	C	→ 0.2	↑↑ 1.1
RS20	138	128	3	B	Not meeting	B	↓ -0.4	↓ -0.2
RS21	110	112	3	B	Not meeting	B	↓↓ -1.8	→ -0.2
RS22	127	123	3	B	Not meeting	B	↑↑ 1.8	↑↑ 1.7
RS23	122	122	3	B	Not meeting	B	↓ -0.7	↓↓ -0.6
RS24	122	119	3	C	Not meeting	C	→ -0.1	↑ 0.2
RS25	144	137	3	A	Meeting	A	↑ 1.0	↑↑ 0.5
RS26	139	131	3	A	Meeting	A	→ -0.6	→ 0.1
RS28	130	132	3	A	Meeting	A	↓ -0.3	↓ -0.2
RS29	103	103	3	C	Not meeting	C	↓ -0.7	↑↑ 1.3
RS31	147	140	3	A	Meeting	A	→ -0.3	↓↓ -0.8
RS32	124	124	3	B	Meeting	B	↑↑ 1.4	↑↑ 1.4
RS33	100	107	3	C	Not meeting	C	→ -0.1	↑↑ 0.8
RS34	106	106	3	C	Not meeting	C	↑ 0.2	↑ 0.4
RS37	88	96	3	C	Not meeting	C	↑ 0.9	↑↑ 1.3
RS38	91	96	3	C	Not meeting	C	↑↑ 0.6	↑↑ 0.5
RS39	60	60	3	D	Not meeting	D	→ 0.1	↓↓ -0.3
RS40	99	101	3	C	Not meeting	C	→ 0.3	↑↑ 0.5
RS41	128	119	3	B	Not meeting	B	↑↑ 1.1	↑↑ 1.1
RS42	81	81	3	C	Not meeting	C	→ 0.0	↑ 0.2
RS45	98	100	3	B	Meeting	B	→ -0.1	→ 0.1
RS46	83	90	3	C	Not meeting	C	→ 0.8	↑↑ 1.8
RS48	106	109	3	C	Not meeting	C	↓↓ -1.2	→ -0.1
RS50	107	107	3	C	Not meeting	C	↑ 0.7	↑↑ 1.5

Site code	Latest MCI (2021/22)	Median MCI (3-yr)	n (3-yr)	MCI class	PNRP objective	State	Raw trends	
							10 yr	15 yr
RS53	91	91	3	C	Not meeting	C	→ -0.2	↑ 1.2
RS55	117	117	3	B	Not meeting	B	↑ 0.2	→ 0.2
RS57	55	69	3	D	Not meeting	D	↑ 0.6	
RS58	105	105	3	C	Not meeting	C		
RS59	113	113	3	B	Meeting	B	↑ 1.7	↑ 0.8
RS60	108	108	3	B	Meeting	B		
RS61	138	138	3	A	Meeting	A		
RS62	139	142	3	A	Meeting	A	→ 0.4	↓↓ -0.4

Table A2.22: **Quantitative and standard macroinvertebrate community index (QMCI & MCI)** results for the period 2017/18 to 2021/22 benchmarked against National Objectives Framework (NOF) guidelines.

Site code	State	n	Median MCI (5-yr)	Median QMCI (5-yr)
RS02	D	5.0	83	4.5
RS04	D	5.0	78	5.1
RS05	B	5.0	123	7.3
RS06	B	5.0	116	6.9
RS07	D	5.0	65	4.1
RS10	B	5.0	114	6.0
RS13	C	5.0	107	4.9
RS14	D	5.0	99	3.9
RS15	C	4.0	101	5.7
RS16	D	5.0	91	4.0
RS17	C	5.0	110	4.7
RS18	D	5.0	91	2.9
RS19	D	5.0	92	3.2
RS20	B	5.0	128	7.9
RS21	B	5.0	112	6.7
RS22	D	5.0	117	4.1
RS23	B	5.0	122	7.0
RS24	C	5.0	121	5.2
RS25	A	5.0	135	8.0
RS26	A	5.0	131	6.8
RS28	A	5.0	132	7.3
RS29	C	5.0	105	5.4
RS31	A	5.0	139	8.1
RS32	B	5.0	124	7.1
RS33	C	5.0	107	6.0
RS34	C	5.0	106	6.5
RS37	D	5.0	96	4.3
RS38	D	5.0	95	4.2
RS39	D	5.0	60	2.4

Site code	State	n	Median MCI (5-yr)	Median QMCI (5-yr)
RS41	B	5.0	116	5.8
RS42	D	4.0	82	2.4
RS45	C	5.0	100	4.5
RS46	D	5.0	88	4.2
RS48	C	5.0	106	6.8
RS50	C	5.0	109	5.1
RS51	D	5.0	87	4.2
RS53	C	5.0	91	5.0
RS55	B	5.0	117	6.5
RS57	D	5.0	68	2.8
RS58	C	4.0	105	6.4
RS59	B	5.0	111	5.7
RS60	C	3.5	99	6.3
RS61	A	5.0	136	8.1
RS62	A	5.0	139	7.9

Table A2.23: **Average score per metric (ASPM)** results for the period 2017/18 to 2021/22 benchmarked against National Objectives Framework (NOF) guidelines.

Site code	State	n	ASPM (5-yr median)
RS02	D	5	0.2
RS04	D	5	0.2
RS05	A	5	0.6
RS06	A	5	0.6
RS07	D	5	0.1
RS10	B	5	0.5
RS13	A	5	0.6
RS14	B	5	0.4
RS15	B	4	0.5
RS16	C	5	0.3
RS17	B	5	0.4
RS18	C	5	0.3
RS19	C	5	0.3
RS20	A	5	0.7
RS21	A	5	0.6
RS22	B	5	0.5
RS23	A	5	0.6
RS24	B	5	0.5
RS25	A	5	0.7
RS26	A	5	0.6
RS28	A	5	0.7
RS29	B	5	0.5
RS31	A	5	0.7
RS32	A	5	0.6
RS33	B	5	0.4
RS34	B	5	0.5

Site code	State	n	ASPM (5-yr median)
RS37	C	5	0.3
RS38	B	5	0.4
RS39	D	5	0.1
RS40	B	5	0.4
RS41	B	5	0.4
RS42	D	4	0.2
RS45	C	5	0.3
RS46	C	5	0.3
RS48	B	5	0.5
RS50	B	5	0.4
RS51	C	5	0.3
RS53	C	5	0.3
RS55	B	5	0.5
RS57	D	5	0.1
RS58	B	4	0.4
RS59	B	5	0.4
RS60	B	3	0.4
RS61	A	5	0.7
RS62	A	5	0.7

Table A2.24: **Number and percentage of (EPT) taxa that are Ephemeroptera (mayfly), Plecoptera (stonefly) and all Trichoptera (caddisfly) except Hydroptilidae** results for the period 2019/20 to 2021/22.

Site code	Substrate	n	Median %	Median count
RS02	Soft	3	18.8	3
RS04	Soft	3	25.0	4
RS05	Hard	3	55.0	11
RS06	Hard	3	56.0	12
RS07	Soft	3	10.5	2
RS10	Hard	3	50.0	15
RS13	Hard	3	50.0	13
RS14	Soft	3	33.3	11
RS15	Hard	3	40.9	9
RS16	Hard	3	34.8	8
RS17	Hard	3	47.6	10
RS18	Hard	3	23.1	6
RS19	Hard	3	23.1	6
RS20	Hard	3	59.1	15
RS21	Hard	3	54.5	12
RS22	Hard	3	58.3	14
RS23	Hard	3	55.2	16
RS24	Hard	3	52.4	12
RS25	Hard	3	68.2	16
RS26	Hard	3	60.7	15

Site code	Substrate	n	Median %	Median count
RS29	Hard	3	41.4	11
RS31	Hard	3	70.0	14
RS32	Hard	3	55.6	10
RS33	Hard	3	50.0	8
RS34	Hard	3	46.2	6
RS37	Hard	3	33.3	7
RS38	Hard	3	43.5	9
RS39	Soft	3	9.5	2
RS40	Hard	3	41.7	10
RS41	Hard	3	52.6	10
RS42	Soft	3	20.0	2
RS45	Hard	3	38.9	7
RS46	Hard	3	31.3	6
RS48	Hard	3	43.5	10
RS50	Hard	3	45.5	10
RS51	Hard	3	30.0	7
RS53	Hard	3	23.1	6
RS55	Hard	3	52.4	11
RS57	Soft	3	0.0	0
RS58	Hard	3	35.3	6
RS59	Hard	3	52.4	11
RS60	Hard	3	40.9	9
RS61	Hard	3	61.3	16
RS62	Hard	5	66.7	13

Periphyton & Cyanobacteria

Table A2.25: **Periphyton biomass (Chlorophyll a mg/m^2)** results for the period 2019/20 to 2021/22 benchmarked against National Objectives Framework (NOF) guidelines. Modelled grades (coloured lines on the map) are shown for River Environment Classification reaches order three and above. See methods for details on modelling and benchmarks. **n** refers to the number of samples and units are **mg/m^2** unless otherwise noted.

Site code	River class	State	n	Median	Max	n > 200 mg/m^2
RS06	Default (8%)	A	36	5	75	0
RS10	Default (8%)	A	36	6	67	0
RS13	Default (8%)	C	36	30	255	1
RS19	Default (8%)	C	36	42	213	1
RS22	Default (8%)	C	36	7	388	1
RS24	Default (8%)	C	36	34	151	0
RS29	Default (8%)	C	36	53	233	2
RS33	Default (8%)	C	36	14	247	1
RS38	Default (8%)	D	36	102	734	13
RS40	Default (8%)	D	36	77	322	3
RS46	Default (8%)	D	36	46	429	5
RS48	Default (8%)	A	36	3	160	0
RS50	Default (8%)	D	36	49	359	3
RS51	Productive (17%)	D	36	117	520	11
RS58	Default (8%)	B	36	10	302	1

Table A2.26: **Periphyton weighted composite cover (WCC)** results for the period 2019/20 to 2021/22 benchmarked against a GWRC periphyton nuisance guideline of 30%.

Site code	n	Max WCC (%)	n ≥ 30%
RS05	35	9.8	0
RS06	34	46.8	2
RS10	35	19.8	0
RS13	35	68.5	4
RS15	35	15.9	0
RS16	35	43.9	1
RS17	35	21.3	0
RS18	35	30.9	1
RS19	35	41.7	3
RS20	34	5.0	0
RS21	35	65.3	1
RS22	35	82.5	4
RS23	35	40.3	1
RS24	35	70.0	6
RS25	35	18.9	0
RS26	35	20.0	0
RS28	35	16.1	0

Site code	n	Max WCC (%)	n ≥ 30%
RS31	35	8.3	0
RS32	35	12.9	0
RS33	34	73.5	2
RS34	35	61.5	1
RS37	35	31.3	1
RS38	35	60.8	5
RS40	35	87.5	2
RS41	35	23.9	0
RS45	33	11.4	0
RS46	35	54.0	4
RS48	35	41.5	1
RS50	35	93.1	4
RS51	34	88.0	18
RS53	34	97.3	11
RS55	34	49.9	2
RS58	35	61.3	5
RS59	35	37.0	3
RS60	33	47.8	4
RS61	35	0.6	0
RS62	35	5.8	0

Table A2.27: **Cyanobacteria mats (% coverage)** results for the period 2019/20 to 2021/22.

Site code	n	Max cover (%)	n 20-50%	n >50%
RS02	35	0.0	0	0
RS04	35	0.0	0	0
RS05	35	0.2	0	0
RS06	34	14.1	0	0
RS07	35	0.0	0	0
RS10	35	4.5	0	0
RS13	35	2.5	0	0
RS14	35	0.0	0	0
RS15	35	0.0	0	0
RS16	35	0.0	0	0
RS17	35	0.5	0	0
RS18	35	0.1	0	0
RS19	35	10.5	0	0
RS20	34	3.3	0	0
RS21	35	40.5	2	0
RS22	35	25.3	1	0
RS23	35	7.5	0	0
RS24	35	24.8	1	0
RS25	35	0.1	0	0
RS26	35	11.3	0	0
RS28	35	1.3	0	0
RS29	35	31.8	1	0

Site code	n	Max cover (%)	n 20-50%	n >50%
RS31	35	1.6	0	0
RS32	35	0.5	0	0
RS33	34	19.3	0	0
RS34	35	25.5	1	0
RS37	35	1.5	0	0
RS38	35	21.8	1	0
RS39	33	0.0	0	0
RS40	35	69.5	3	1
RS41	35	20.3	1	0
RS42	31	0.0	0	0
RS45	33	0.0	0	0
RS46	35	0.3	0	0
RS48	35	11.0	0	0
RS50	35	12.8	0	0
RS51	34	30.7	2	0
RS53	34	0.0	0	0
RS55	34	0.0	0	0
RS57	35	0.0	0	0
RS58	35	9.5	0	0
RS59	35	0.0	0	0
RS60	33	0.0	0	0
RS61	35	0.8	0	0
RS62	35	0.8	0	0

Habitat quality

Table A2.28: **Habitat quality** results for 2021/22. Assessment categories are scored from 1 ("poor") to 10 ("excellent") with an overall score as the total of these out of 100. See methods for details on assessments.

Site code	Overall	Deposited Sediment	Invertebrate Habitat Diversity	Invertebrate Habitat Abundance	Fish Cover Diversity	Fish Cover Abundance	Hydraulic Heterogeneity	Bank Erosion	Bank Vegetation	Riparian Width	Riparian Shade
RS02	57.0	1.0	5.0	3.0	4.0	4.0	3.0	9.0	8.0	10.0	10.0
RS04	49.5	1.0	5.0	4.0	6.0	8.0	3.0	6.5	6.0	6.0	4.0
RS05	88.0	10.0	9.0	10.0	7.0	9.0	10.0	10.0	8.0	10.0	5.0
RS06	67.5	9.0	8.0	10.0	5.0	7.0	6.0	9.0	4.0	8.5	1.0
RS07	29.0	1.0	1.0	1.0	2.0	3.0	2.0	4.0	4.0	8.0	3.0
RS10	71.5	8.0	9.0	7.0	8.0	5.0	7.0	9.5	6.0	10.0	2.0
RS13	61.0	9.0	6.0	4.0	7.0	7.0	6.0	7.5	2.0	9.5	3.0
RS14	65.5	1.0	8.0	1.0	10.0	10.0	4.0	8.0	5.0	9.5	9.0
RS15	65.0	8.0	8.0	3.0	8.0	6.0	7.0	7.0	5.0	9.0	4.0
RS16	58.0	8.0	8.0	4.0	8.0	5.0	5.0	9.0	2.0	8.0	1.0
RS17	69.0	4.0	8.0	1.0	10.0	10.0	4.0	8.5	6.0	9.5	8.0
RS18	62.5	9.0	8.0	3.0	5.0	6.0	5.0	9.5	4.0	7.0	6.0
RS19	77.5	8.0	8.0	3.0	10.0	9.0	6.0	7.5	8.0	10.0	8.0
RS20	78.5	10.0	9.0	9.0	6.0	9.0	8.0	8.5	7.0	10.0	2.0
RS21	69.5	9.0	9.0	6.0	9.0	8.0	5.0	8.0	5.0	9.5	1.0
RS22	72.5	9.0	8.0	9.0	6.0	8.0	6.0	8.5	6.0	9.0	3.0
RS23	75.5	9.0	9.0	7.0	9.0	7.0	8.0	9.5	6.0	6.0	5.0
RS24	73.0	9.0	9.0	4.0	9.0	4.0	8.0	9.0	6.0	10.0	5.0
RS25	81.5	1.0	10.0	9.0	8.0	9.0	10.0	10.0	9.0	9.5	6.0
RS26	90.0	9.0	10.0	9.0	10.0	9.0	9.0	8.0	9.0	10.0	7.0
RS28	96.0	9.0	10.0	10.0	10.0	9.0	9.0	10.0	10.0	10.0	9.0
RS29	64.5	9.0	8.0	4.0	8.0	5.0	7.0	9.5	3.0	10.0	1.0
RS38	73.0	9.0	9.0	4.0	9.0	9.0	9.0	6.0	6.0	5.0	7.0
RS39	59.0	4.0	8.0	1.0	8.0	8.0	1.0	8.5	7.0	5.5	8.0
RS40	69.5	9.0	10.0	3.0	8.0	5.0	9.0	8.5	5.0	9.0	3.0
RS42	34.0	1.0	7.0	1.0	6.0	3.0	2.0	1.0	2.0	10.0	1.0
RS45	79.0	9.0	10.0	2.0	9.0	6.0	3.0	10.0	10.0	10.0	10.0
RS46	54.0	5.0	8.0	5.0	8.0	3.0	5.0	9.0	4.0	3.0	4.0
RS48	73.5	9.0	7.0	6.0	9.0	7.0	6.0	10.0	6.0	9.5	4.0
RS50	63.0	9.0	10.0	5.0	0.0	6.0	7.0	8.0	5.0	9.0	4.0
RS51	59.0	8.0	8.0	2.0	6.0	5.0	4.0	9.0	6.0	10.0	1.0
RS53	65.0	6.0	7.0	2.0	5.0	7.0	5.0	9.5	8.0	9.5	6.0
RS55	69.5	7.0	10.0	2.0	9.0	5.0	10.0	7.5	6.0	10.0	3.0
RS57	41.5	1.0	4.0	1.0	8.0	7.0	1.0	8.5	1.0	8.0	2.0
RS59	52.0	9.0	5.0	5.0	5.0	3.0	6.0	4.5	4.0	4.5	6.0
RS61	98.0	10.0	10.0	10.0	10.0	10.0	9.0	10.0	10.0	10.0	9.0
RS62	89.0	10.0	10.0	10.0	9.0	9.0	10.0	9.0	9.0	10.0	3.0