2022/23 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 2018/19 to 2022/23.

Monitoring network

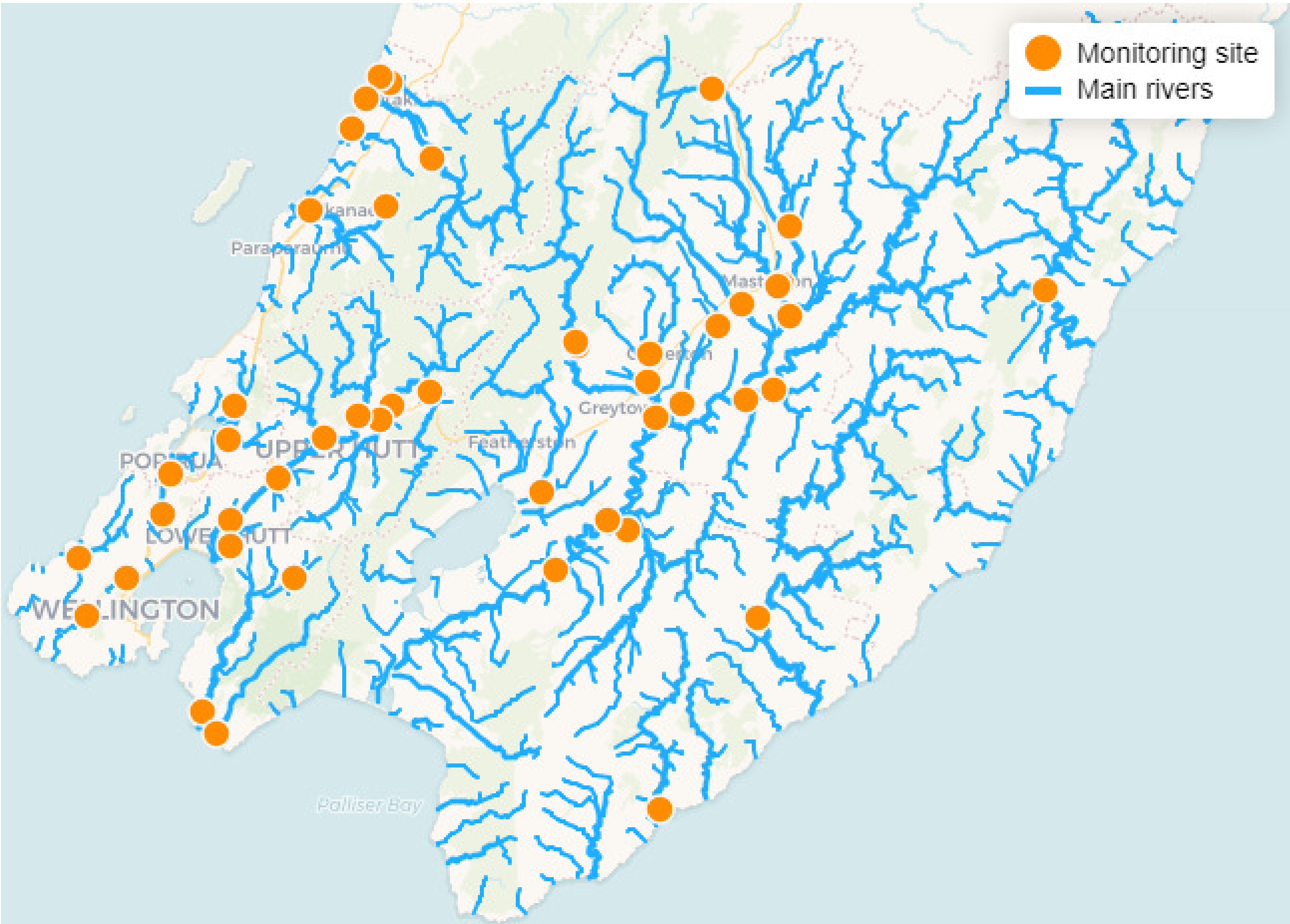

Figure 1: Locations of RWQE monitoring sites.

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 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 2022/23, chlorophyll a samples were collected from 18 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

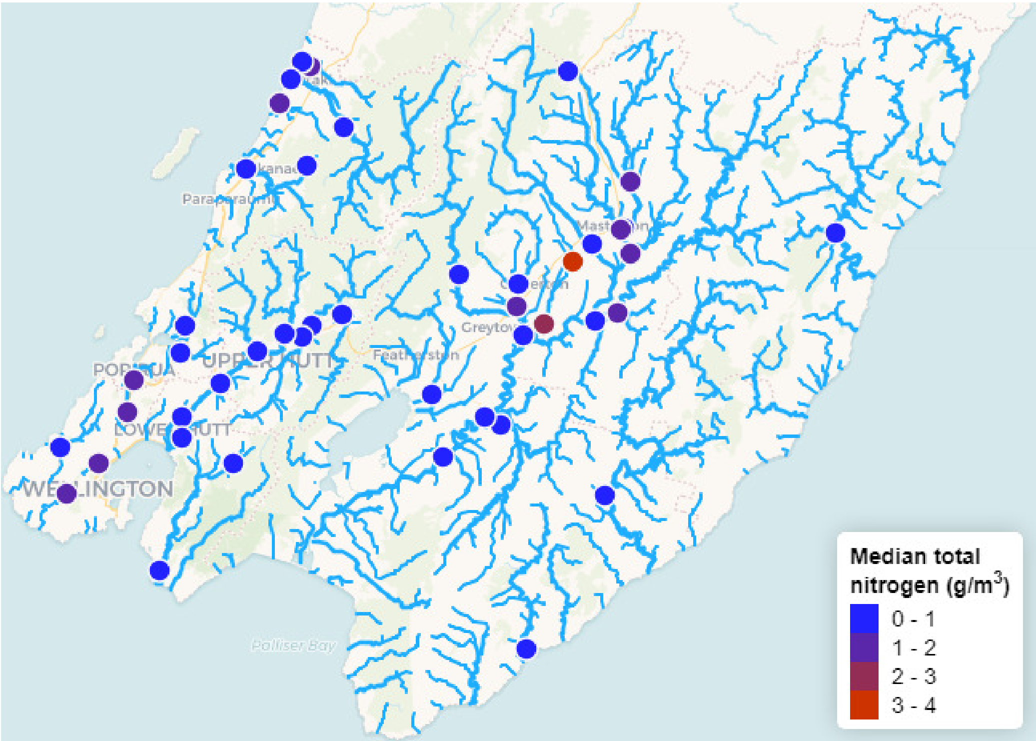

Figure 2: Total nitrogen (g/m^3) results for the period 2020/21 to 2022/23

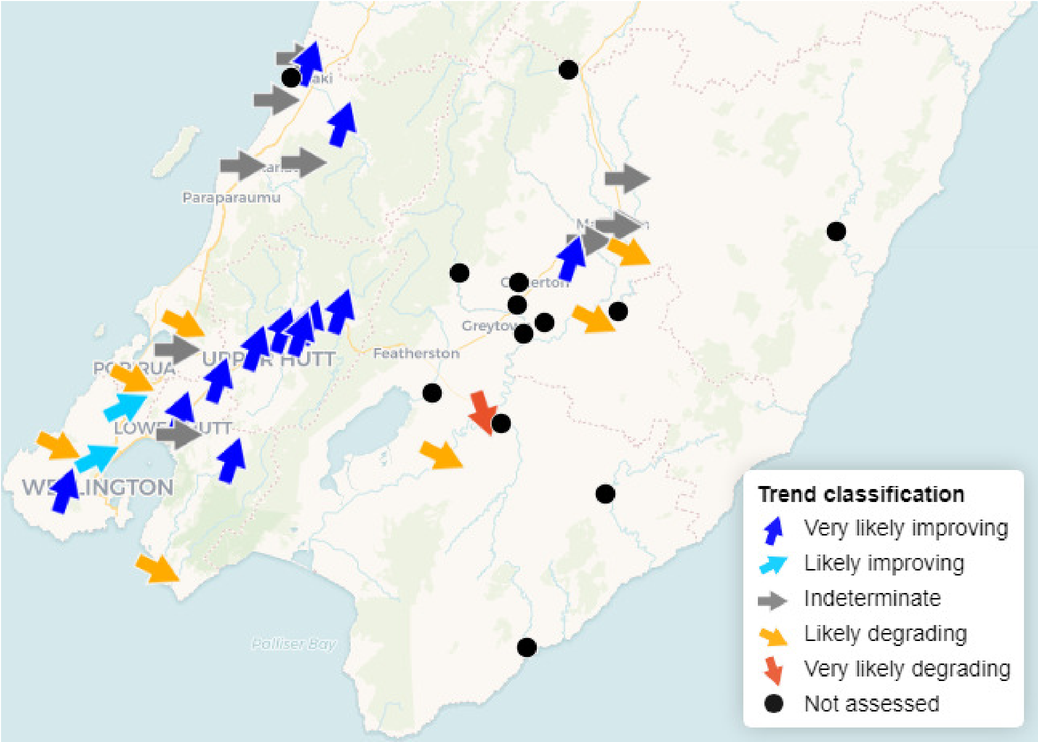

Figure 3: Total nitrogen 5-yr trends

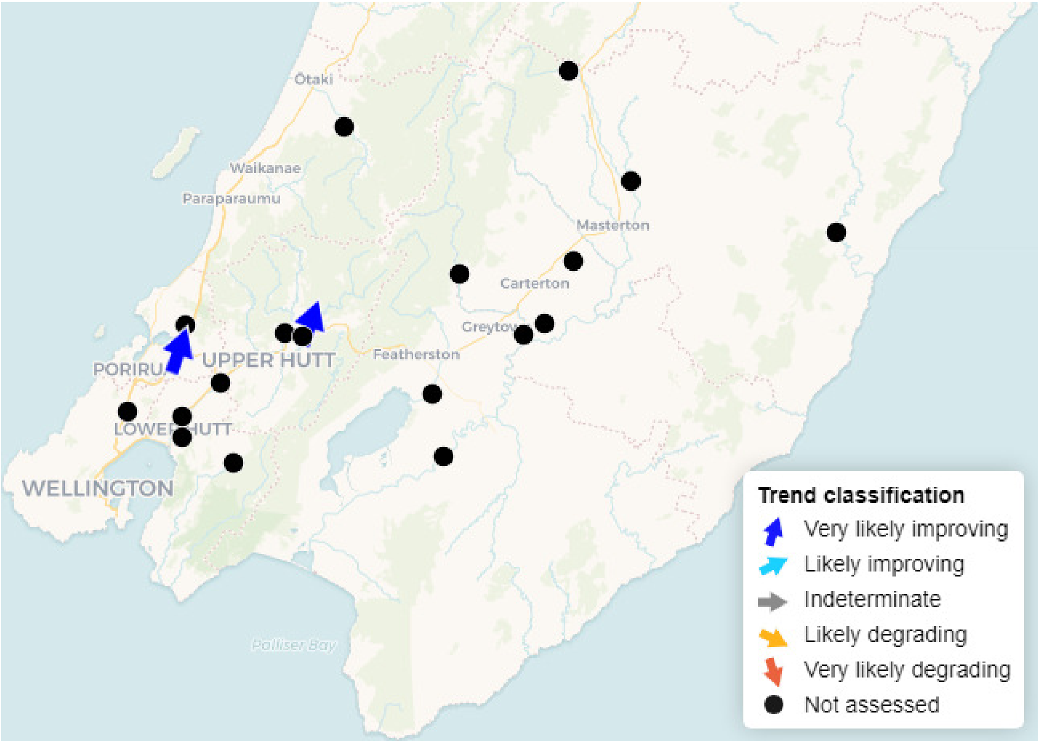

Figure 4: Total nitrogen flow adjusted 5-yr trends

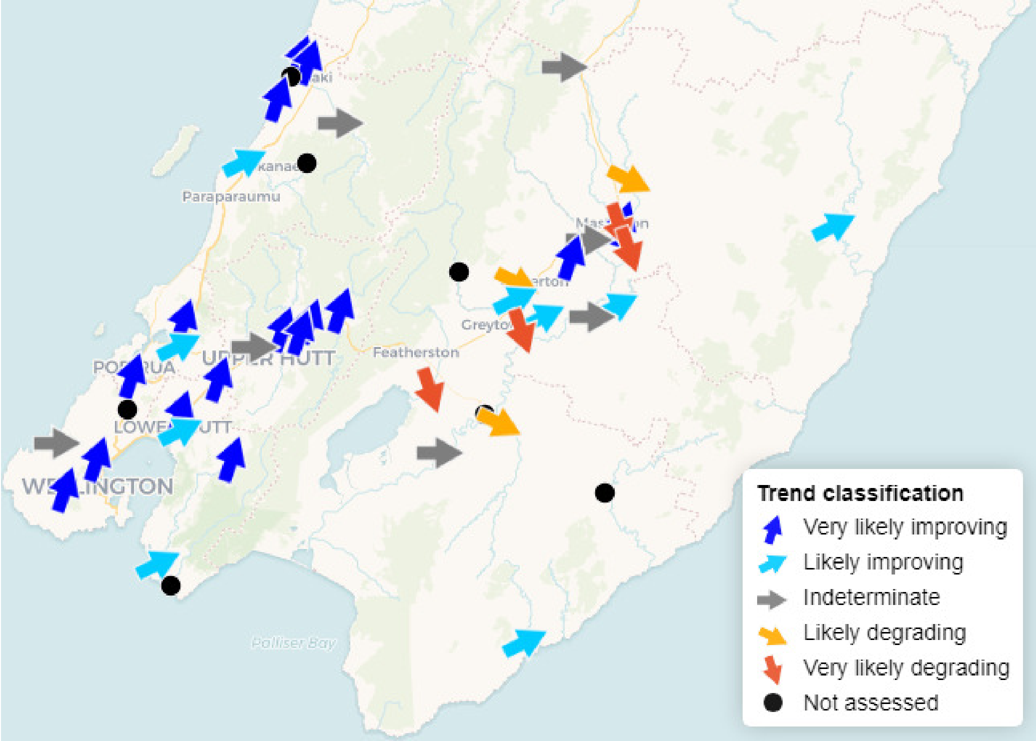

Figure 5: Total nitrogen 10-yr trends

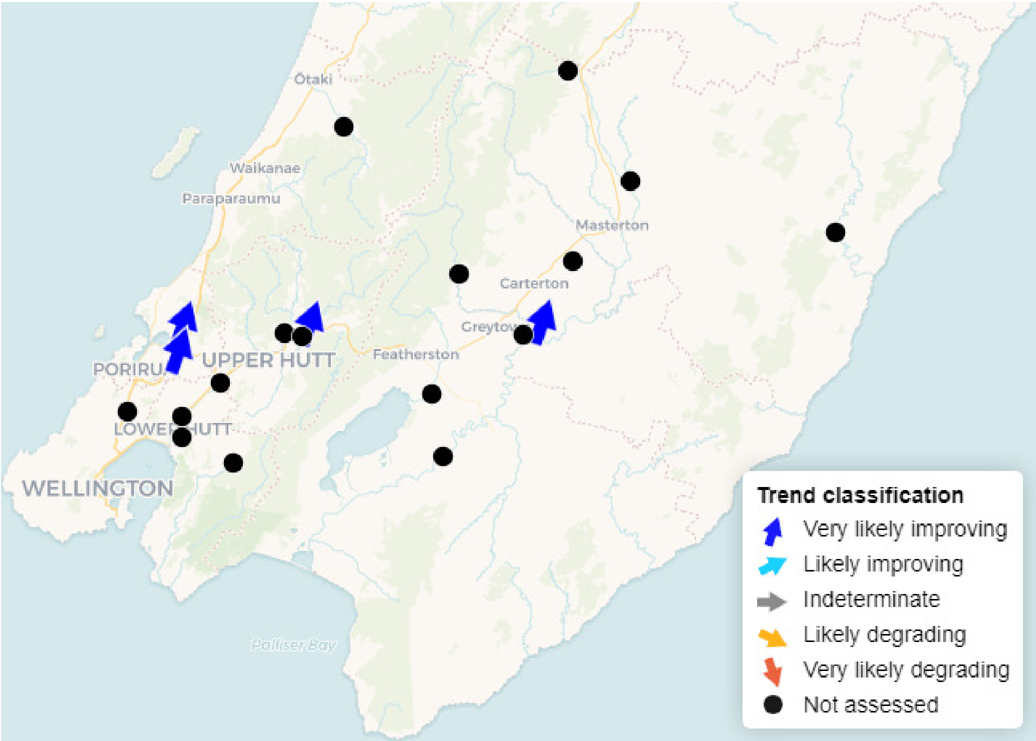

Figure 6: Total nitrogen flow adjusted 10-yr trends

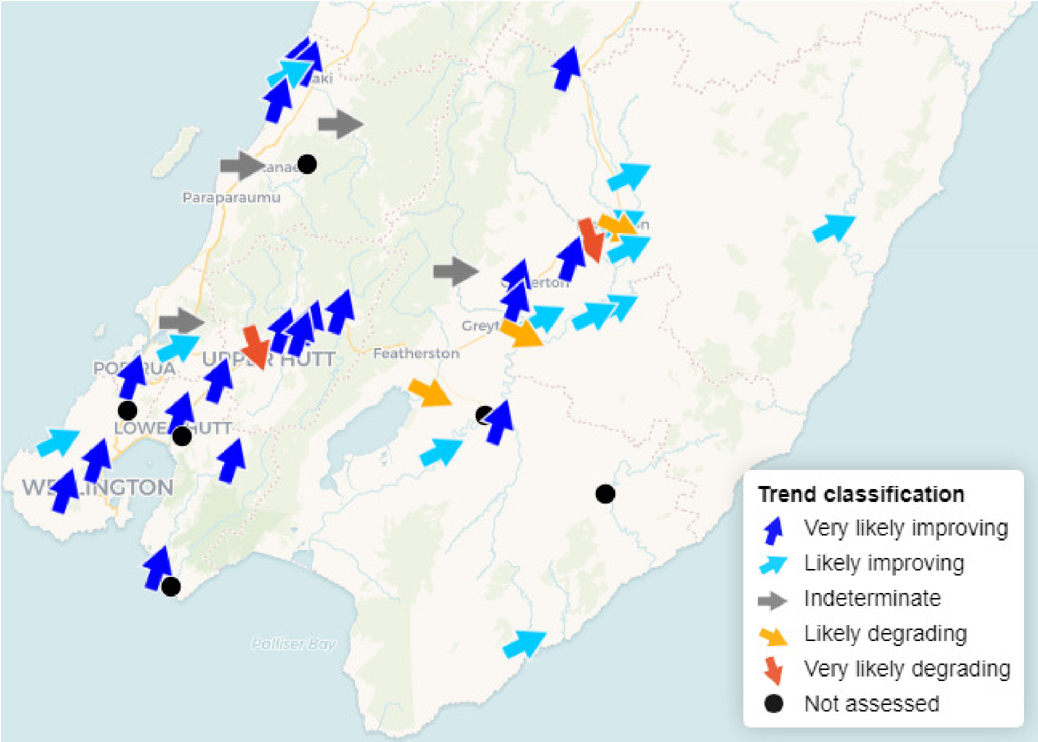

Figure 7: Total nitrogen 15-yr trends

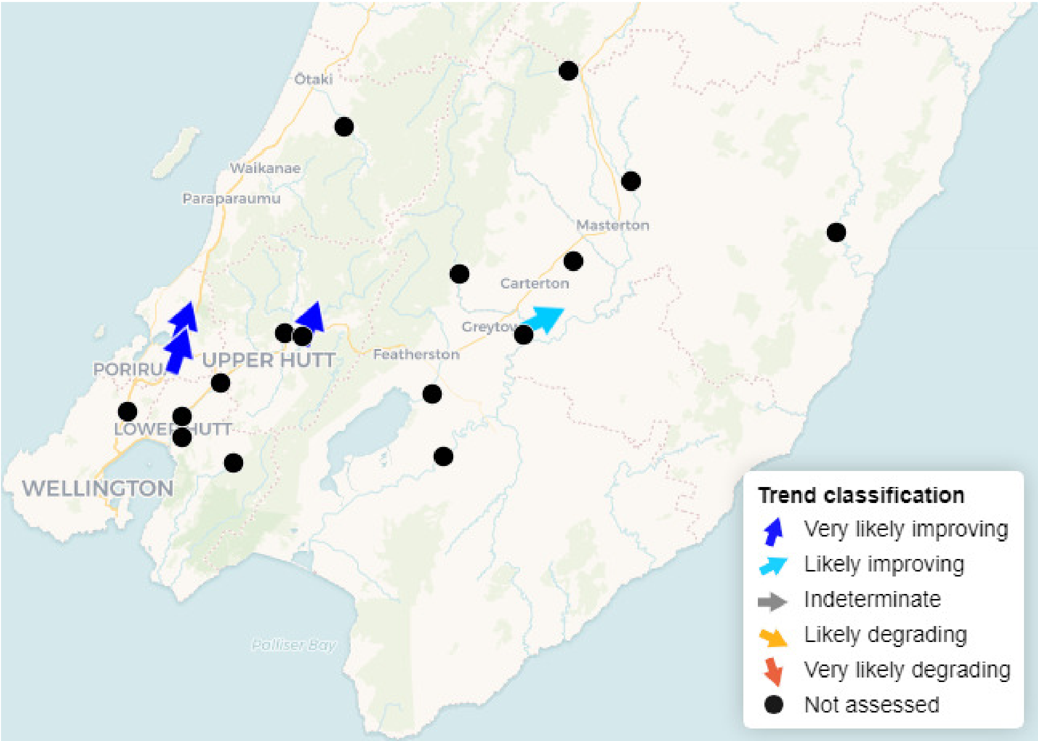

Figure 8: Total nitrogen flow adjusted 15-yr trends

Total Kjeldahl nitrogen

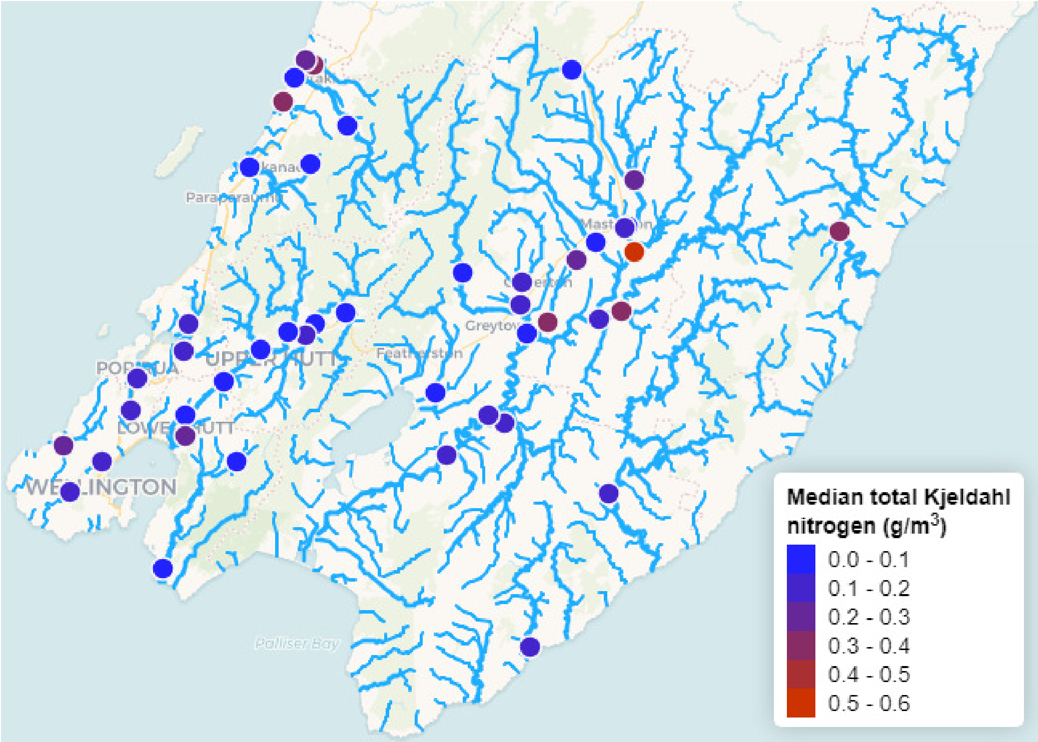

Figure 9: Total Kjeldahl nitrogen (g/m^3) results for the period 2020/21 to 2022/23

Dissolved inorganic nitrogen

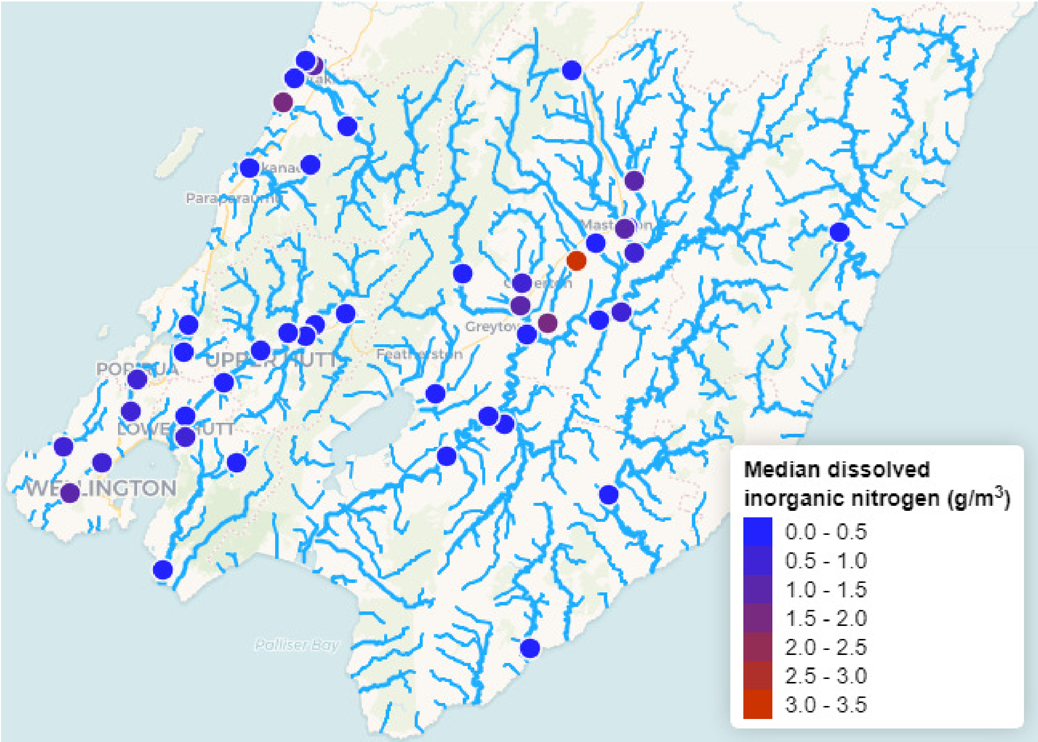

Figure 10: Dissolved inorganic nitrogen (g/m^3) results for the period 2018/19 to 2022/23

Ammoniacal nitrogen (pH adjusted)

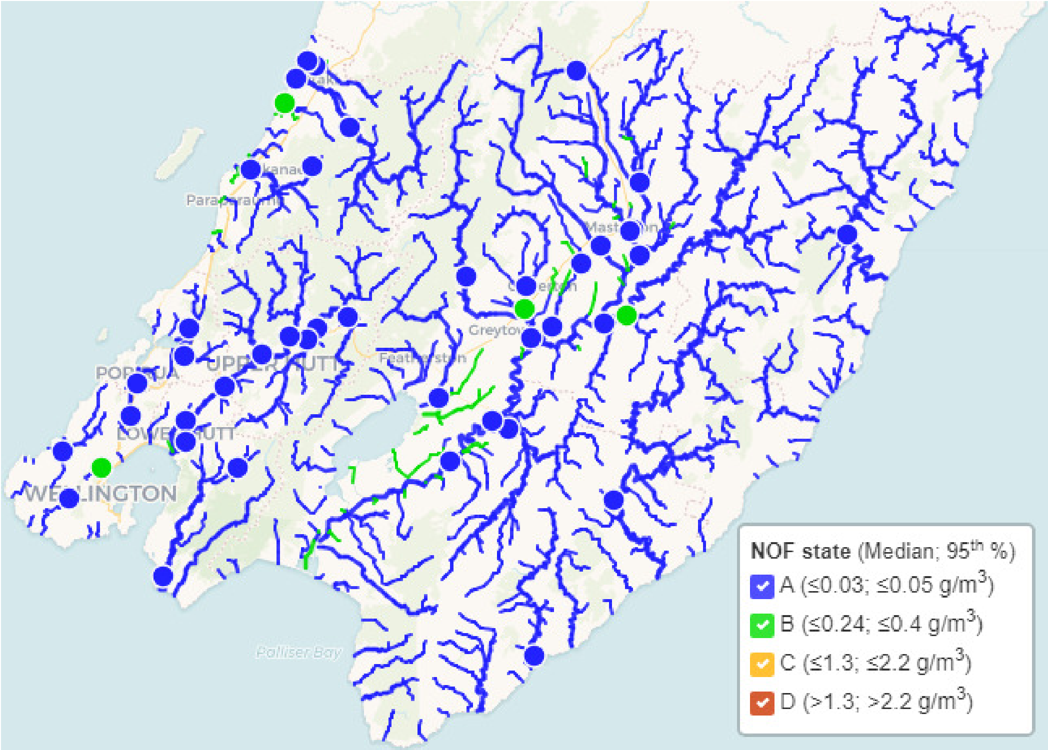

Figure 11: Ammoniacal nitrogen (pH adjusted g/m^3) NOF states for the period 2020/21 to 2022/23. See the methods nutrients benchmarking section for details.

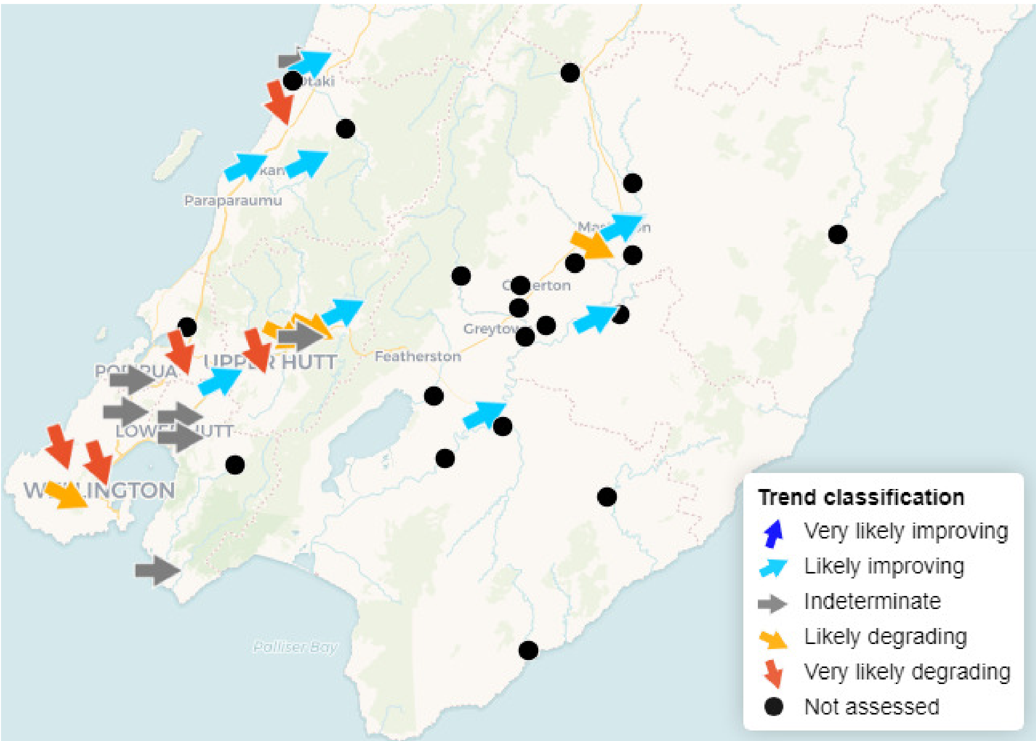

Figure 12: Ammoniacal nitrogen 5-yr trends

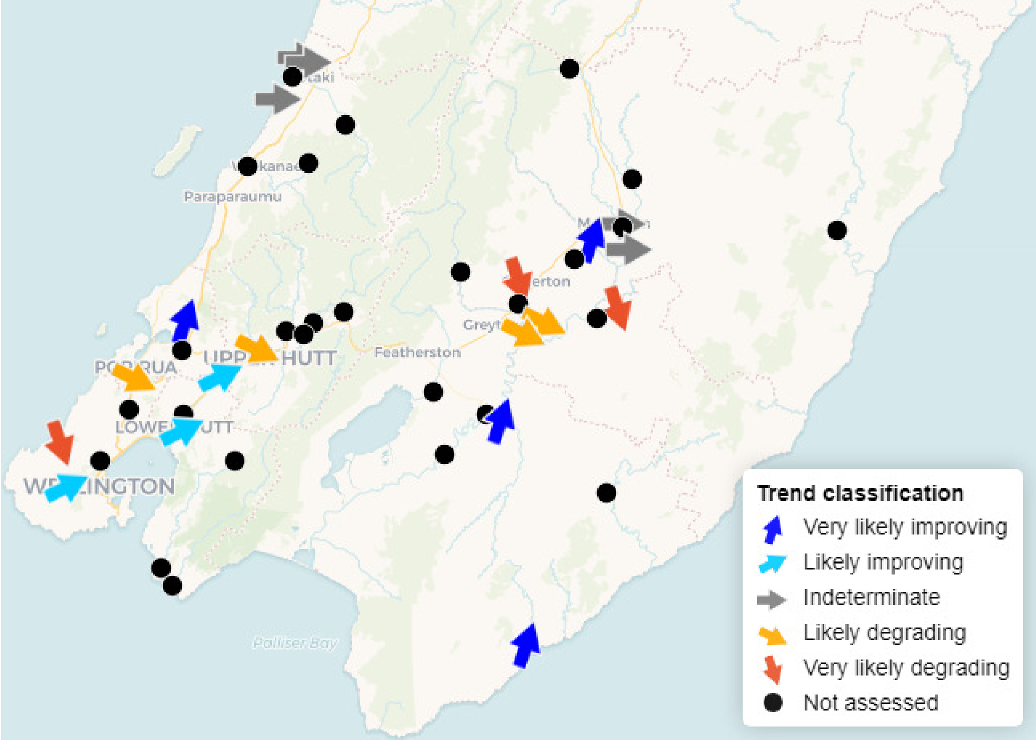

Figure 13: Ammoniacal nitrogen 10-yr trends

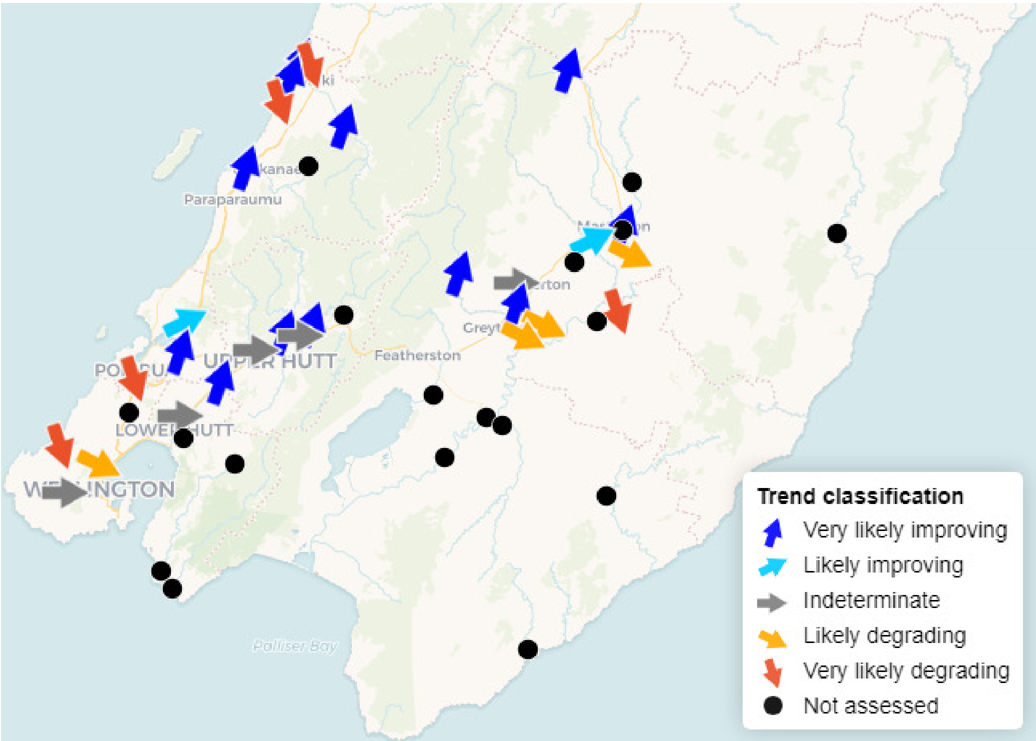

Figure 14: Ammoniacal nitrogen 15-yr trends

Nitrite nitrogen

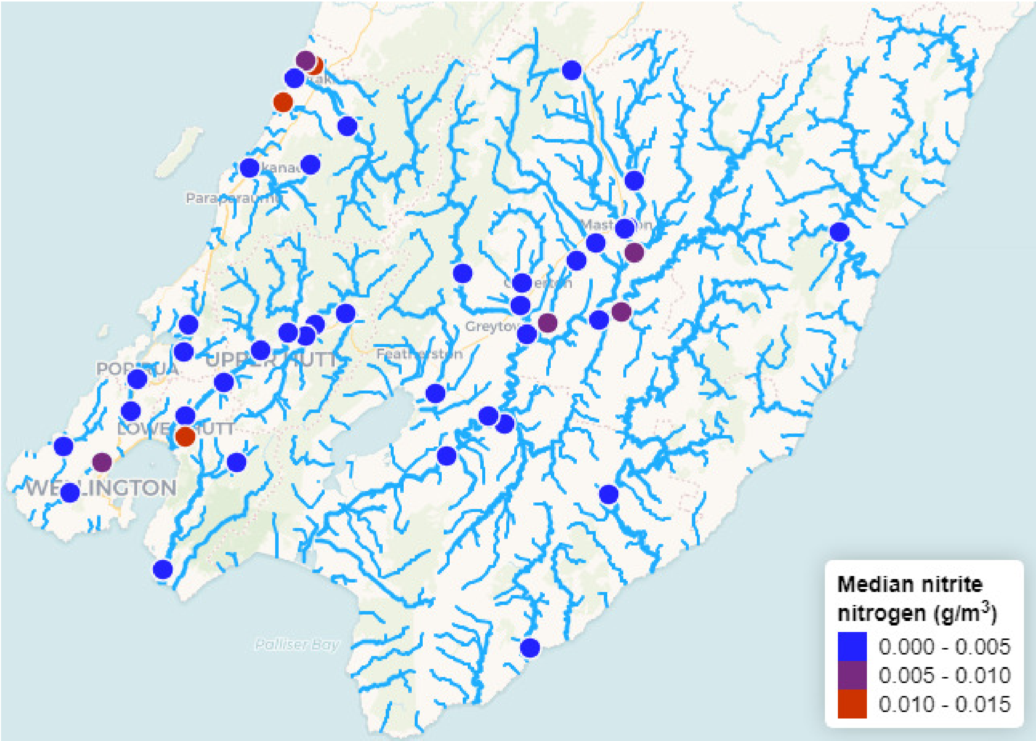

Figure 15: Nitrite nitrogen (g/m^3) results for the period 2020/21 to 2022/23

Nitrate nitrogen

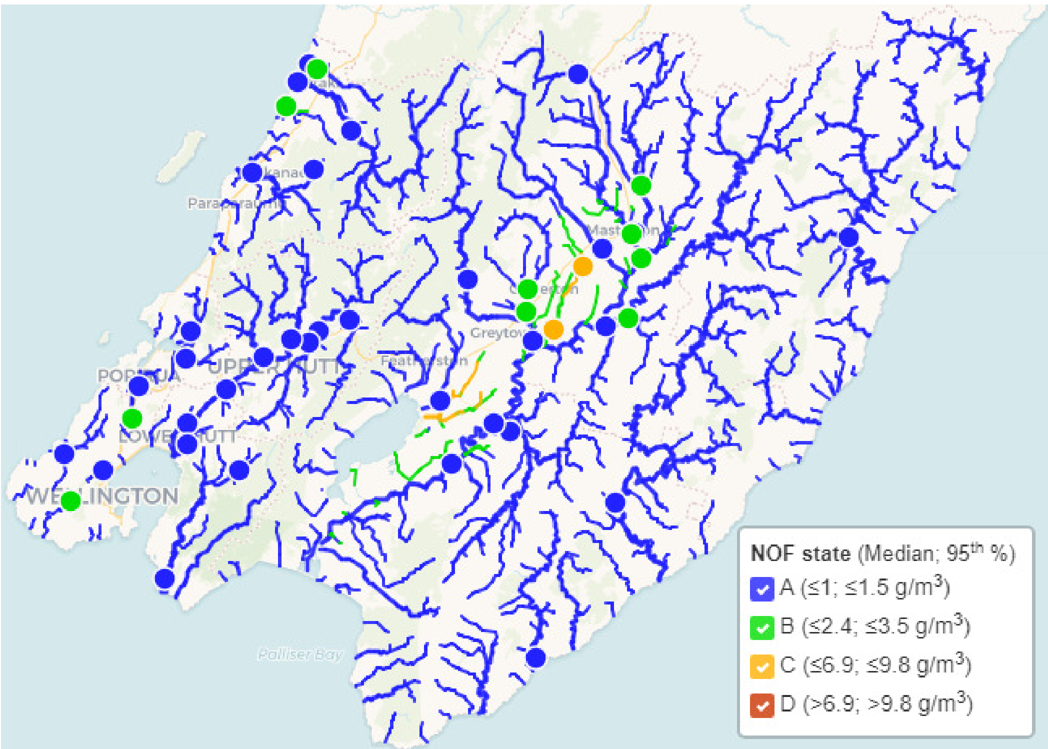

Figure 16: Nitrate nitrogen (g/m^3) NOF states for the period 2020/21 to 2022/23. See the methods nutrients benchmarking section for details.

Nitrite-nitrate nitrogen

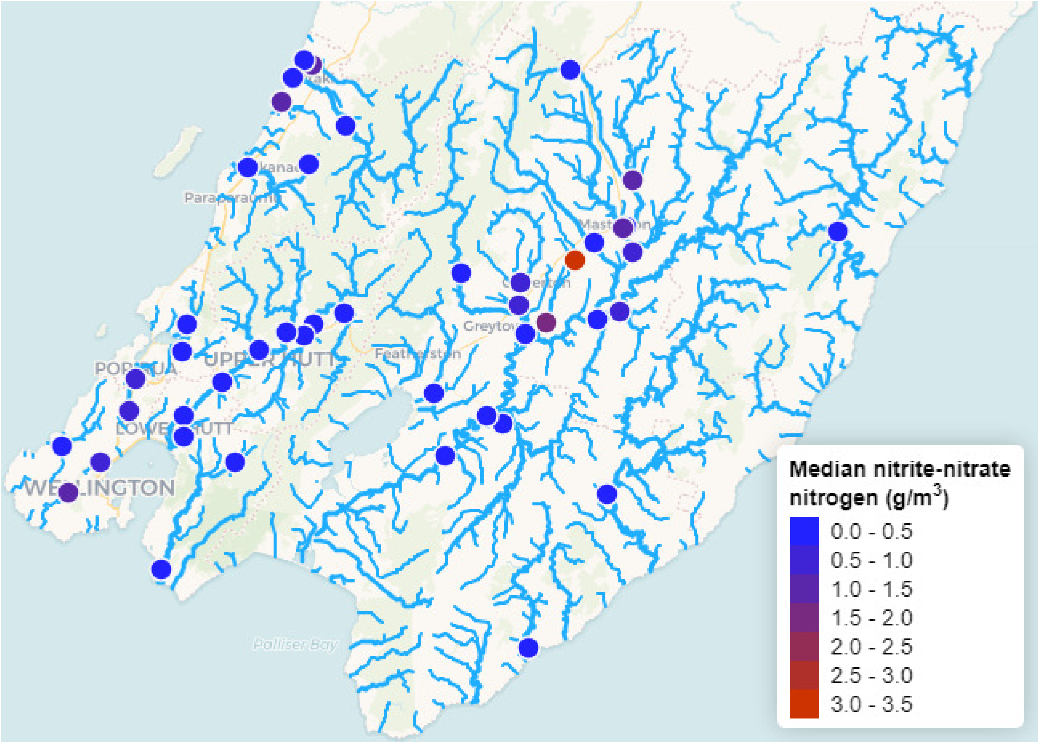

Figure 17: Nitrite-nitrate nitrogen (g/m^3) results for the period 2020/21 to 2022/23

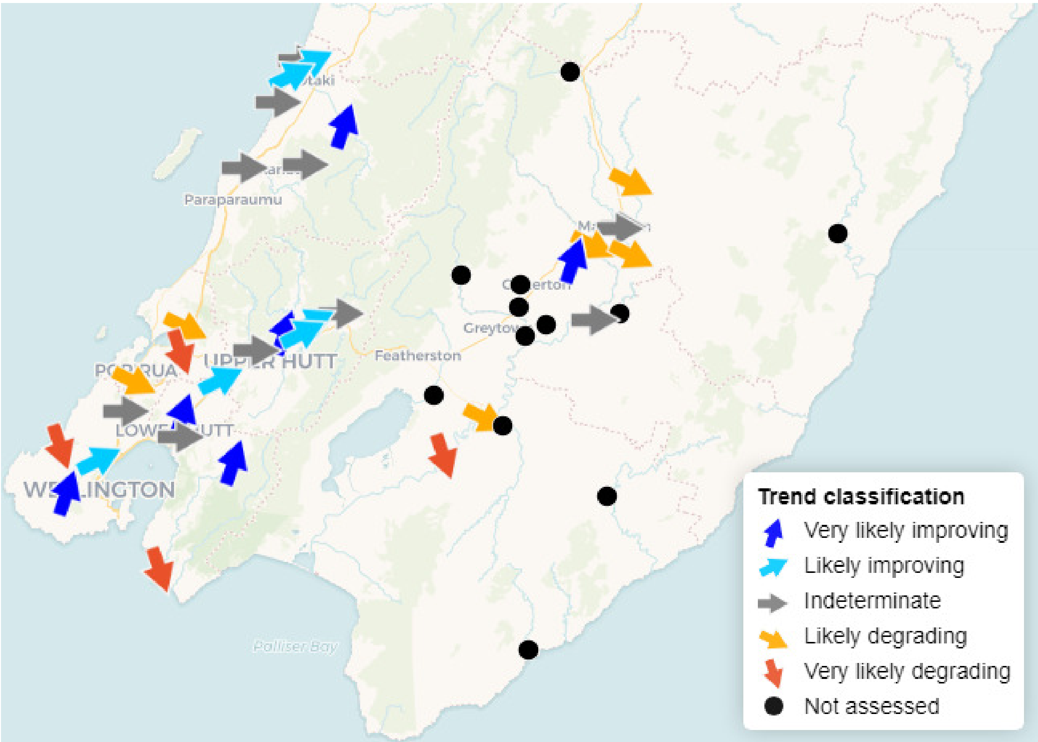

Figure 18: Nitrite-nitrate nitrogen 5-yr trends

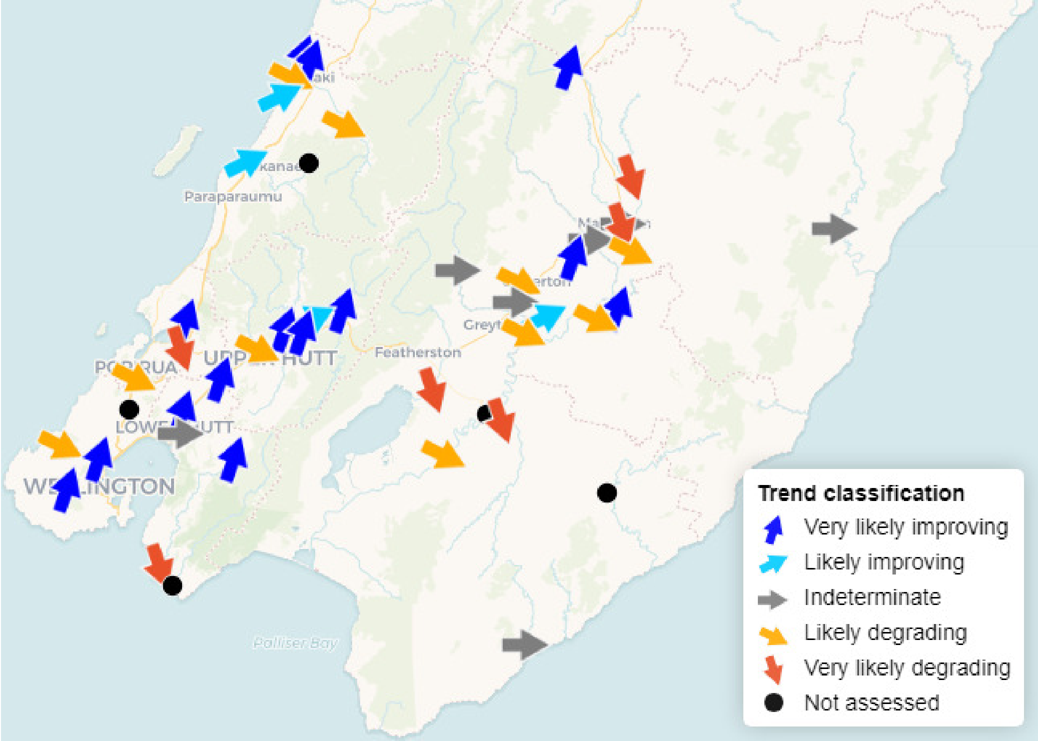

Figure 19: Nitrite-nitrate nitrogen 10-yr trends

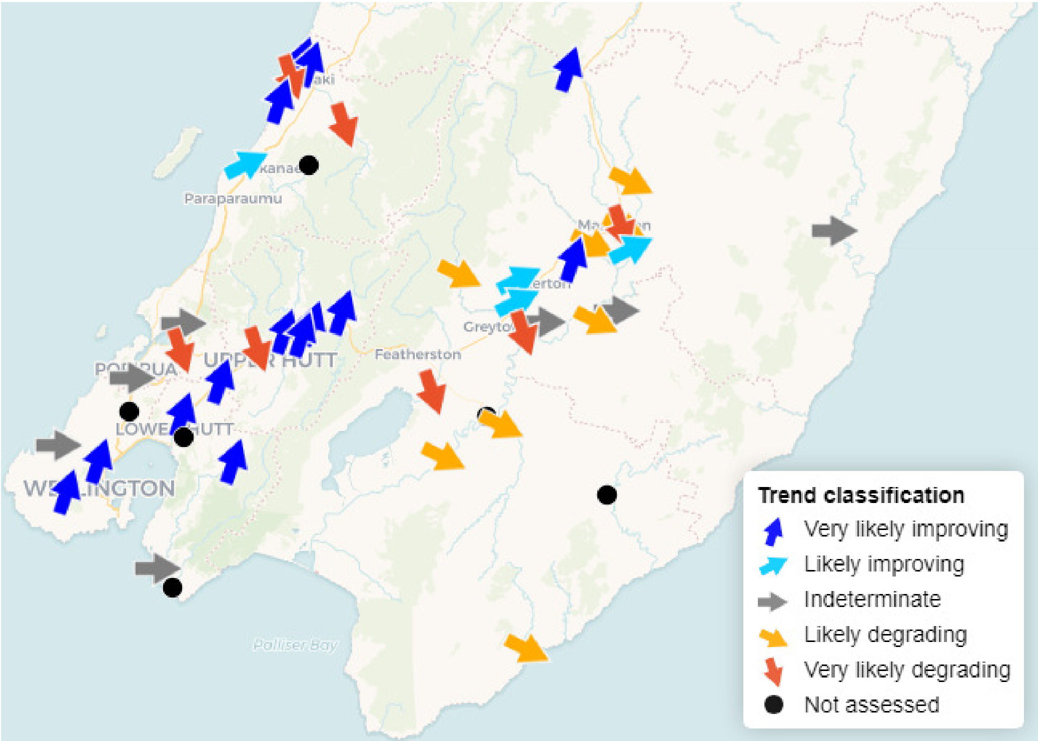

Figure 20: Nitrite-nitrate nitrogen 15-yr trends

Total phosphorus

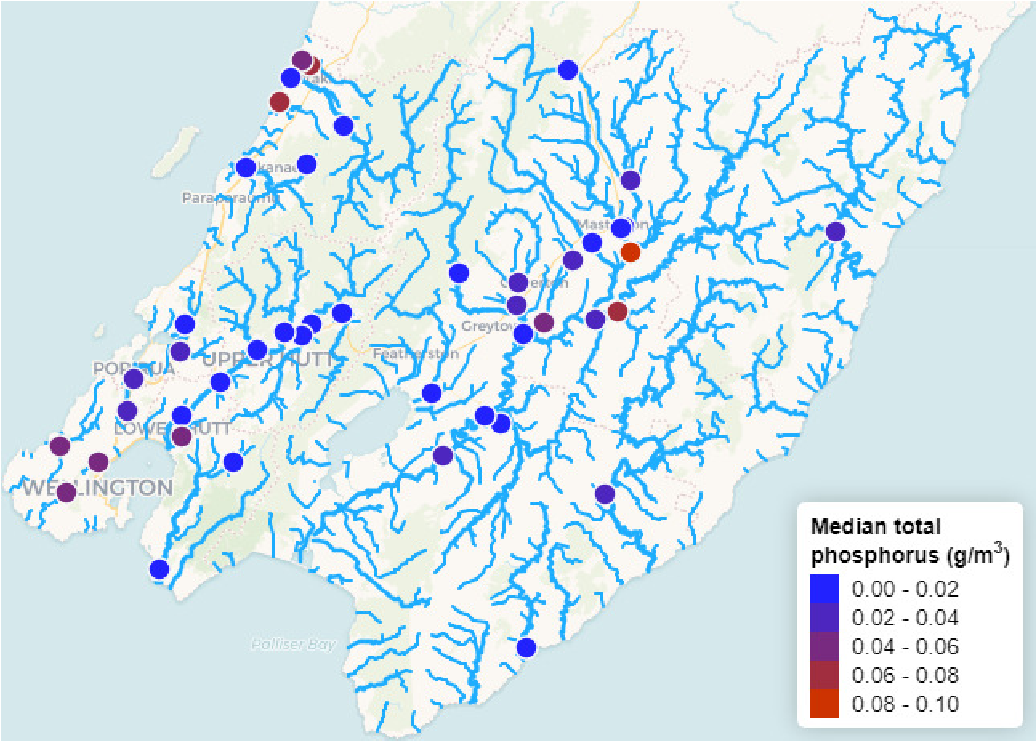

Figure 21: Total phosphorus (g/m^3) results for the period 2020/21 to 2022/23

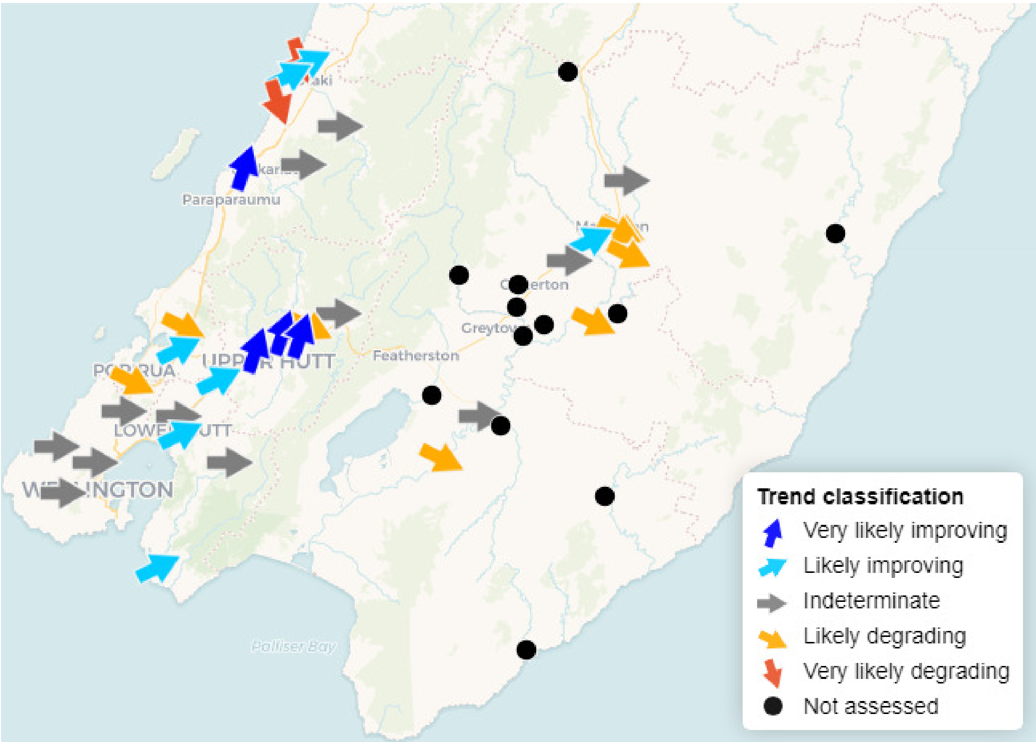

Figure 22: Total phosphorus 5-yr trends

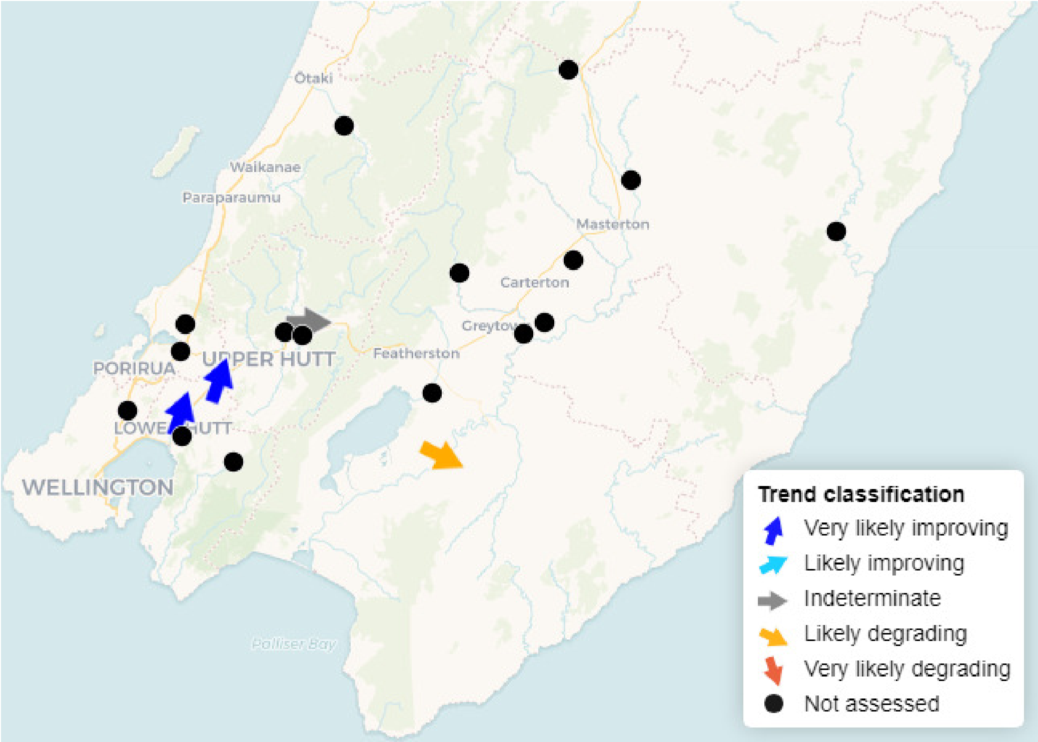

Figure 23: Total phosphorus flow adjusted 5-yr trends

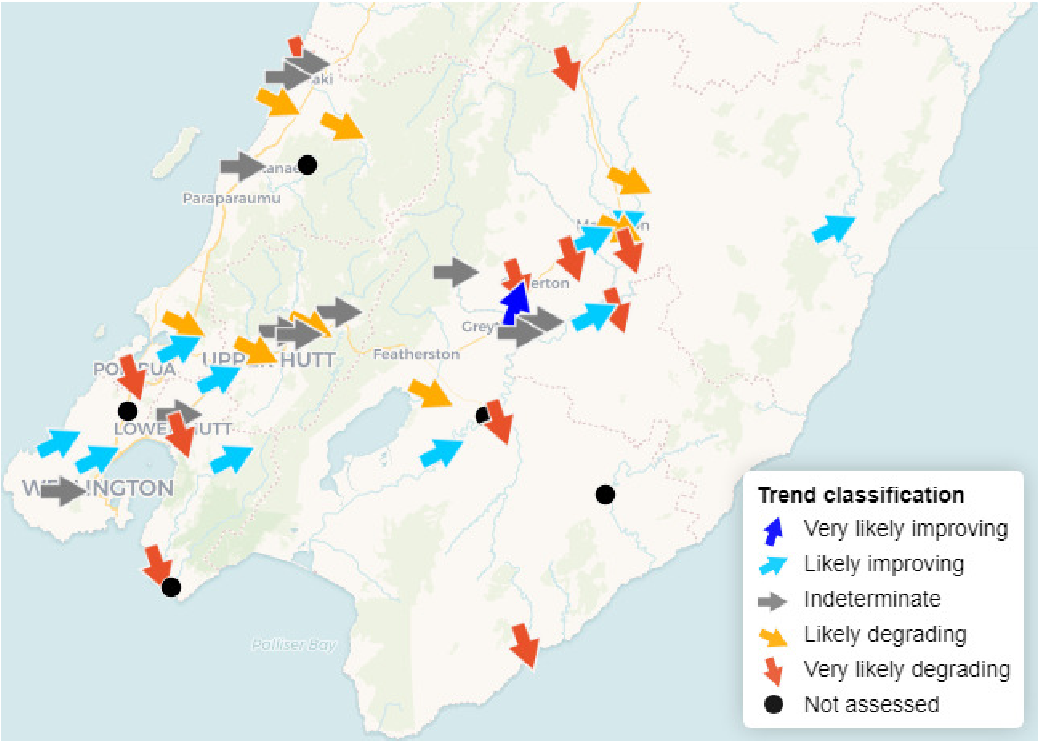

Figure 24: Total phosphorus 10-yr trends

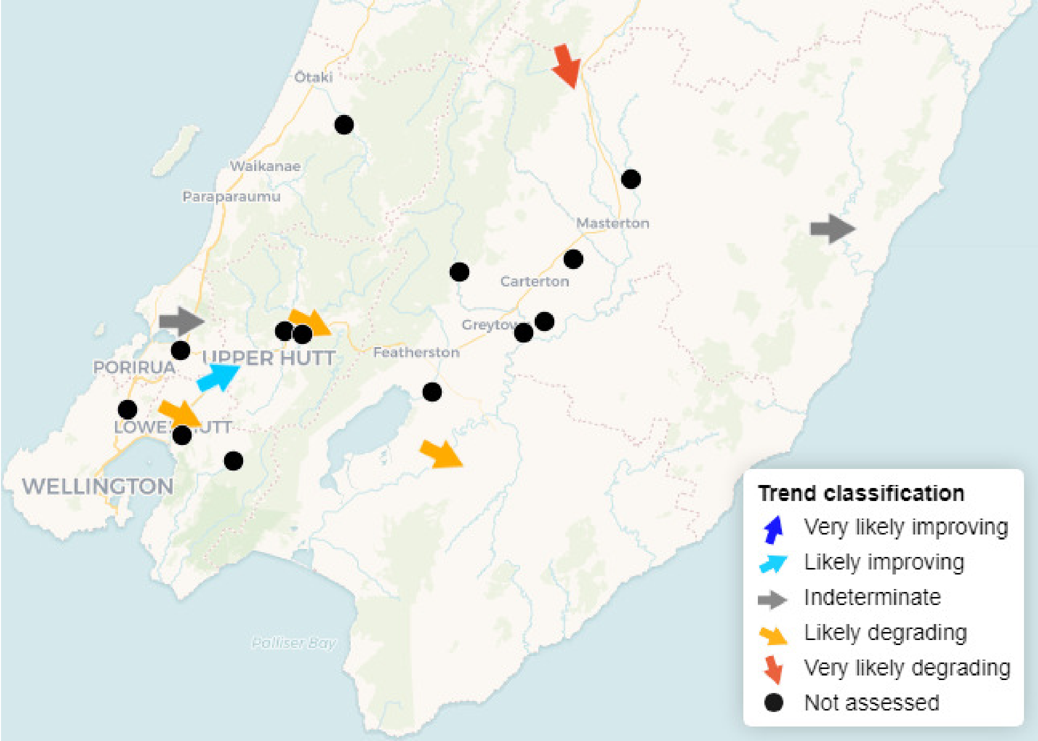

Figure 25: Total phosphorus flow adjusted 10-yr trends

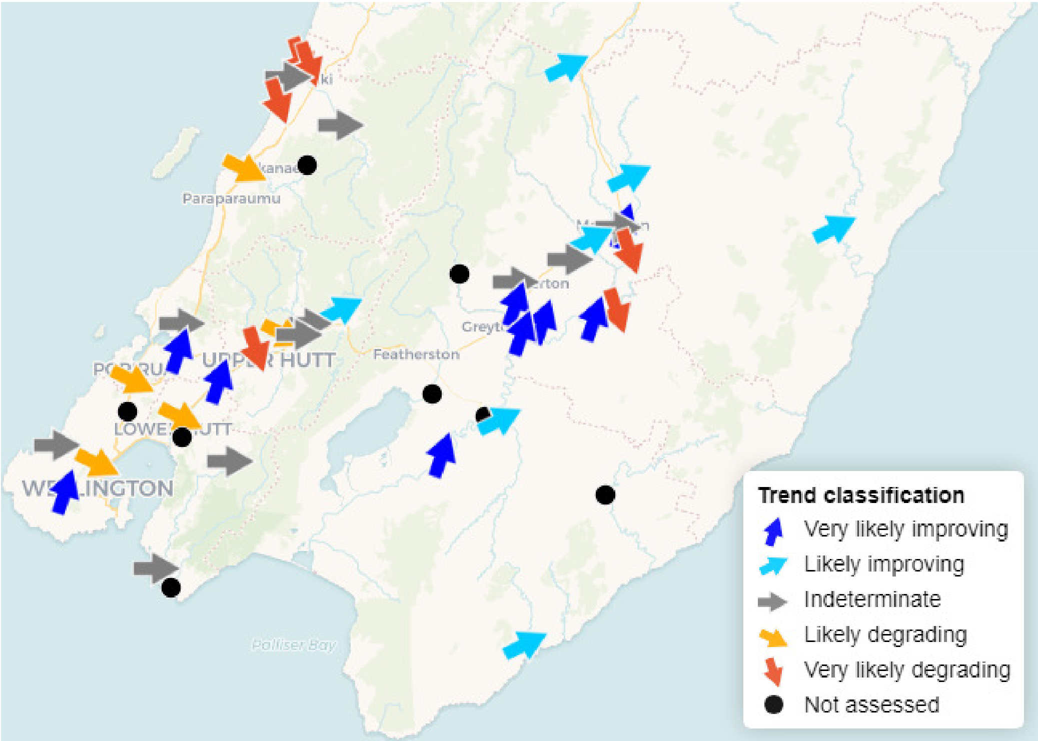

Figure 26: Total phosphorus 15-yr trends

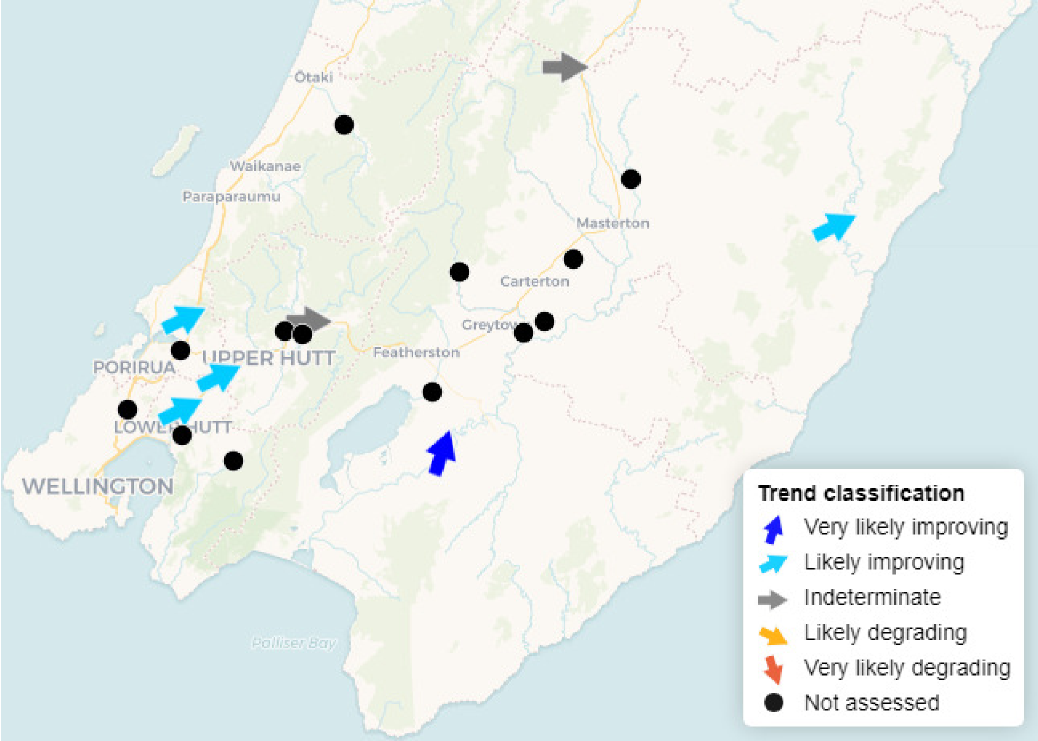

Figure 27: Total phosphorus flow adjusted 15-yr trends

Dissolved reactive phosphorus

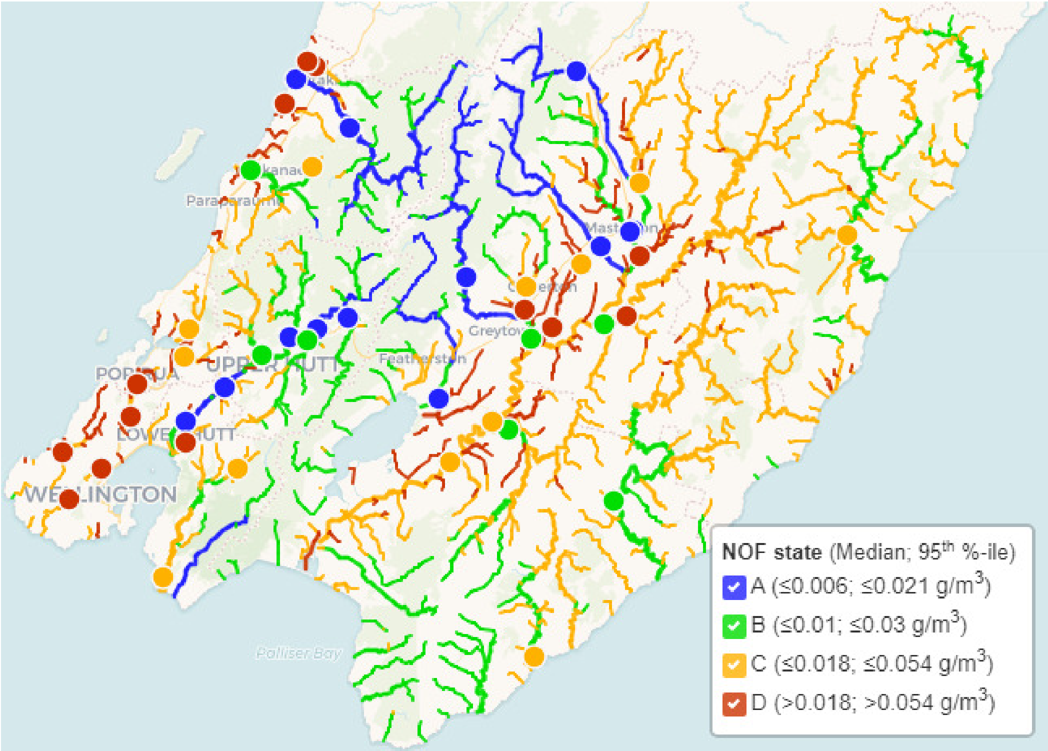

Figure 28: Dissolved reactive phosphorus (g/m^3) NOF states for the period 2018/19 to 2022/23. See the methods nutrients benchmarking section for details.

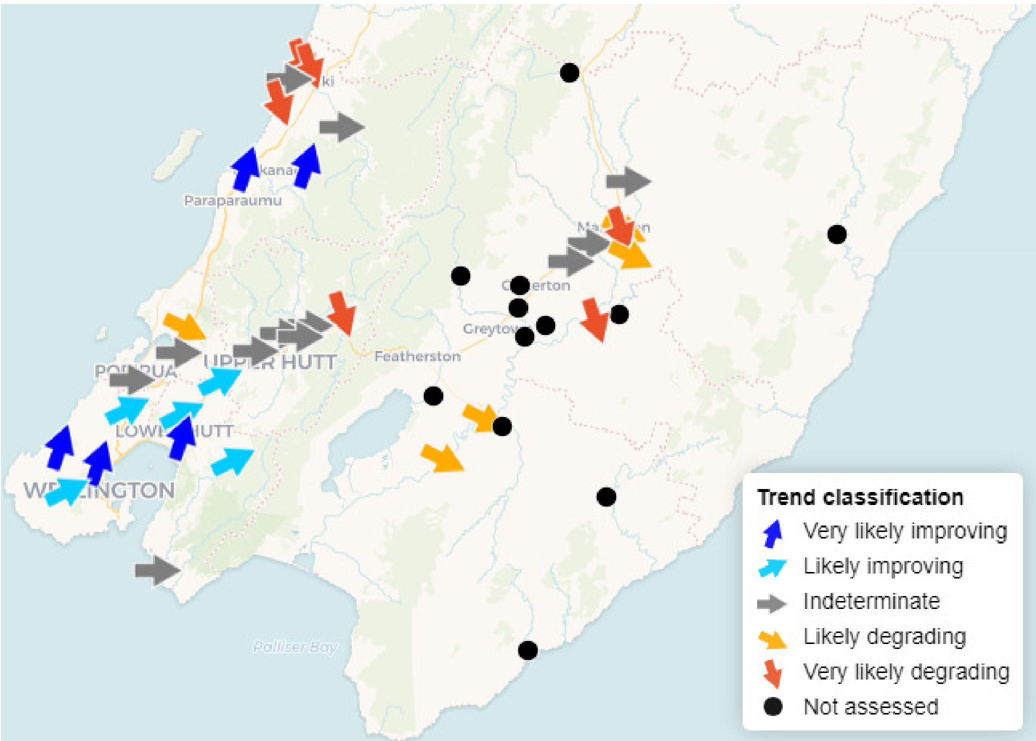

Figure 29: Dissolved reactive phosphorus 5-yr trends

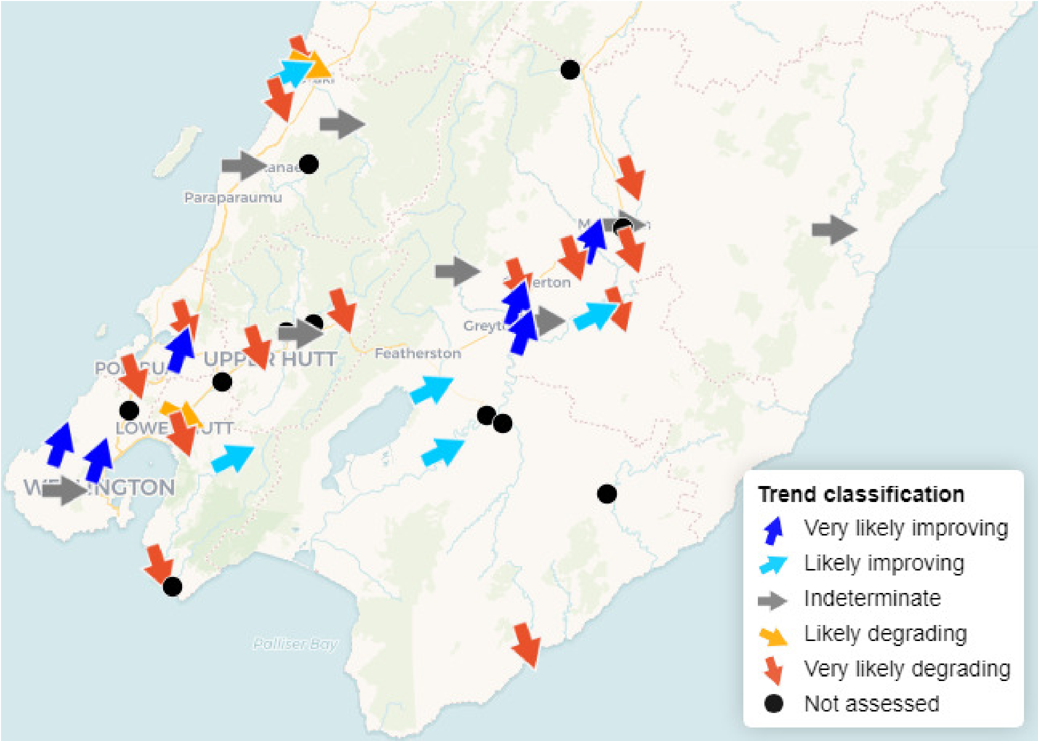

Figure 30: Dissolved reactive phosphorus 10-yr trends

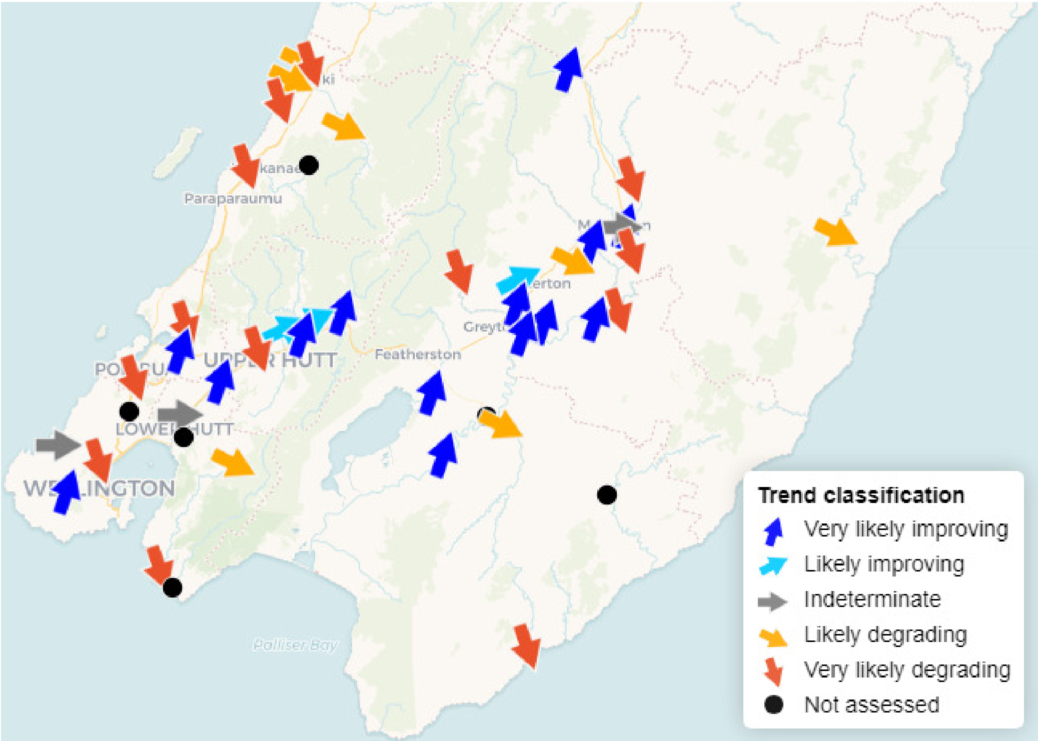

Figure 31: Dissolved reactive phosphorus 15-yr trends

Metals

Dissolved copper

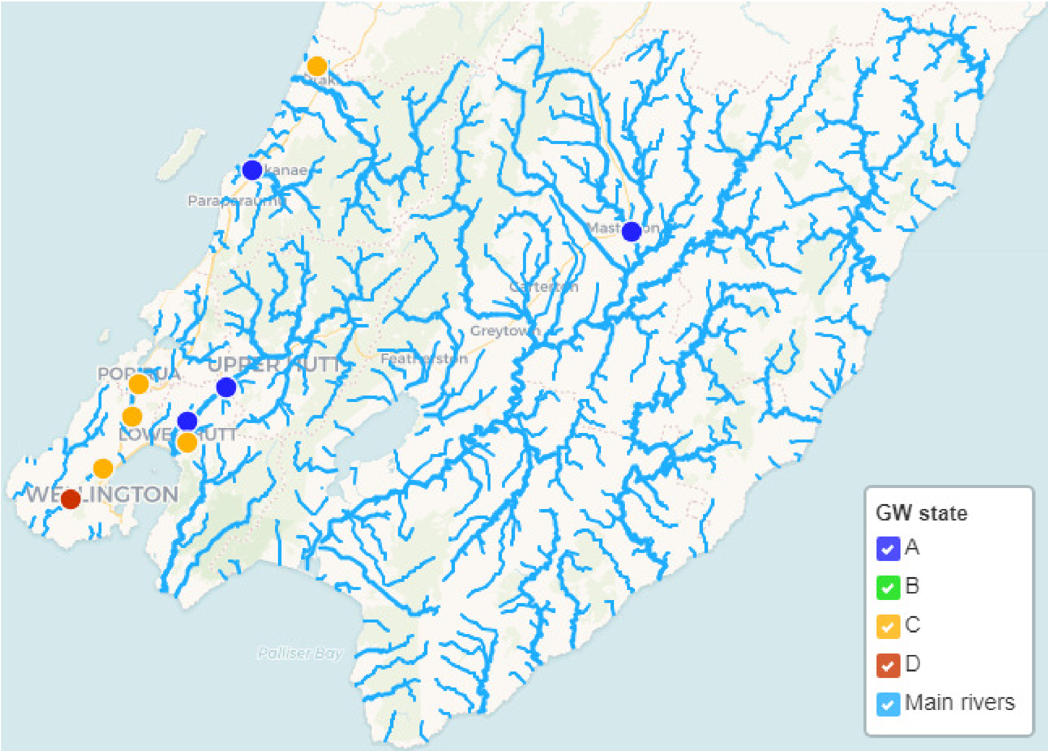

Figure 32: Dissolved copper (g/m^3) GW states for the period 2020/21 to 2022/23. See the methods metals benchmarking section for details.

Dissolved zinc

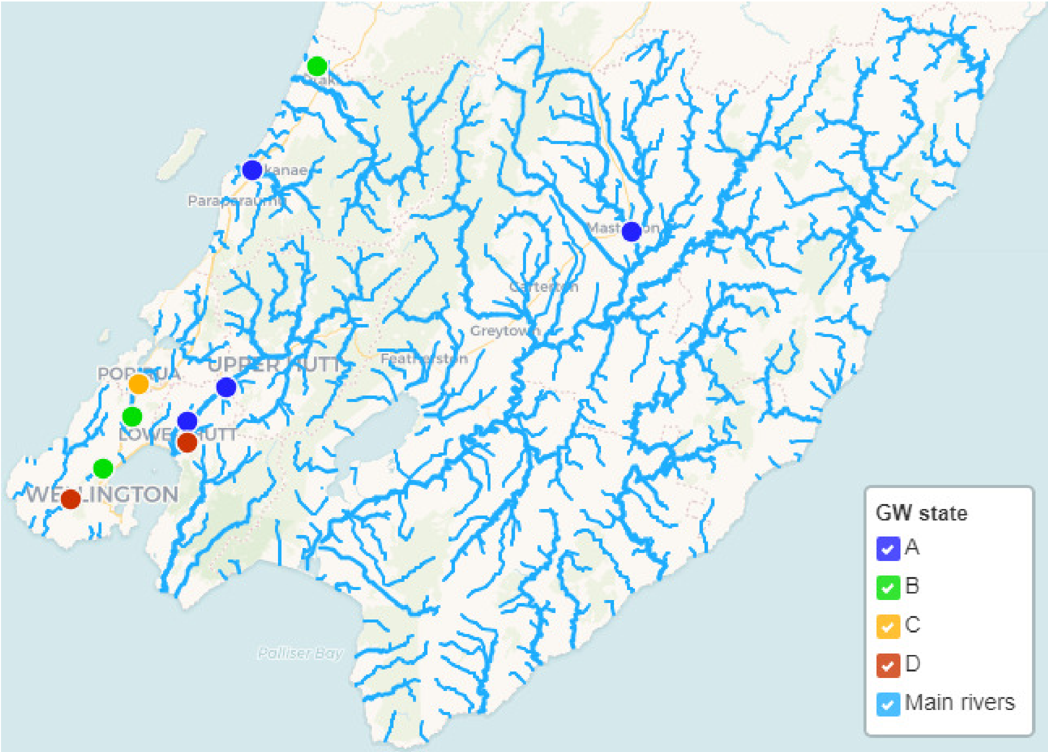

Figure 33: Dissolved copper (g/m^3) GW states for the period 2020/21 to 2022/23. See the methods metals benchmarking section for details.

Microbiology

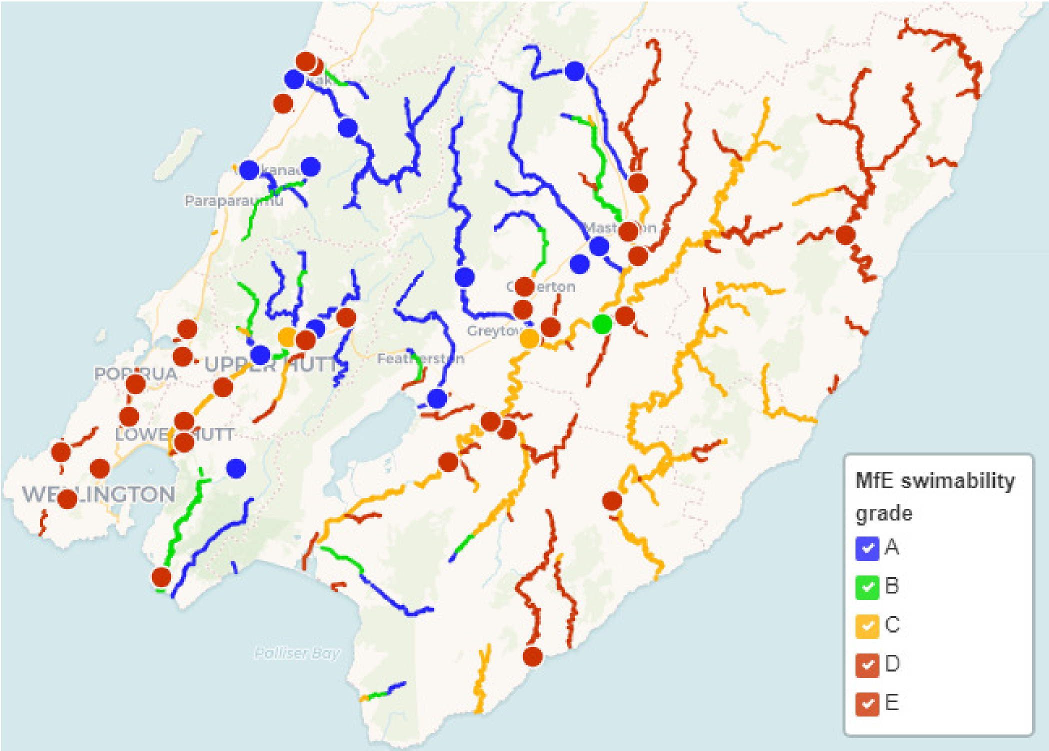

Figure 34: *E. coli* (cfu/100ml) MfE swimability grades for the period 2018/19 to 2022/23. See the methods *E. coli* benchmarking section for details.

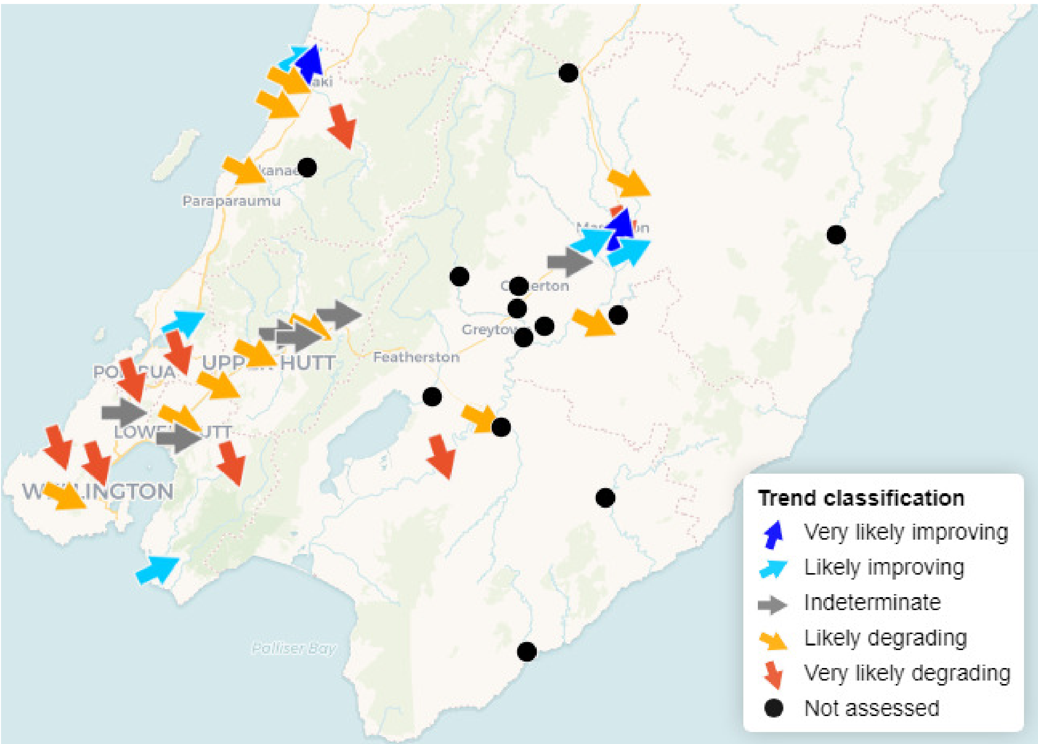

Figure 35: *E. coli* 5-yr trends

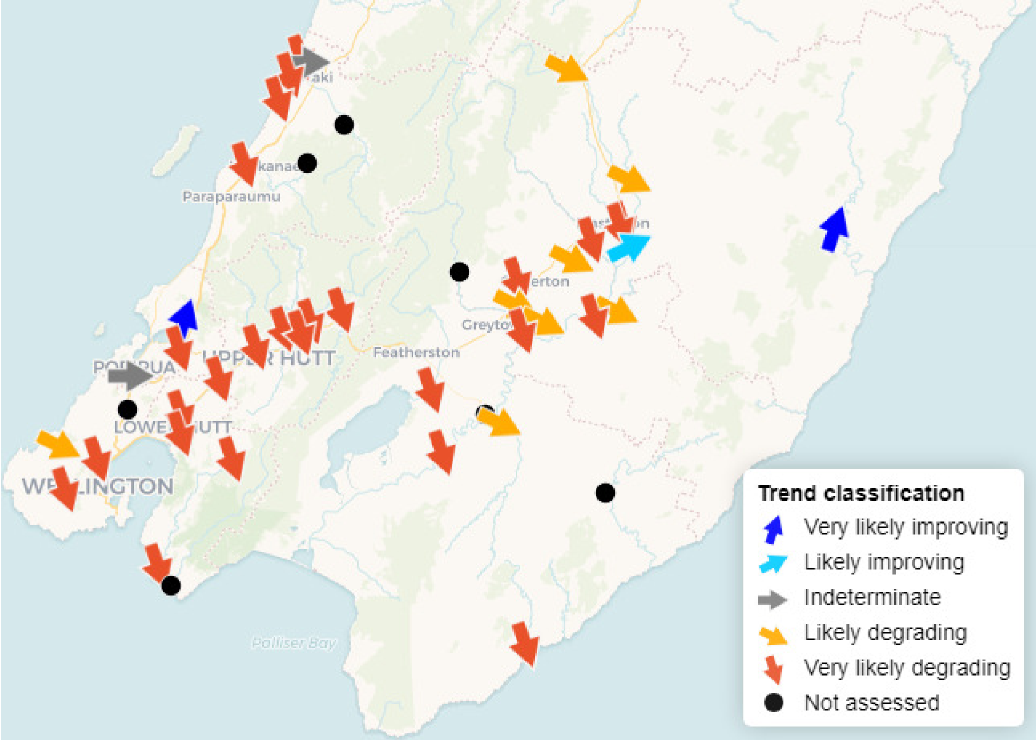

Figure 36: *E. coli* 10-yr trends

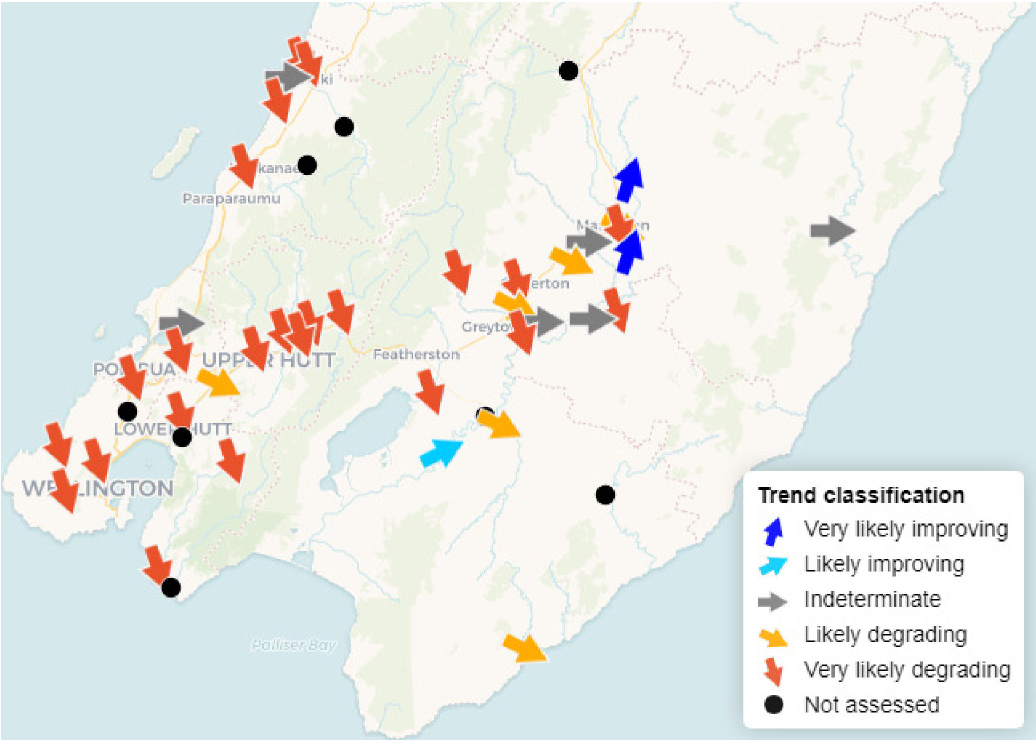

Figure 37: *E. coli* 15-yr trends

Sediment

Water clarity

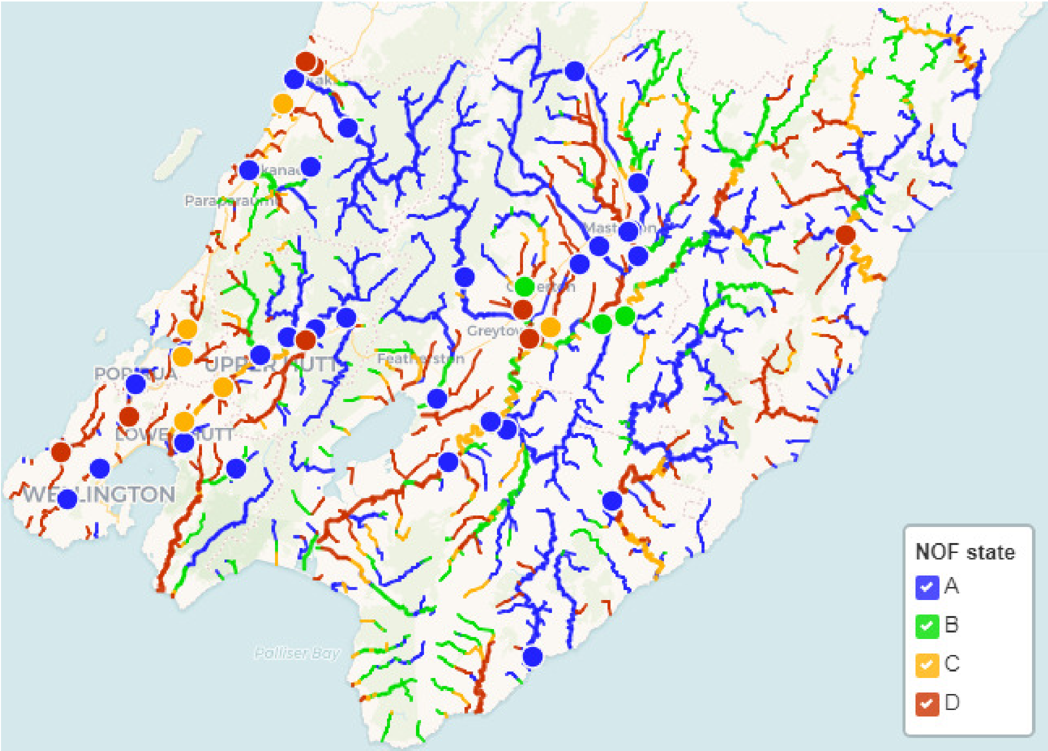

Figure 38: Water clarity (m) NOF states for the period 2018/19 to 2022/23. See the methods sediment benchmarking section for details.

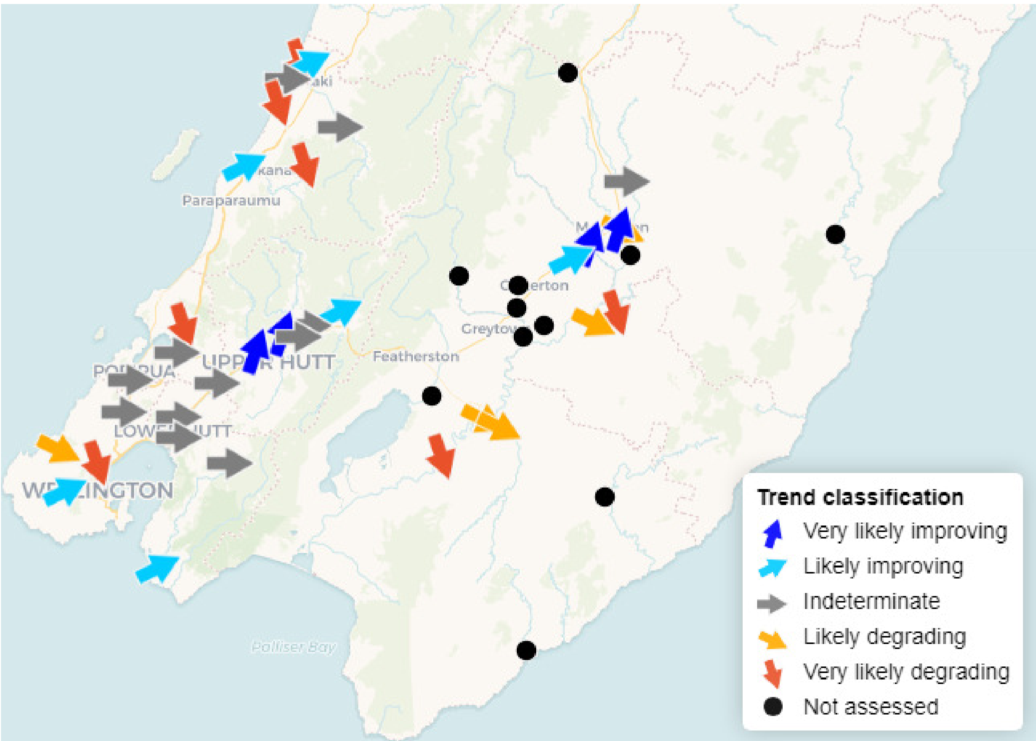

Figure 39: Water clarity 5-yr trends

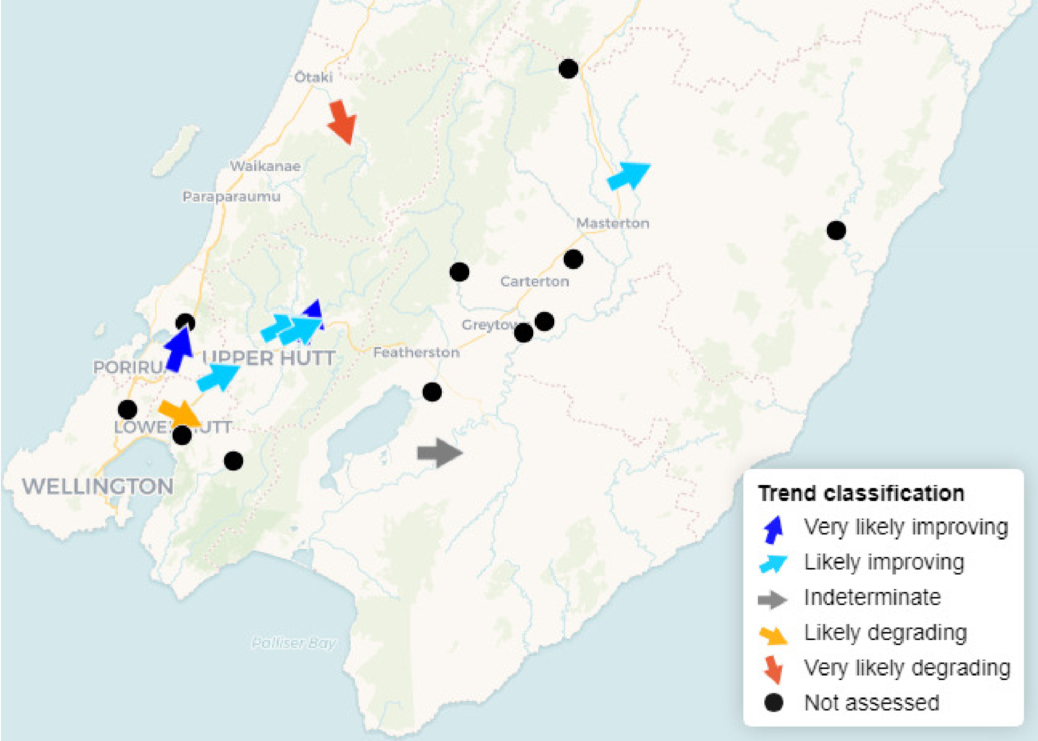

Figure 40: Water clarity flow adjusted 5-yr trends

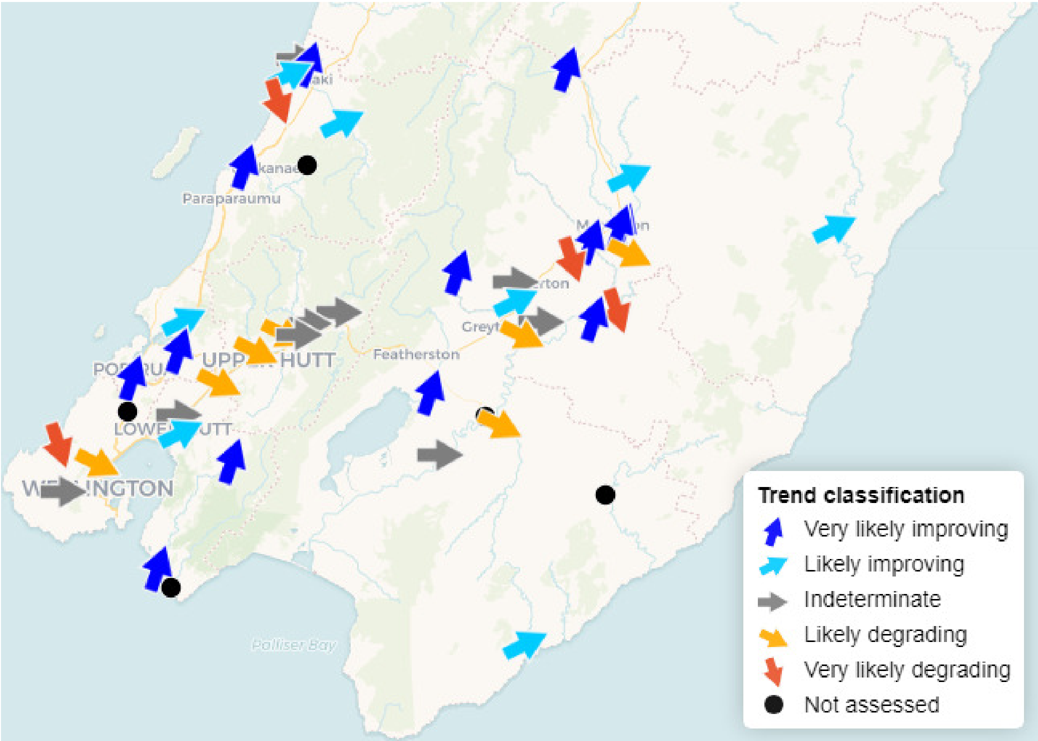

Figure 41: Water clarity 10-yr trends

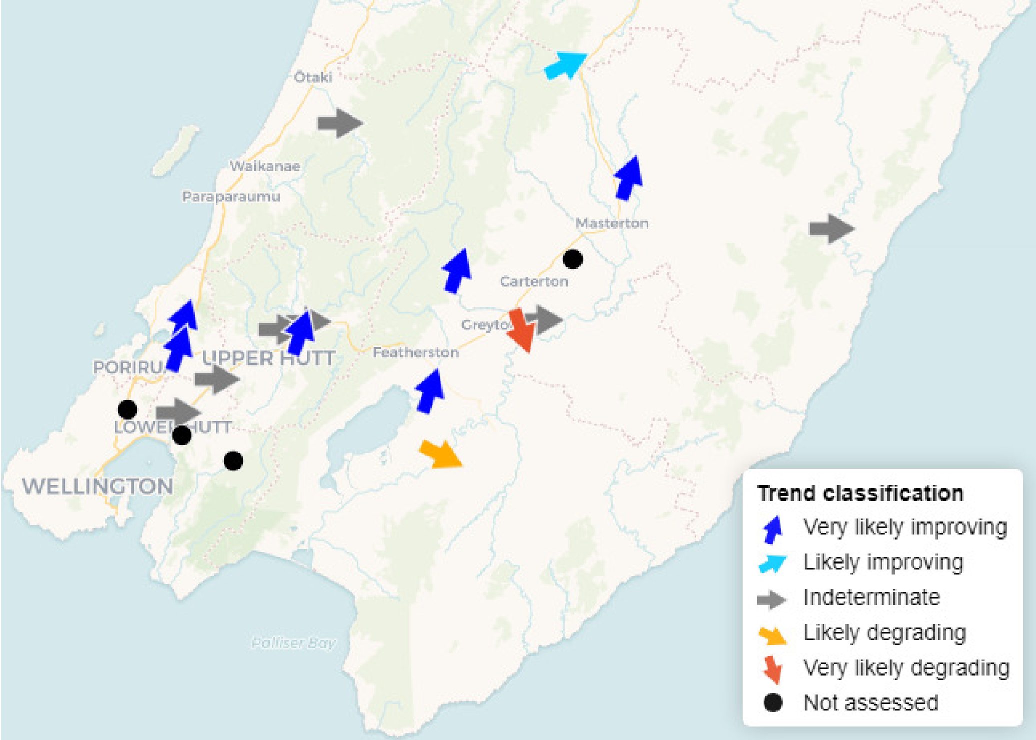

Figure 42: Water clarity flow adjusted 10-yr trends

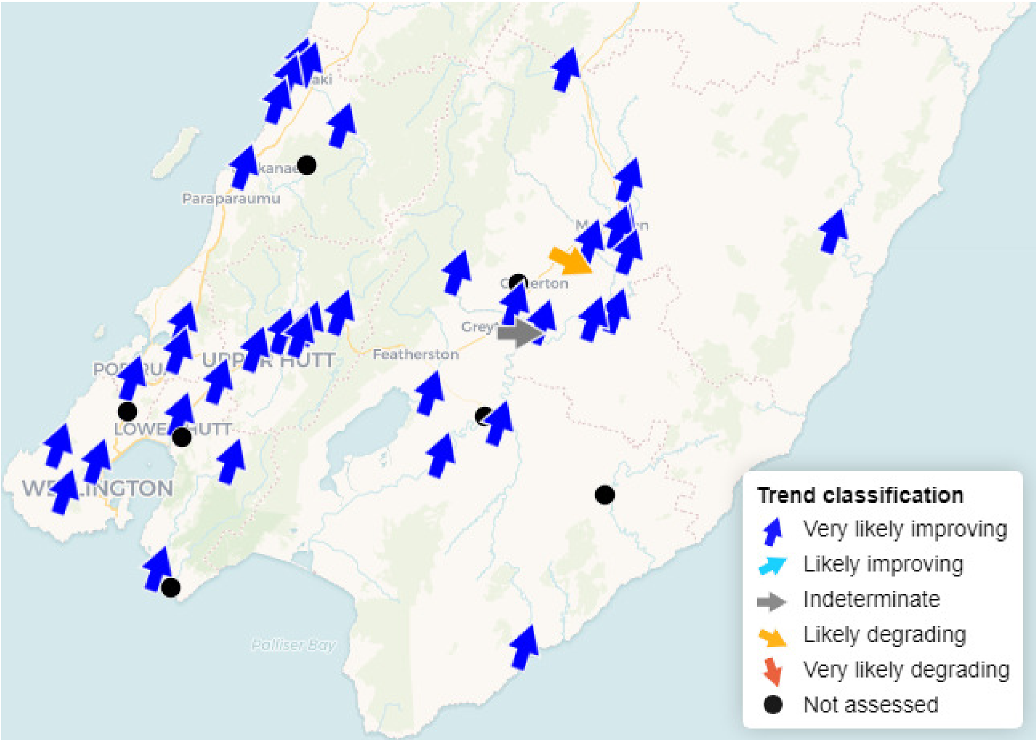

Figure 43: Water clarity 15-yr trends

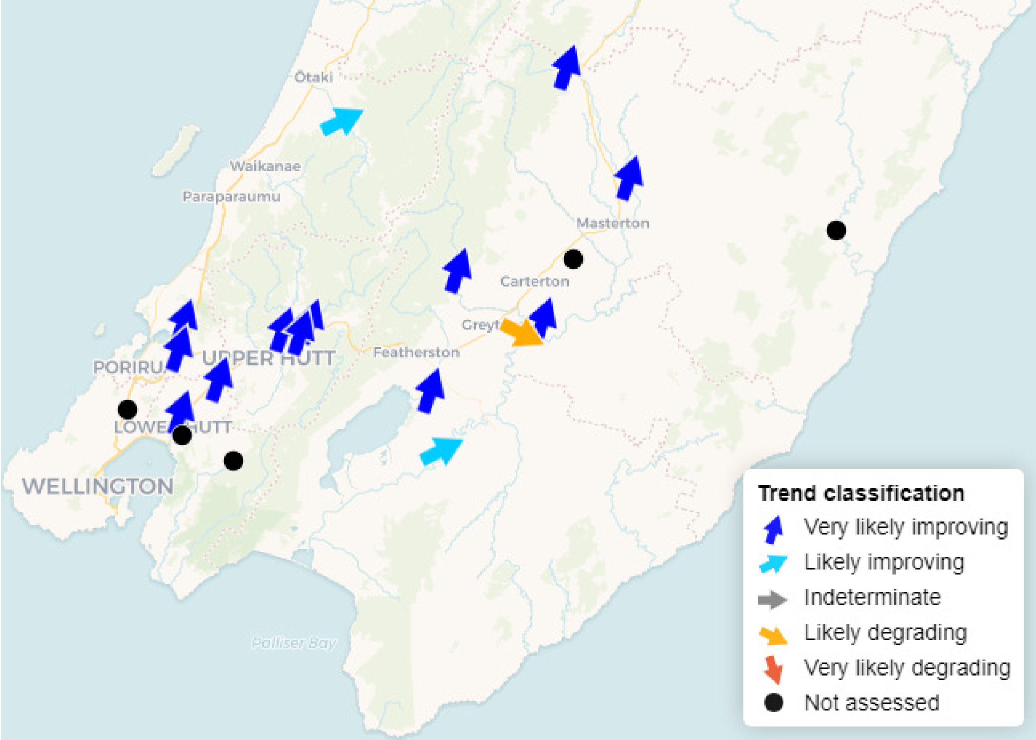

Figure 44: Water clarity flow adjusted 15-yr trends

Deposited fine sediment

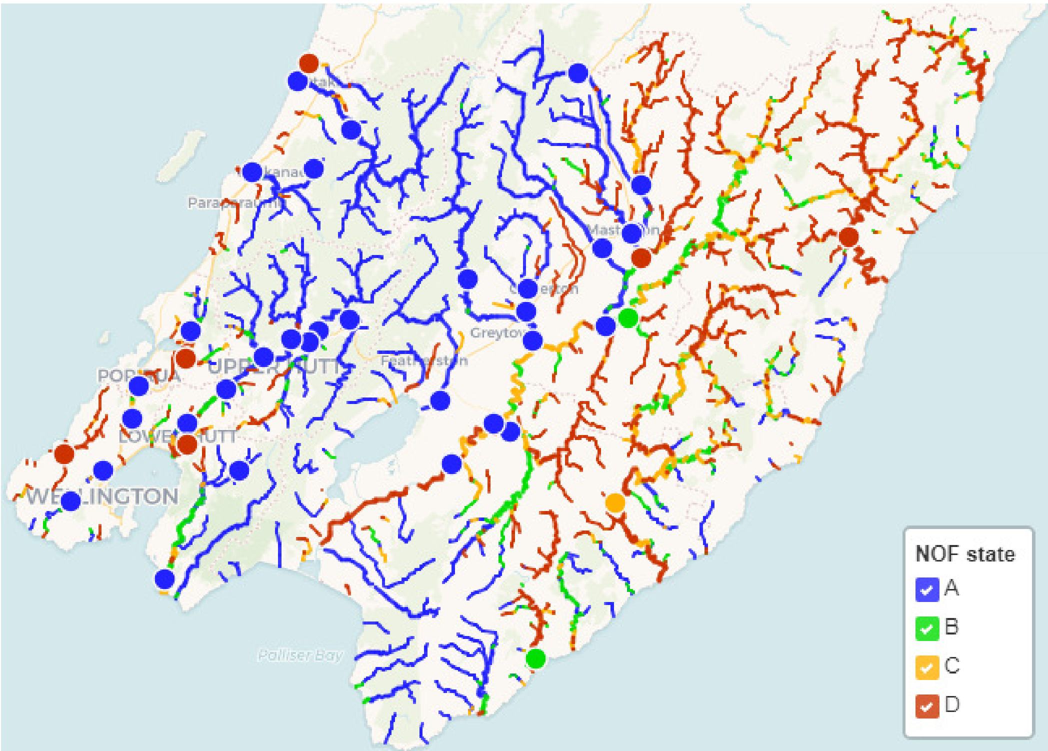

Figure 45: Deposited fine sediment (% cover) NOF states for the period 2018/19 to 2022/23. See the methods sediment benchmarking section for details.

Suspended sediment concentration

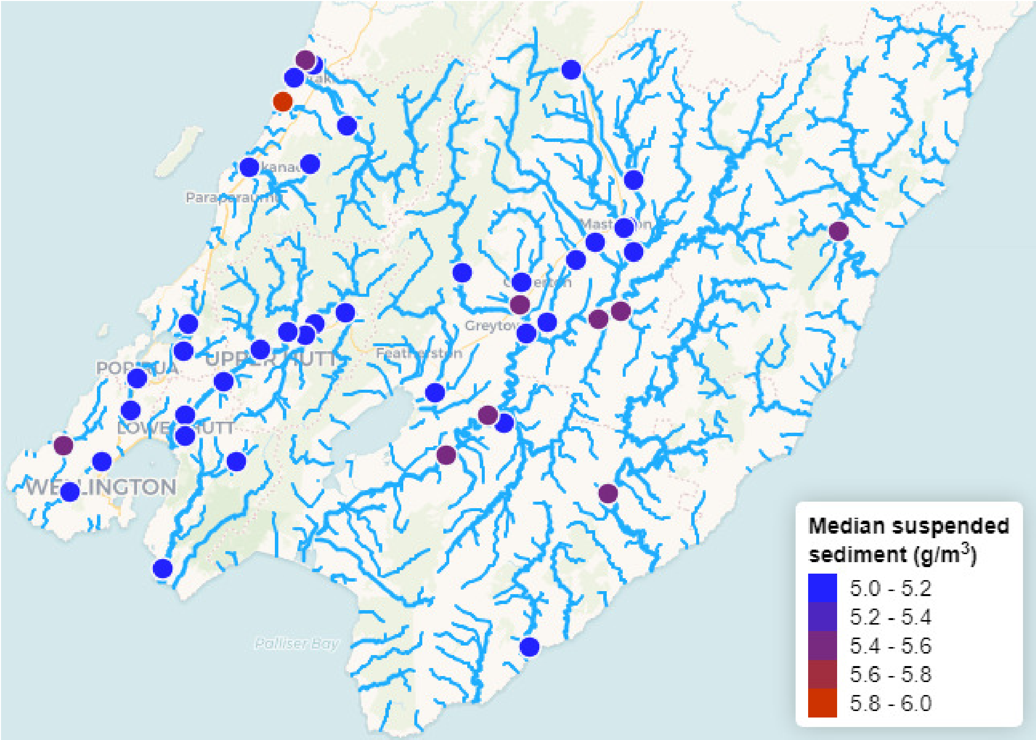

Figure 46: Suspended sediment concentration (g/m^3) results for the period 2020/21 to 2022/23

Total suspended solids

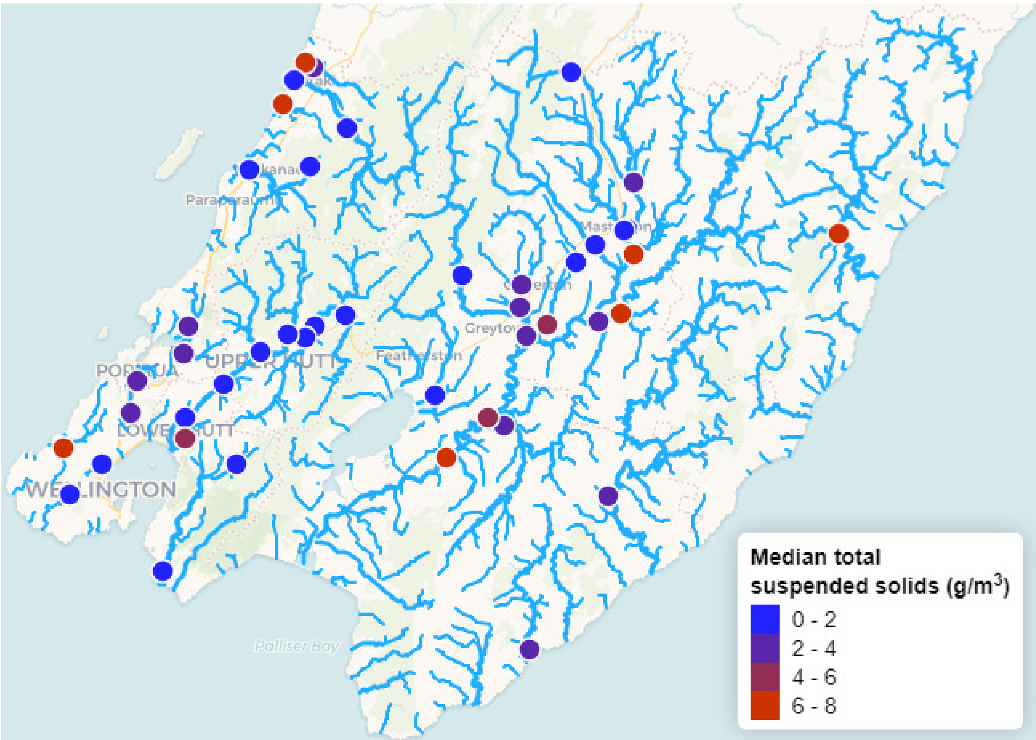

Figure 47: Total suspended solids (g/m^3) results for the period 2020/21 to 2022/23

Other water qualty variables

Dissolved oxygen

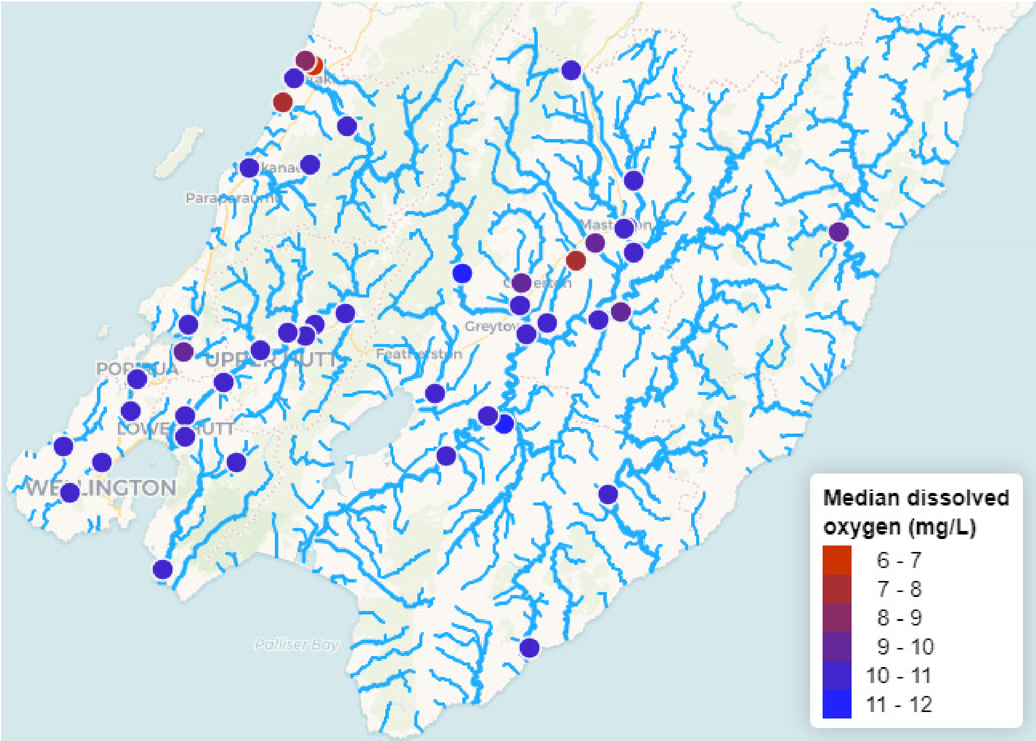

Figure 48: Dissolved oxygen (mg/L) results for the period 2020/21 to 2022/23

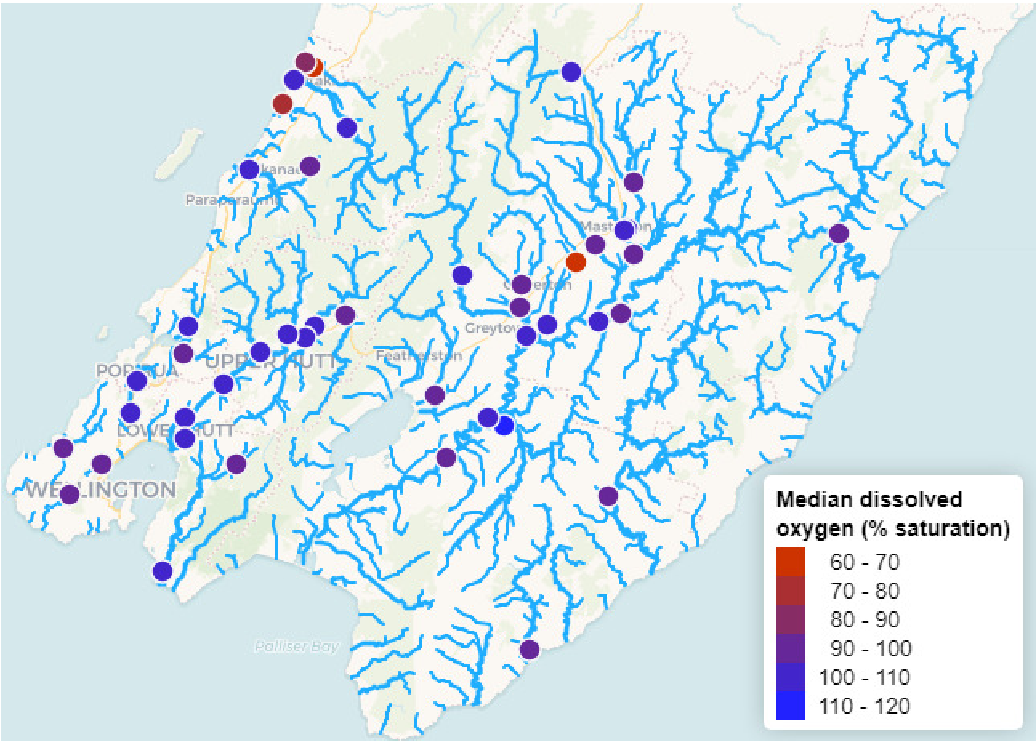

Figure 49: Dissolved oxygen (% saturation) results for the period 2020/21 to 2022/23

pH

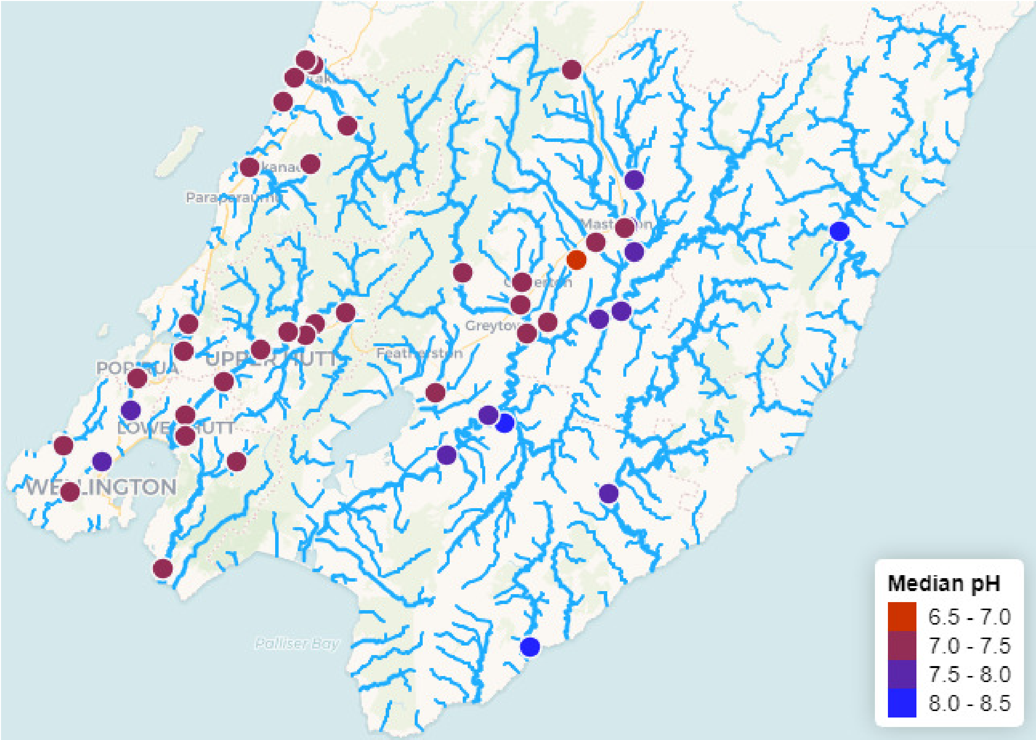

Figure 50: pH results for the period 2020/21 to 2022/23

Electrical conductivity

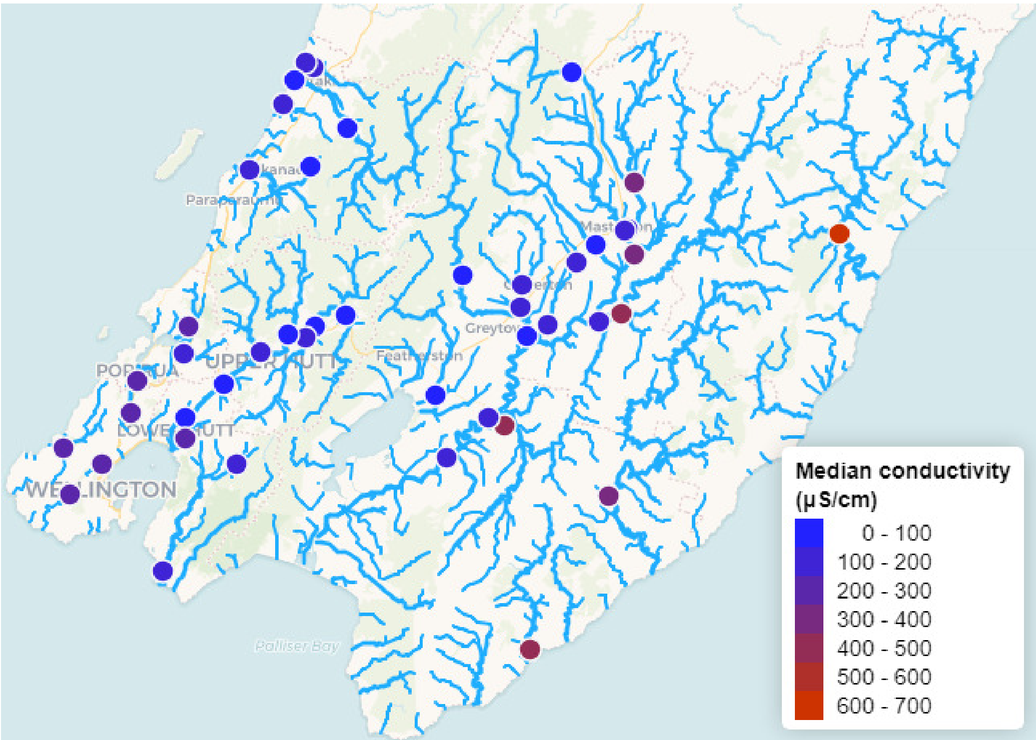

Figure 51: Electrical conductivity (µS/cm) results for the period 2020/21 to 2022/23

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

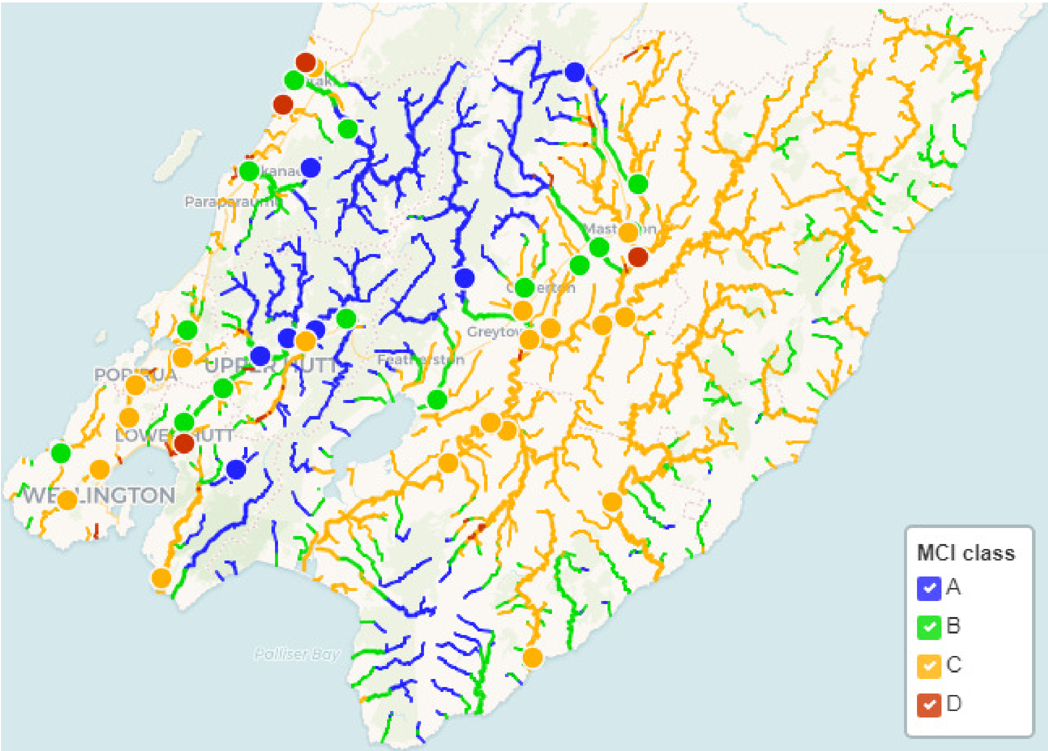

Figure 52: MCI PNRP classes for the period 2020/21 to 2022/23. See the methods macroinvertebrates benchmarking section for details.

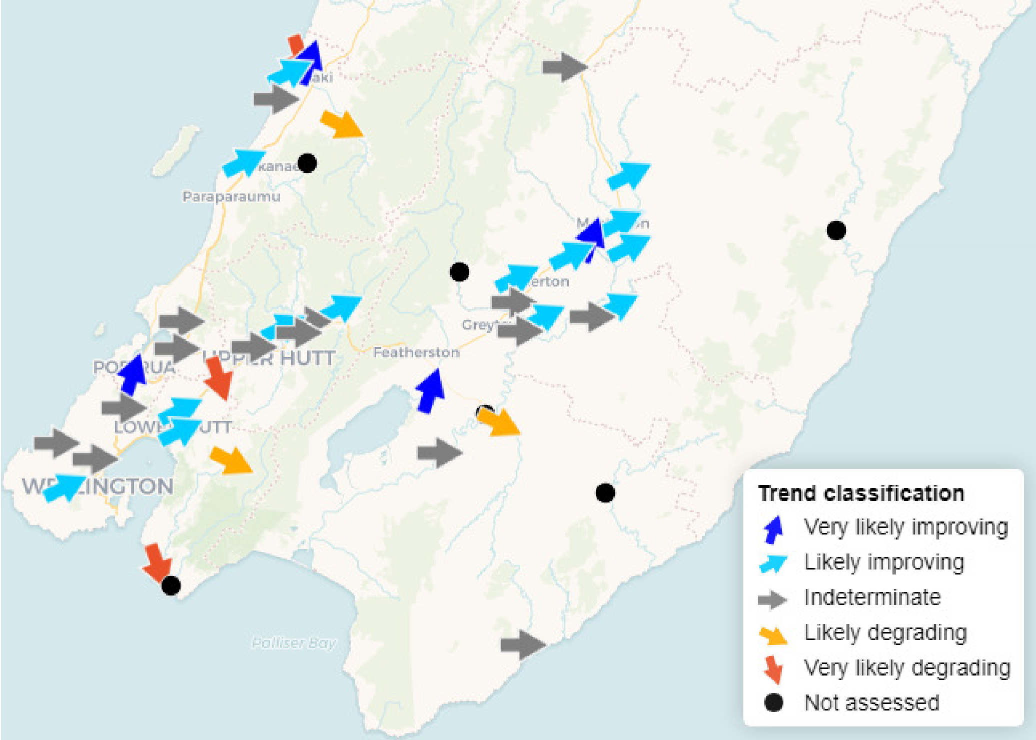

Figure 53: MCI 10-yr trends

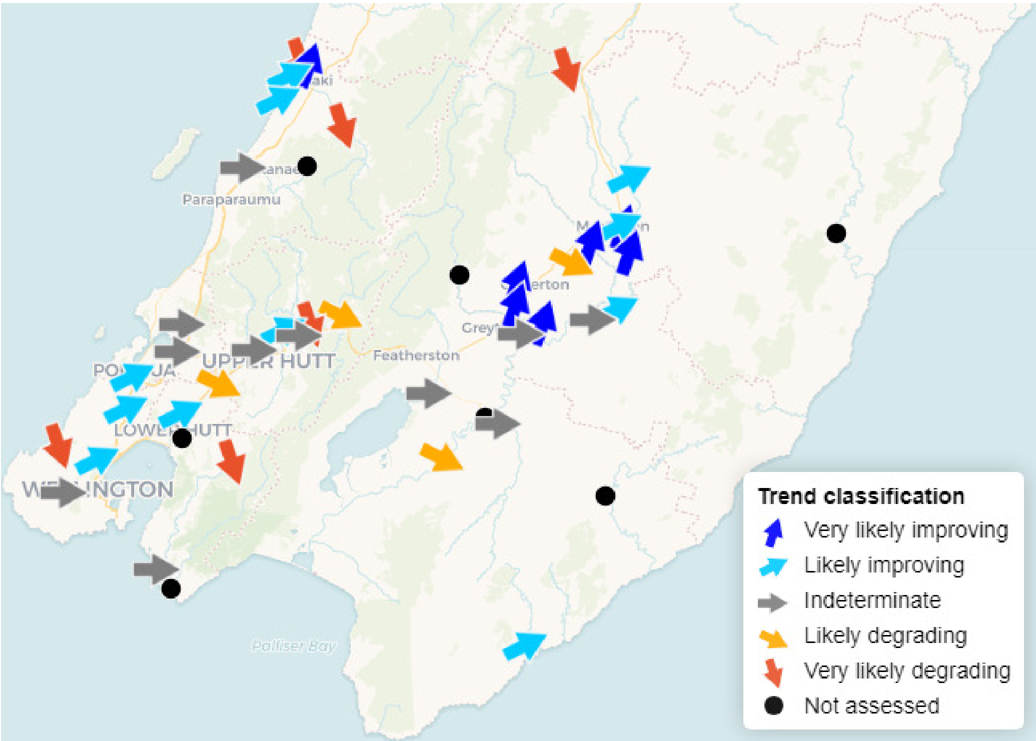

Figure 54: MCI 15-yr trends

MCI & QMCI

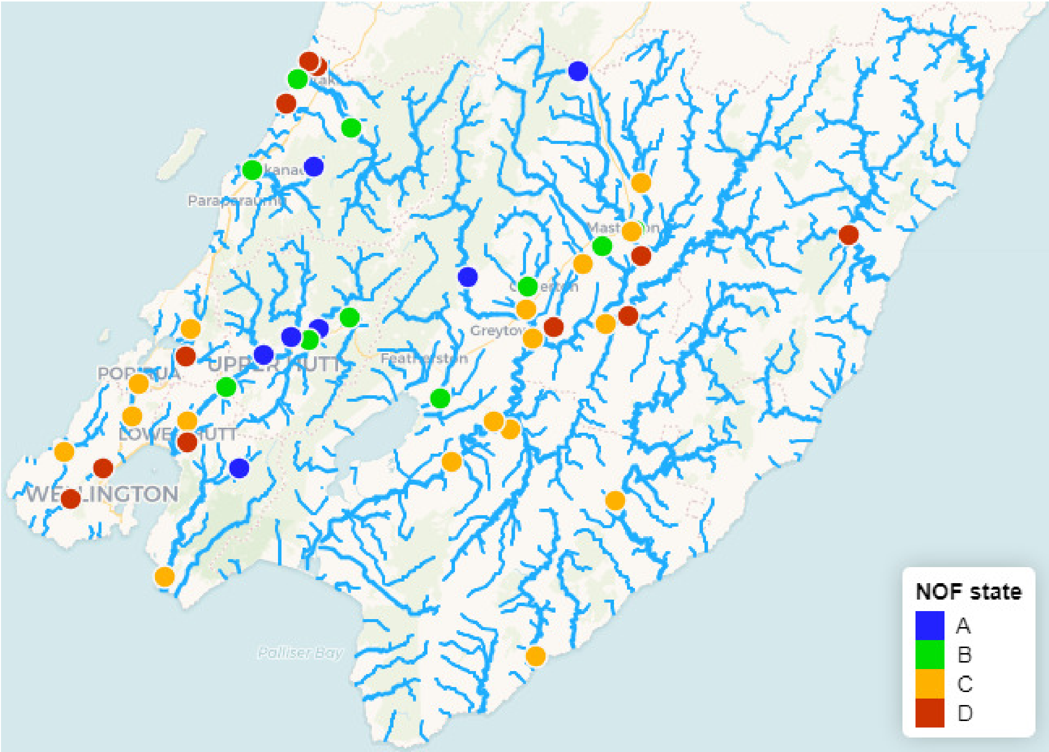

Figure 55: MCI & QMCI NOF states for the period 2018/19 to 2022/23. See the methods macroinvertebrates benchmarking section for details.

ASPM

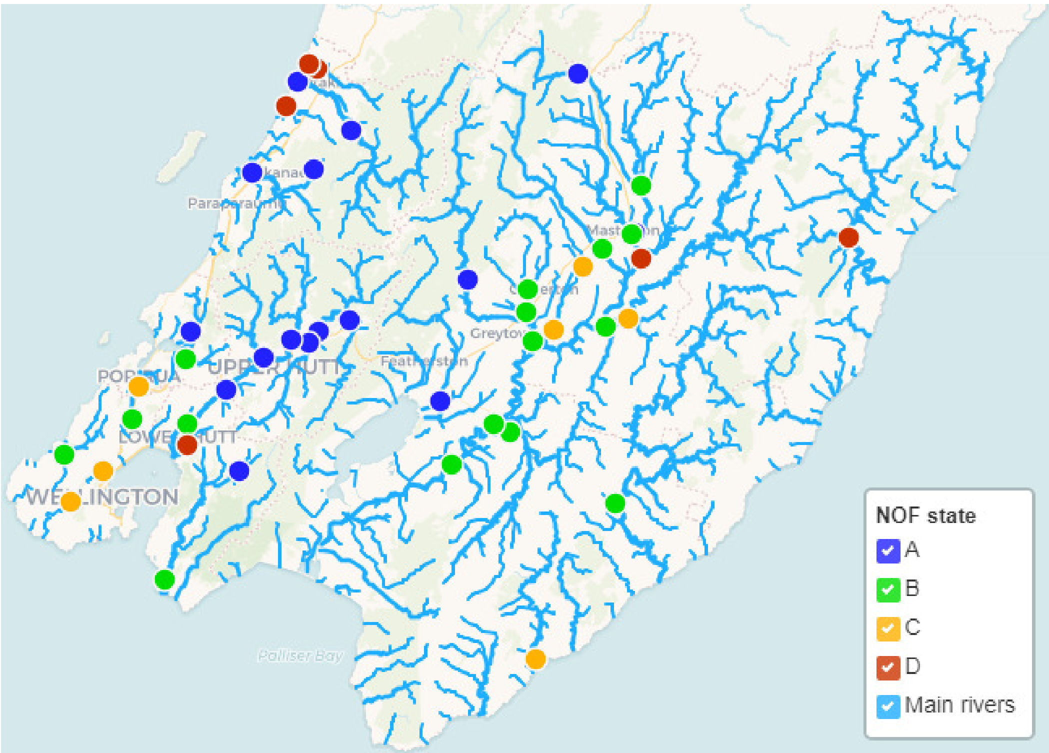

Figure 56: ASPM NOF states for the period 2018/19 to 2022/23. See the methods macroinvertebrates benchmarking section for details.

% EPT richness

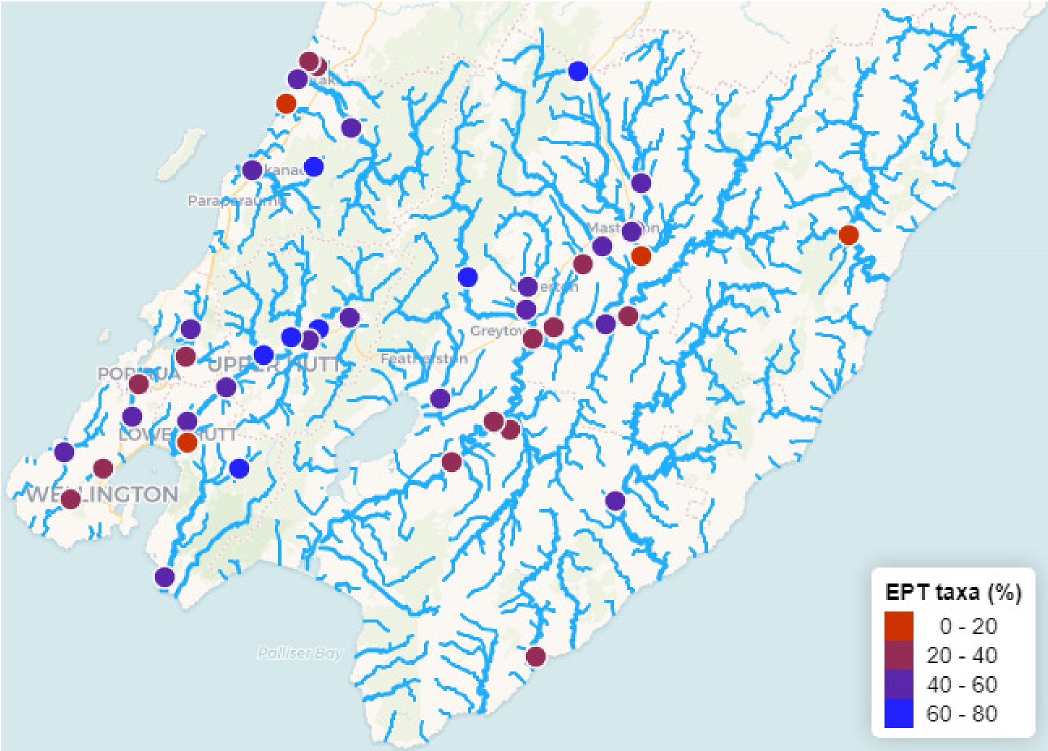

Figure 57: Percentage of (EPT) taxa that are *Ephemeroptera* (mayfly), *Plecoptera* (stonefly) and all *Trichoptera* (caddisfly) except *Hydroptilidae* results for the period 2020/21 to 2022/23

Periphyton & Cyanobacteria

Periphyton biomass

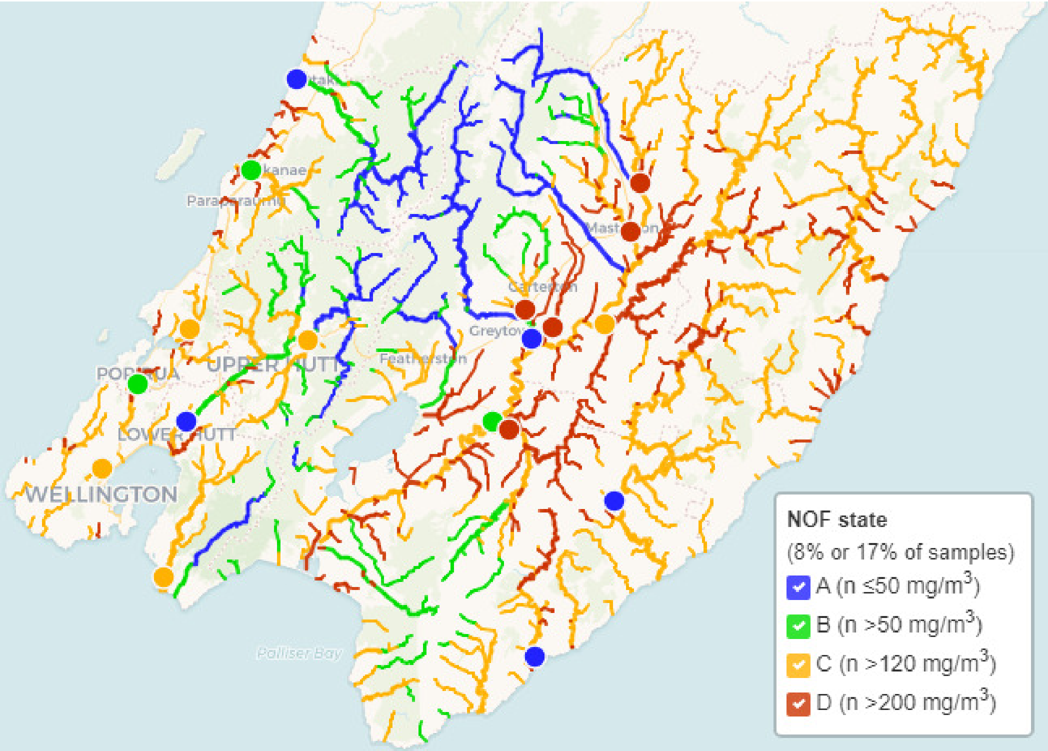

Figure 58: Periphyton biomass NOF states for the period 2020/21 to 2022/23. See the methods periphyton benchmarking section for details.

Periphyton cover

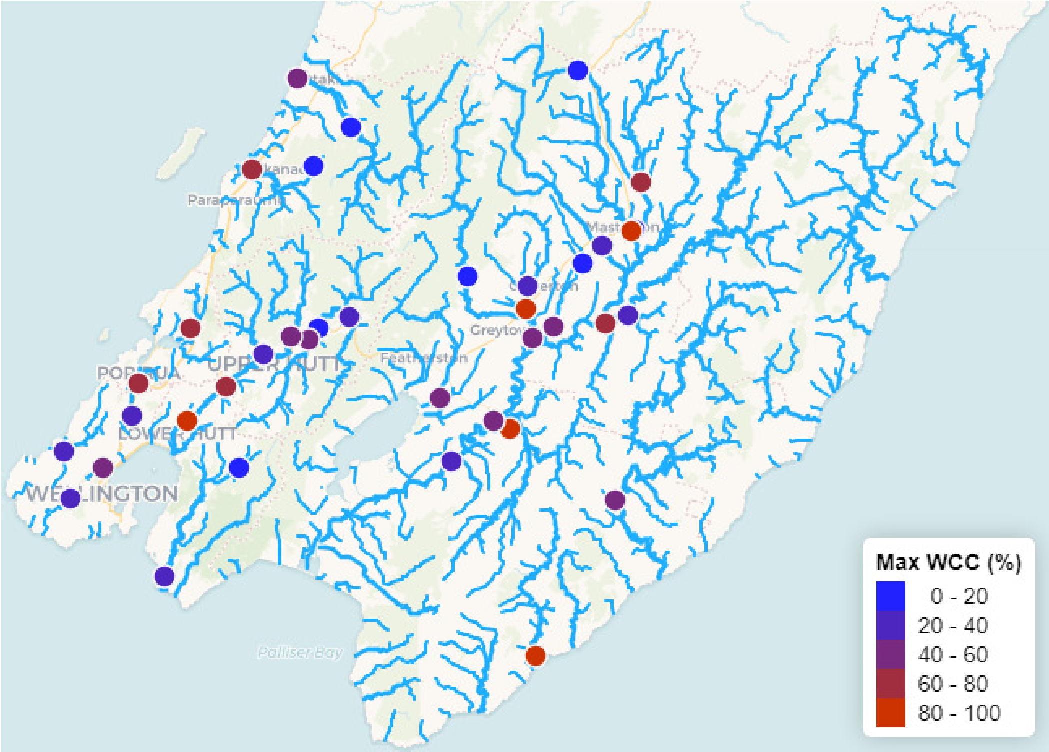

Figure 59: Periphyton weighted composite cover (WCC) results for the period 2020/21 to 2022/23. See the methods periphyton section for details.

Cyanobacteria cover

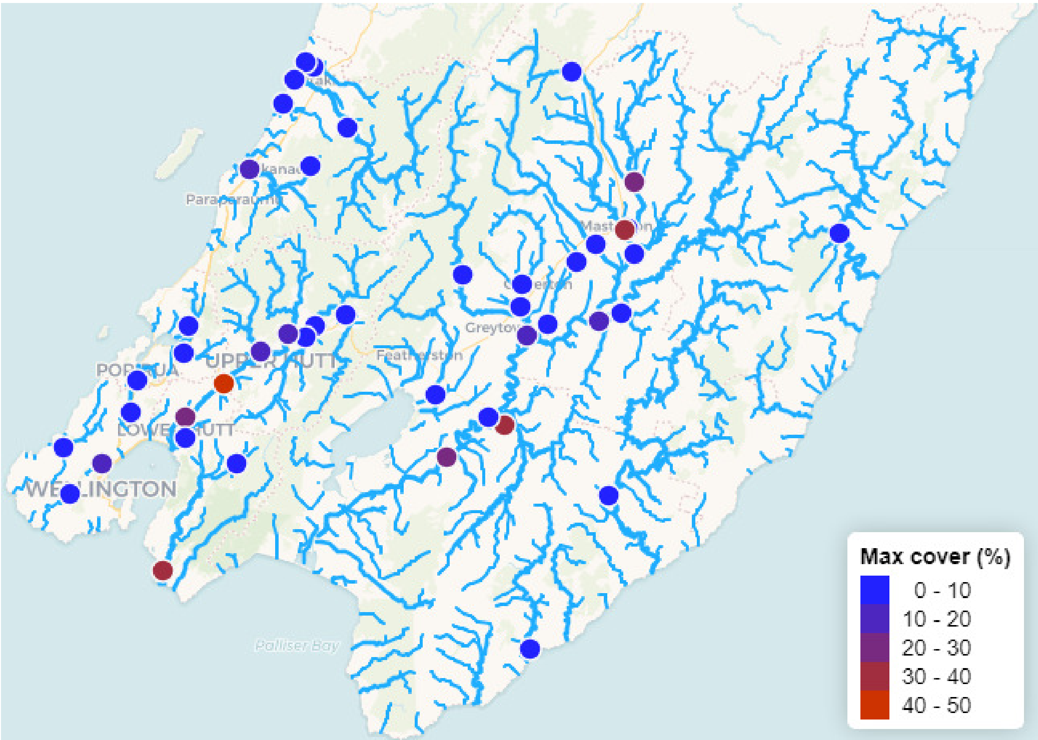

Figure 60: Cyanobacteria cover (%) results for the period 2020/21 to 2022/23

Habitat quality

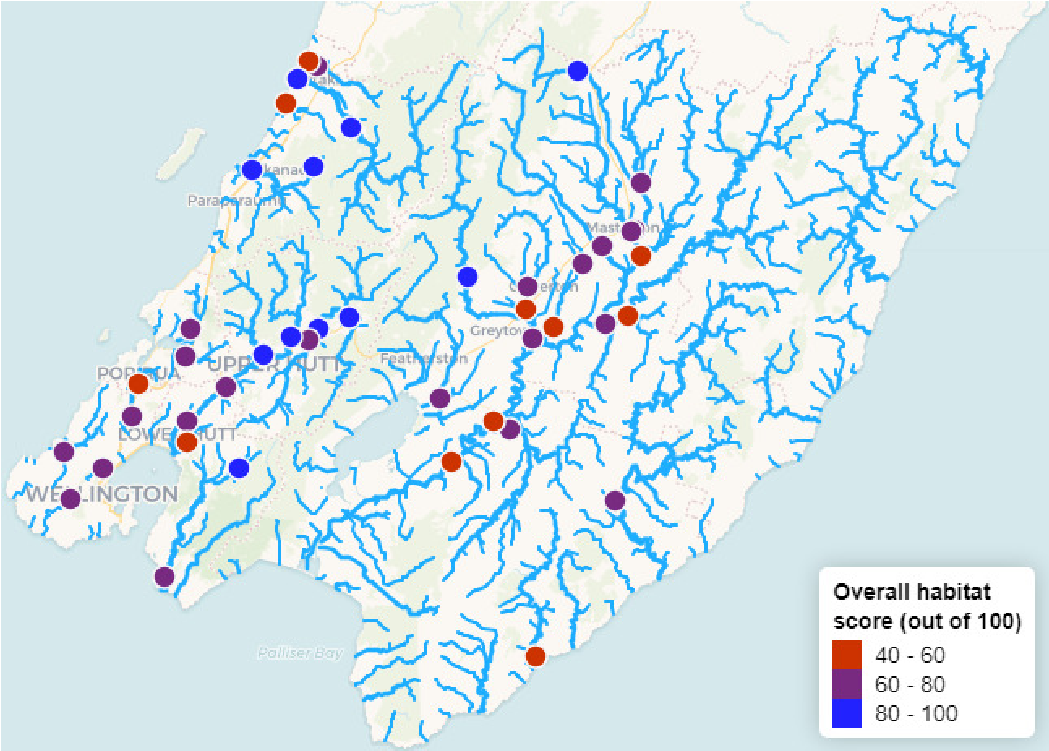

Figure 61: Habitat quality results for the period 2020/21 to 2022/23. See the methods habitat quality section for details.

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
Eastern Wairarapa	Whareama River at Gauge	RS42	Soft	5	9006652
Eastern Wairarapa	Awhea River at Tora Rd	RS53	Hard	5	9017635
Eastern Wairarapa	Pahaoa River at Hinakura	RS60	Hard	5	9014719
Kāpiti Coast	Mangapouri Stream at Bennetts Rd	RS02	Soft	6	9000495
Kāpiti Coast	Waitohu Stream at Norfolk Crescent	RS04	Soft	5	9000356
Kāpiti Coast	Otaki River at Pukehinau	RS05	Hard	1	9002382
Kāpiti Coast	Otaki River at Mouth	RS06	Hard	4	9000731
Kāpiti Coast	Mangaone Stream at Sims Road Bridge	RS07	Soft	5	9001470
Kāpiti Coast	Waikanae River at Greenaway Rd	RS10	Hard	4	9003856
Kāpiti Coast	Waikanae River at Footbridge on Mangaone Walkway	RS61	Hard	2	9003697
Ruamāhanga	Ruamahanga River at McLays	RS31	Hard	1	9000758
Ruamāhanga	Ruamahanga River at Te Ore Ore	RS32	Hard	4	9006280
Ruamāhanga	Ruamahanga River at Gladstone Bridge	RS33	Hard	4	9009060
Ruamāhanga	Ruamahanga River at Pukio	RS34	Hard	4	9013512
Ruamāhanga	Taueru River at Gladstone	RS37	Hard	3	9009016
Ruamāhanga	Kopuaranga River at Stuarts	RS38	Hard	5	9004627
Ruamāhanga	Whangaehu River at 250m from Confluence	RS39	Soft	3	9007085
Ruamāhanga	Waipoua River at Colombo Rd Bridge	RS40	Hard	4	9006301
Ruamāhanga	Waingawa River at South Rd	RS41	Hard	4	9006741
Ruamāhanga	Parkvale tributary at Lowes Reserve	RS45	Hard	6	9007329
Ruamāhanga	Parkvale Stream at Renalls Weir	RS46	Hard	5	9009215
Ruamāhanga	Waiohine River at Bicknells	RS48	Hard	4	9009625
Ruamāhanga	Mangatarere River at State Highway 2	RS50	Hard	4	9008718
Ruamāhanga	Huangarua River at Ponatahi Bridge	RS51	Hard	4	9012636
Ruamāhanga	Tauherenikau River at Websters	RS55	Hard	4	9011002
Ruamāhanga	Ruamahanga River at Waihenga Bridge	RS58	Hard	4	9012311
Ruamāhanga	Enaki Stream D/S site for Riparian	RS59	Hard	4	9007826
Ruamāhanga	Waiohine River at Gorge Rd Carpark	RS62	Hard	1	9007799
Te Awarua-o-Porirua	Horokiri Stream at Snodgrass	RS13	Hard	2	9009035
Te Awarua-o-Porirua	Pauatahanui Stream at Elmwood Bridge	RS14	Soft	2	9010034
Te Awarua-o-Porirua	Porirua Stream at Glenside Overhead Cables	RS15	Hard	2	9011723
Te Awarua-o-Porirua	Porirua Stream at Milk Depot	RS16	Hard	2	9010816
Te Whanganui-a-Tara	Makara Stream at Kennels	RS17	Hard	2	9012604
Te Whanganui-a-Tara	Karori Stream at Makara Peak Mountain Bike Park	RS18	Hard	2	9014420
Te Whanganui-a-Tara	Kaiwharawhara Stream at Ngaio Gorge	RS19	Hard	2	9013489
Te Whanganui-a-Tara	Hutt River at Te Marua Intake Site	RS20	Hard	1	9009042
Te Whanganui-a-Tara	Hutt River Opposite Manor Park Golf Club	RS21	Hard	4	9010876
Te Whanganui-a-Tara	Hutt River at Boulcott	RS22	Hard	4	9012031
Te Whanganui-a-Tara	Pakuratahi River 50m Below Farm Creek	RS23	Hard	1	9008887
Te Whanganui-a-Tara	Mangaroa River at Te Marua	RS24	Hard	1	9009586
Te Whanganui-a-Tara	Akatarawa River at Hutt Confluence	RS25	Hard	1	9009342
Te Whanganui-a-Tara	Whakatikei River at Riverstone	RS26	Hard	4	9010025
Te Whanganui-a-Tara	Wainuiomata River at Manuka Track	RS28	Hard	1	9013597

Whaitua	Site	Site code	Substrate	River class	NZ reach
Te Whanganui-a-Tara	Wainuiomata River Dnstr of White Bridge	RS29	Hard	4	9016506
Te Whanganui-a-Tara	Orongorongo River at Orongorongo Station	RS30	Hard	1	9016841
Te Whanganui-a-Tara	Waiwhetu Stream at Whites Line East	RS57	Soft	6	9012664

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 2020/21 to 2022/23. **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	33	0.62	1.75	2.80	↑↑ -0.095	↑↑ -0.107	↑↑ -0.089			
RS04	33	0.30	0.61	1.04	→ -0.007	↑↑ -0.012	↑↑ -0.019			
RS05	33	0.06	0.06	0.19	↑↑ N/A	→ N/A	→ N/A			
RS06	33	0.06	0.06	0.14			↑ N/A			
RS07	33	0.96	1.79	3.10	→ 0.023	↑↑ -0.029	↑↑ -0.033			
RS10	33	0.06	0.26	0.91	→ 0.002	↑ -0.003	→ N/A			
RS13	32	0.24	0.56	1.36	↓ 0.015	↑↑ -0.010	→ -0.001		↑↑ -0.024	↑↑ -0.009
RS14	33	0.16	0.49	1.27	→ N/A	↑ -0.004	↑ -0.001	↑↑ -0.069	↑↑ -0.019	↑↑ -0.007
RS15	35	0.63	1.12	2.00	↑ -0.017					
RS16	35	0.66	1.13	2.10	↓ 0.013	↑↑ -0.012	↑↑ -0.007			
RS17	35	0.18	0.78	2.50	↓ 0.012	→ N/A	↑ -0.001			
RS18	35	0.55	1.30	1.58	↑↑ -0.027	↑↑ -0.025	↑↑ -0.018			
RS19	34	0.74	1.12	2.10	↑ -0.012	↑↑ -0.031	↑↑ -0.026			
RS20	35	0.06	0.14	0.61	↑↑ -0.010	↑↑ -0.003	↑↑ -0.002	↑↑ -0.013	↑↑ -0.003	↑↑ -0.002
RS21	35	0.18	0.23	0.47	↑↑ -0.016	↑↑ -0.007	↑↑ -0.005			
RS22	35	0.14	0.25	0.56	↑↑ -0.011	↑↑ -0.005	↑↑ -0.002			
RS23	33	0.18	0.25	1.04	↑↑ -0.012	↑↑ -0.008	↑↑ -0.005			
RS24	35	0.26	0.51	0.84	↑↑ -0.020	↑↑ -0.012	↑↑ -0.009			
RS25	33	0.06	0.11	0.26	↑↑ -0.016	↑↑ -0.005	↑↑ N/A			

					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	0.06	0.26	↑↑ N/A	↑↑ -0.007	↑↑ -0.003			
RS29	34	0.06	0.30	0.64	↓ N/A	↑ N/A	↑↑ -0.002			
RS31	30	0.06	0.06	0.24		→ N/A	↑↑ N/A			
RS32	35	0.15	0.50	3.40	→ -0.003	↑↑ -0.006	↑ -0.002			
RS33	35	0.15	0.56	1.76	↓ 0.021	→ N/A	↑ -0.004			
RS34	35	0.16	0.65	1.53	↓ 0.050	→ N/A	↑ -0.005			
RS37	31	0.82	1.15	1.83		↑ -0.005	↑ -0.004			
RS38	35	0.75	1.26	1.84	→ -0.001	↓ 0.008	↑ -0.005			
RS39	34	0.31	1.44	2.90	↓ 0.043	↓↓ 0.030	↑ -0.007			
RS40	35	0.45	1.25	2.70	→ -0.003	↓↓ 0.025	↓ 0.010			
RS41	35	0.06	0.15	0.49	→ N/A	→ N/A	↓↓ N/A			
RS42	22	0.18	0.39	1.09		↑ -0.008	↑ -0.003			
RS45	21	1.82	3.95	6.70	↑↑ -0.427	↑↑ -0.256	↑↑ -0.086			
RS46	33	0.30	2.05	5.10		↑ -0.040	↑ -0.012		↑↑ -0.093	↑ -0.011
RS48	33	0.16	0.48	1.23		↓↓ 0.010	↓ 0.004			
RS50	33	0.72	1.20	3.00		↑ -0.010	↑↑ -0.013			
RS51	32	0.11	0.39	1.18		↓ 0.004	↑↑ -0.005			
RS53	32	0.06	0.19	1.25		↑ -0.003	↑ -0.001			
RS55	32	0.06	0.13	0.34		↓↓ N/A	↓ N/A			
RS57	35	0.46	0.70	1.11	→ N/A	↑ -0.007				
RS58	35	0.14	0.63	1.53	↓↓ 0.042					
RS59	33	0.06	0.85	2.20		↓ 0.018	↑↑ -0.010			
RS60	27	0.11	0.30	0.84						
RS61	34	0.06	0.21	0.43	→ N/A					
RS62	30	0.06	0.06	0.33			→ N/A			

Table A2.2: **Total Kjeldahl nitrogen (g/m^3)** results for the period 2020/21 to 2022/23. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	33	0.25	0.38	1.02
RS04	33	0.10	0.23	0.49
RS05	33	0.05	0.05	0.12
RS06	33	0.05	0.05	0.05
RS07	33	0.18	0.40	0.83
RS10	33	0.05	0.05	0.84
RS13	32	0.05	0.11	0.62
RS14	33	0.05	0.16	0.47
RS15	35	0.05	0.16	0.92
RS16	35	0.05	0.18	0.62
RS17	35	0.13	0.25	1.80
RS18	35	0.05	0.16	0.58
RS19	34	0.05	0.17	0.57
RS20	35	0.05	0.05	0.44

Site code	n	Min	Median	Max
RS22	35	0.05	0.05	0.43
RS23	33	0.05	0.05	0.94
RS24	35	0.05	0.16	0.77
RS25	33	0.05	0.05	0.11
RS26	32	0.05	0.05	0.24
RS28	34	0.05	0.05	0.21
RS29	34	0.05	0.05	0.26
RS31	30	0.05	0.05	0.22
RS32	35	0.05	0.05	2.70
RS33	35	0.05	0.11	0.96
RS34	35	0.05	0.13	0.52
RS37	31	0.16	0.36	1.38
RS38	35	0.12	0.23	0.61
RS39	34	0.28	0.55	1.14
RS40	35	0.05	0.14	0.31
RS41	35	0.05	0.05	0.19
RS42	22	0.17	0.32	0.78
RS45	21	0.19	0.28	0.73
RS46	33	0.20	0.35	1.14
RS48	33	0.05	0.05	0.23
RS50	33	0.05	0.20	0.54
RS51	32	0.05	0.17	0.52
RS53	32	0.05	0.15	1.15
RS55	32	0.05	0.05	0.17
RS57	35	0.10	0.21	0.46
RS58	35	0.05	0.11	0.48
RS59	33	0.05	0.14	1.25
RS60	27	0.11	0.19	0.48
RS61	34	0.05	0.05	0.29
RS62	30	0.05	0.05	0.21

Table A2.3: **Dissolved inorganic nitrogen (g/m^3)** results for the period 2018/19 to 2022/23. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	33	0.38	1.35	2.50
RS04	33	0.13	0.37	0.86
RS05	33	0.01	0.04	0.16
RS06	33	0.01	0.05	0.11
RS07	33	0.74	1.51	2.90
RS10	33	0.04	0.17	0.41
RS13	32	0.14	0.47	1.03
RS14	33	0.05	0.31	1.03
RS15	35	0.51	0.87	1.78
RS16	35	0.49	0.86	1.84
RS17	35	0.02	0.51	1.28

Site code	n	Min	Median	Max
RS18	35	0.17	1.15	1.48
RS19	34	0.44	0.93	1.82
RS20	35	0.03	0.06	0.18
RS21	35	0.06	0.17	0.38
RS22	35	0.06	0.16	0.38
RS23	33	0.07	0.16	0.29
RS24	35	0.07	0.37	0.58
RS25	33	0.01	0.06	0.17
RS26	32	0.05	0.14	0.35
RS28	34	0.02	0.04	0.07
RS29	34	0.01	0.22	0.42
RS31	30	0.01	0.02	0.04
RS32	35	0.06	0.38	1.17
RS33	35	0.07	0.47	1.37
RS34	35	0.06	0.41	1.40
RS37	31	0.37	0.72	1.63
RS38	35	0.38	1.05	1.64
RS39	34	0.03	0.87	2.10
RS40	35	0.30	1.09	2.50
RS41	35	0.01	0.08	0.42
RS42	22	0.00	0.07	0.81
RS45	21	1.56	3.45	6.30
RS46	33	0.01	1.64	4.30
RS48	33	0.08	0.41	1.10
RS50	33	0.50	1.12	2.90
RS51	32	0.01	0.23	0.94
RS53	32	0.00	0.06	0.33
RS55	32	0.02	0.07	0.32
RS57	35	0.27	0.52	0.76
RS58	35	0.08	0.41	1.41
RS59	33	0.01	0.72	1.94
RS60	27	0.00	0.05	0.52
RS61	34	0.06	0.15	0.24
RS62	30	0.01	0.03	0.12

Table A2.4: **pH adjusted ammoniacal nitrogen (g/m^3)** results for the period 2020/21 to 2022/23 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	Raw trends 10 yr	Raw trends 15 yr
RS02	A	33	0.02	0.04	↑ -0.0013	→ 0.0001	↓↓ 0.0010
RS04	A	33	0.01	0.03	→ 0.0001	→ N/A	↑↑ -0.0005
RS05	A	33	0.00	0.00			↑↑ N/A
RS06	A	33	0.00	0.00			↑↑ N/A
RS07	B	33	0.04	0.10	↓↓ 0.0058	→ 0.0003	↓↓ 0.0023
RS10	A	33	0.00	0.00	↑ N/A		↑↑ N/A
RS13	A	32	0.00	0.01		↑↑ N/A	↑ N/A
RS14	A	33	0.00	0.01	↓↓ 0.0007		↑↑ N/A
RS15	A	35	0.00	0.02	→ N/A		
RS16	A	35	0.01	0.03	→ N/A	↓ N/A	↓↓ N/A
RS17	A	35	0.01	0.02	↓↓ 0.0009	↓↓ 0.0004	↓↓ N/A
RS18	A	35	0.01	0.02	↓ 0.0003	↑ N/A	→ N/A
RS19	B	34	0.01	0.07	↓↓ N/A		↓ N/A
RS20	A	35	0.00	0.00	↓ N/A		↑↑ N/A
RS21	A	35	0.00	0.00	↑ N/A	↑ N/A	↑↑ N/A
RS22	A	35	0.00	0.01	→ N/A		→ N/A
RS23	A	33	0.00	0.00	↑ N/A		
RS24	A	35	0.00	0.01	→ N/A		→ N/A
RS25	A	33	0.00	0.01	↓ N/A		↑↑ N/A
RS26	A	32	0.00	0.01	↓↓ N/A	↓ N/A	→ N/A
RS28	A	34	0.00	0.00			
RS29	A	34	0.00	0.01	→ N/A		
RS31	A	30	0.00	0.00			↑↑ N/A
RS32	A	35	0.00	0.01	↑ N/A	→ N/A	↑↑ N/A
RS33	A	35	0.00	0.05	↑ N/A		
RS34	A	35	0.00	0.03			
RS37	B	31	0.01	0.07		↓↓ N/A	↓↓ N/A
RS38	A	35	0.01	0.02			
RS39	A	34	0.01	0.05		→ N/A	↓ N/A
RS40	A	35	0.00	0.01	↑ N/A		
RS41	A	35	0.00	0.00	↓ N/A	↑↑ N/A	↑ N/A
RS42	A	22	0.01	0.02			
RS45	A	21	0.00	0.00			
RS46	A	33	0.01	0.05		↓ N/A	↓ N/A
RS48	A	33	0.01	0.02		↓ N/A	↓ N/A
RS50	B	33	0.01	0.17			↑↑ -0.0011
RS51	A	32	0.00	0.01		↑↑ N/A	
RS53	A	32	0.00	0.01		↑↑ N/A	
RS55	A	32	0.00	0.00			

Site code	State	n	Median	95th percentile	Raw trends		
					5 yr	10 yr	15 yr
RS57	A	35	0.02	0.05	→ 0.0008	↑ -0.0010	
RS58	A	35	0.00	0.03	↑ 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	30	0.00	0.00			↑↑ N/A

Table A2.5: **Nitrite nitrogen (g/m^3)** results for the period 2020/21 to 2022/23. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	33	0.0066	0.0128	0.0230
RS04	33	0.0027	0.0056	0.0122
RS05	33	0.0005	0.0005	0.0005
RS06	33	0.0005	0.0005	0.0010
RS07	33	0.0062	0.0130	0.0370
RS10	33	0.0005	0.0005	0.0014
RS13	32	0.0005	0.0013	0.0044
RS14	33	0.0005	0.0016	0.0052
RS15	35	0.0015	0.0029	0.0095
RS16	35	0.0023	0.0042	0.0110
RS17	35	0.0012	0.0024	0.0089
RS18	35	0.0019	0.0048	0.0188
RS19	34	0.0021	0.0072	0.0360
RS20	35	0.0005	0.0005	0.0600
RS21	35	0.0005	0.0012	0.1190
RS22	35	0.0005	0.0011	0.0850
RS23	33	0.0005	0.0005	0.2700
RS24	35	0.0014	0.0031	0.4400
RS25	33	0.0005	0.0005	0.0137
RS26	32	0.0005	0.0005	0.0760
RS28	34	0.0005	0.0005	0.0015
RS29	34	0.0005	0.0011	0.0040
RS31	30	0.0005	0.0005	0.0015
RS32	35	0.0005	0.0016	0.0035
RS33	35	0.0005	0.0022	0.0450
RS34	35	0.0005	0.0028	0.0152
RS37	31	0.0034	0.0070	0.0128
RS38	35	0.0029	0.0043	0.0111
RS39	34	0.0005	0.0060	0.0290
RS40	35	0.0012	0.0023	0.0089
RS41	35	0.0005	0.0005	0.0014
RS42	22	0.0005	0.0013	0.0070
RS45	21	0.0005	0.0021	0.0055

Site code	n	Min	Median	Max
RS48	33	0.0010	0.0020	0.0097
RS50	33	0.0014	0.0036	0.0330
RS51	32	0.0005	0.0020	0.0071
RS53	32	0.0005	0.0005	0.0045
RS55	32	0.0005	0.0005	0.0018
RS57	35	0.0066	0.0134	0.0220
RS58	35	0.0013	0.0032	0.0157
RS59	33	0.0005	0.0015	0.0089
RS60	27	0.0005	0.0014	0.0062
RS61	34	0.0005	0.0005	0.0019
RS62	30	0.0005	0.0005	0.0022

Table A2.6: **Nitrate nitrogen (g/m^3)** results for the period 2020/21 to 2022/23 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	33	1.32	2.19
RS04	A	33	0.32	0.71
RS05	A	33	0.04	0.07
RS06	A	33	0.05	0.11
RS07	B	33	1.41	2.46
RS10	A	33	0.17	0.40
RS13	A	32	0.46	0.94
RS14	A	33	0.31	0.87
RS15	B	35	0.86	1.58
RS16	A	35	0.84	1.47
RS17	A	35	0.48	0.99
RS18	B	35	1.11	1.37
RS19	A	34	0.92	1.24
RS20	A	34	0.06	0.13
RS21	A	35	0.16	0.30
RS22	A	35	0.15	0.30
RS23	A	33	0.15	0.27
RS24	A	33	0.36	0.54
RS25	A	33	0.06	0.12
RS26	A	32	0.13	0.27
RS28	A	34	0.04	0.06
RS29	A	34	0.21	0.38
RS31	A	30	0.01	0.04
RS32	A	35	0.37	0.97
RS33	A	35	0.42	0.96
RS34	A	35	0.40	1.06

Site code	State	n	Median	95th percentile
RS38	B	35	1.05	1.52
RS39	B	34	0.84	1.96
RS40	B	35	1.08	2.00
RS41	A	35	0.08	0.23
RS42	A	22	0.05	0.53
RS45	C	21	3.45	6.05
RS46	C	33	1.60	4.18
RS48	A	33	0.41	0.97
RS50	B	33	0.99	2.46
RS51	A	32	0.23	0.67
RS53	A	32	0.05	0.26
RS55	A	32	0.06	0.26
RS57	A	35	0.48	0.66
RS58	A	35	0.39	1.04
RS59	B	33	0.71	1.87
RS60	A	27	0.04	0.51
RS61	A	34	0.14	0.23
RS62	A	30	0.03	0.06

Table A2.7: **Nitrite-nitrate nitrogen (g/m^3)** results for the period 2020/21 to 2022/23. **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		
Site code	n	Min	Median	Max	5 yr	10 yr	15 yr
RS02	33	0.34	1.33	2.40	↑ -0.025	↑↑ -0.077	↑↑ -0.071
RS04	33	0.13	0.33	0.82	→ 0.006	↑↑ -0.008	↑↑ -0.011
RS05	33	0.01	0.04	0.16	↑↑ -0.004	↓ 0.000	↓↓ 0.001
RS06	33	0.01	0.05	0.11	↑ -0.003	↓ 0.001	↓↓ 0.001
RS07	33	0.71	1.42	2.80	→ 0.012	↑ -0.012	↑↑ -0.030
RS10	33	0.04	0.17	0.41	→ 0.002	↑ -0.002	↑ -0.001
RS13	32	0.13	0.46	1.02	↓ 0.011	↑↑ -0.014	→ 0.001
RS14	33	0.04	0.31	1.00	↓↓ 0.019	↓↓ 0.006	↓↓ 0.003
RS15	35	0.50	0.86	1.77	→ N/A		
RS16	35	0.48	0.84	1.79	↓ 0.020	↓ 0.004	→ N/A
RS17	35	0.01	0.48	1.25	↓↓ 0.017	↓ 0.004	→ N/A
RS18	35	0.16	1.12	1.47	↑↑ -0.033	↑↑ -0.017	↑↑ -0.016
RS19	34	0.42	0.93	1.77	↑ -0.017	↑↑ -0.025	↑↑ -0.020
RS20	35	0.03	0.06	0.17	↑ 0.000	↑ -0.001	↑↑ -0.001
RS21	35	0.06	0.16	0.38	↑ -0.009	↑↑ -0.004	↑↑ -0.004
RS22	35	0.06	0.16	0.38	↑↑ -0.011	↑↑ -0.003	↑↑ -0.003
RS23	33	0.07	0.16	0.29	→ -0.001	↑↑ -0.004	↑↑ -0.005
RS24	35	0.06	0.37	0.56	↑ -0.010	↑↑ -0.010	↑↑ -0.006
RS25	33	0.01	0.06	0.17	↑↑ -0.006	↑↑ -0.003	↑↑ -0.001
RS26	32	0.05	0.13	0.35	→ -0.003	↓ 0.002	↓↓ 0.003

Site code	n	Min	Median	Max	Raw trends		
					5 yr	10 yr	15 yr
RS29	34	0.01	0.21	0.41	↓↓ 0.011	↓↓ 0.004	→ N/A
RS31	30	0.00	0.01	0.04		↑↑ 0.000	↑↑ 0.000
RS32	35	0.06	0.37	1.17	→ N/A	→ -0.002	↓ 0.003
RS33	35	0.07	0.42	1.37	→ 0.005	↓ 0.005	↓ 0.002
RS34	35	0.05	0.40	1.39	↓↓ 0.035	↓ 0.005	↓ 0.004
RS37	31	0.34	0.72	1.62		↑↑ -0.007	→ -0.001
RS38	35	0.36	1.05	1.63	↓ 0.018	↓↓ 0.010	↓ 0.004
RS39	34	0.00	0.86	2.10	↓ 0.048	↓ 0.013	↑ -0.008
RS40	35	0.30	1.09	2.50	→ 0.017	↓↓ 0.031	↓↓ 0.010
RS41	35	0.01	0.08	0.42	↓ 0.004	→ 0.000	↓ 0.000
RS42	22	0.00	0.05	0.79		→ N/A	→ N/A
RS45	21	1.55	3.45	6.30	↑↑ -0.389	↑↑ -0.260	↑↑ -0.081
RS46	33	0.01	1.61	4.30		↑ -0.020	→ N/A
RS48	33	0.06	0.41	1.07		↓ 0.010	↓↓ 0.005
RS50	33	0.36	0.99	2.60		→ -0.005	↑ -0.006
RS51	32	0.00	0.23	0.93		↓↓ 0.004	↓ 0.001
RS53	32	0.00	0.05	0.33		→ N/A	↓ 0.000
RS55	32	0.01	0.06	0.31		↓↓ 0.004	↓↓ 0.002
RS57	35	0.26	0.49	0.68	→ N/A	→ N/A	
RS58	35	0.07	0.40	1.41	↓ 0.017		
RS59	33	0.00	0.71	1.94		↓ 0.017	↑ -0.005
RS60	27	0.00	0.04	0.52			
RS61	34	0.06	0.15	0.24	→ 0.001		
RS62	30	0.01	0.03	0.12		→ 0.000	↓ 0.000

Table A2.8: **Total phosphorus (g/m^3)** results for the period 2020/21 to 2022/23. **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	33	0.048	0.066	0.220	↑ -0.0021	→ N/A	↓↓ 0.0008			
RS04	33	0.026	0.050	0.144	↓↓ 0.0025	↓↓ 0.0018	↓↓ 0.0004			
RS05	33	0.002	0.007	0.039	→ N/A	↓ N/A	→ N/A			
RS06	33	0.002	0.005	0.055	↑ -0.0004	→ N/A	→ N/A			
RS07	33	0.034	0.079	0.210	↓↓ 0.0059	↓ 0.0009	↓↓ 0.0012			
RS10	33	0.004	0.009	0.029	↑↑ -0.0005	→ N/A	↓ N/A			
RS13	32	0.007	0.017	0.150	↓ 0.0010	↓ 0.0001	→ N/A		→ 0.0000	↑ -0.0002
RS14	33	0.011	0.021	0.100	↑ -0.0010	↑ -0.0002	↑↑ -0.0004			
RS15	35	0.019	0.031	0.210	→ N/A					
RS16	35	0.020	0.032	0.190	↓ 0.0004	↓↓ 0.0005	↓ 0.0003			
RS17	35	0.020	0.043	0.400	→ -0.0002	↑ -0.0002	→ N/A			
RS18	35	0.025	0.045	0.230	→ N/A	→ N/A	↑↑ -0.0004			
RS19	34	0.029	0.047	0.240	→ 0.0004	↑ -0.0001	↓ 0.0002			

Site code	n	Min	Median	Max	Raw trends			Flow adj.		
					5 yr	10 yr	15 yr	5 yr	10 yr	15 yr
RS21	35	0.002	0.008	0.210	↑ -0.0005	↑ -0.0001	↑↑ -0.0001	↑↑ -0.0011	↑ -0.0001	↑ 0.0000
RS22	35	0.003	0.010	0.200	→ N/A	→ N/A	↓ N/A	↑↑ -0.0006	↓ N/A	↑ -0.0001
RS23	33	0.004	0.008	0.330	→ N/A	→ N/A	↑ N/A			
RS24	35	0.012	0.016	0.250	↑↑ -0.0009	→ N/A	→ N/A			
RS25	33	0.003	0.006	0.017	↑↑ -0.0005	→ N/A	↓ N/A			
RS26	32	0.005	0.010	0.026	↑↑ -0.0010	↓ N/A	↓↓ 0.0000			
RS28	34	0.009	0.014	0.023	→ N/A	↑ N/A	→ N/A			
RS29	34	0.009	0.019	0.076	↑ -0.0004	↓↓ 0.0002	→ N/A			
RS31	30	0.001	0.004	0.048		↓↓ N/A	↑ N/A		↓↓ N/A	→ N/A
RS32	35	0.004	0.011	0.102	↓ 0.0003	↑ -0.0003	↑↑ -0.0005			
RS33	35	0.004	0.022	0.104	↓ 0.0008	↑ -0.0005	↑↑ -0.0014			
RS34	35	0.006	0.022	0.113	↓ 0.0010	↑ -0.0002	↑↑ -0.0010	↓ 0.0008	↓ 0.0006	↑↑ -0.0003
RS37	31	0.010	0.068	0.300		↓↓ 0.0016	↓↓ 0.0005			
RS38	35	0.016	0.029	0.220	→ -0.0005	↓ 0.0005	↑ -0.0001			
RS39	34	0.037	0.091	0.580	↓ 0.0047	↓↓ 0.0045	↓↓ 0.0014			
RS40	35	0.003	0.008	0.055	↓ 0.0004	↓ N/A	→ N/A			
RS41	35	0.002	0.005	0.035	↑ N/A	↑ N/A	↑ N/A			
RS42	22	0.011	0.023	0.370		↑ -0.0005	↑ -0.0002		→ 0.0000	↑ -0.0002
RS45	21	0.007	0.021	0.077	→ N/A	↓↓ 0.0004	→ N/A			
RS46	33	0.020	0.041	0.380		→ N/A	↑↑ -0.0018			
RS48	33	0.006	0.017	0.096		→ N/A	↑↑ -0.0005			
RS50	33	0.009	0.030	0.400		↑↑ -0.0025	↑↑ -0.0052			
RS51	32	0.004	0.016	0.290		↓↓ 0.0005	↑ N/A			
RS53	32	0.005	0.015	0.470		↓↓ 0.0006	↑ -0.0001			
RS55	32	0.001	0.006	0.054		↓ N/A				
RS57	35	0.023	0.048	0.098	↑ -0.0015	↓↓ 0.0011				
RS58	35	0.005	0.020	0.106	→ 0.0004					
RS59	33	0.005	0.024	0.520		↓↓ 0.0010	→ N/A			
RS60	27	0.005	0.022	0.116						
RS61	34	0.008	0.016	0.045	→ N/A					
RS62	30	0.001	0.005	0.038		→ N/A				

Table A2.9: **Dissolved reactive phosphorus (g/m^3)** results for the period 2018/19 to 2022/23 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	D	56	0.036	0.065	↓↓ 0.0020	↓ 0.0001	↓↓ 0.0003
RS04	D	56	0.019	0.037	↓↓ 0.0020	↓↓ 0.0006	↓ 0.0001
RS05	A	56	0.005	0.007	→ 0.0000	→ N/A	↓ N/A
RS06	A	55	0.005	0.007	→ -0.0001	↑ N/A	↓ N/A
RS07	D	56	0.030	0.053	↓↓ 0.0037	↓↓ 0.0009	↓↓ 0.0006
RS10	B	56	0.008	0.012	↑↑ -0.0003	→ N/A	↓↓ 0.0001
RS13	C	55	0.013	0.020	↓ 0.0005	↓↓ 0.0002	↓↓ 0.0001
RS14	C	56	0.013	0.019	→ N/A	↑↑ -0.0002	↑↑ -0.0002
RS15	D	58	0.024	0.033	↑ -0.0005		
RS16	D	58	0.024	0.036	→ N/A	↓↓ 0.0005	↓↓ 0.0004
RS17	D	58	0.025	0.051	↑↑ -0.0011	↑↑ -0.0003	→ N/A
RS18	D	58	0.033	0.050	↑ -0.0009	→ -0.0001	↑↑ -0.0002
RS19	D	57	0.035	0.058	↑↑ -0.0019	↑↑ -0.0005	↓↓ 0.0003
RS20	A	58	0.004	0.006	→ 0.0001		↑ N/A
RS21	A	58	0.005	0.008	↑ -0.0001		↑↑ N/A
RS22	A	58	0.005	0.009	↑ -0.0001	↓ N/A	→ N/A
RS23	A	56	0.005	0.008	↓↓ 0.0004	↓↓ 0.0001	↑↑ N/A
RS24	B	57	0.010	0.015	→ 0.0001	→ 0.0000	↑↑ -0.0001
RS25	A	56	0.004	0.006	→ N/A		↑ N/A
RS26	B	55	0.008	0.012	→ N/A	↓↓ 0.0001	↓↓ 0.0001
RS28	C	57	0.011	0.015	↑ -0.0001	↑ 0.0000	↓ 0.0000
RS29	C	57	0.013	0.018	→ N/A	↓↓ 0.0002	↓↓ 0.0001
RS31	A	48	0.002	0.004			↑↑ N/A
RS32	A	58	0.006	0.016	↓ 0.0002	→ N/A	↑↑ -0.0001
RS33	B	57	0.009	0.027	↓↓ 0.0008	↑ -0.0001	↑↑ -0.0008
RS34	C	57	0.013	0.030	↓ 0.0003	↑ -0.0001	↑↑ -0.0002
RS37	D	53	0.023	0.053		↓↓ 0.0005	↓↓ 0.0005
RS38	C	57	0.017	0.045	→ 0.0002	↓↓ 0.0004	↓↓ 0.0001
RS39	D	54	0.045	0.119	↓ 0.0025	↓↓ 0.0022	↓↓ 0.0009
RS40	A	58	0.004	0.012	↓↓ 0.0005		→ N/A
RS41	A	58	0.003	0.005	→ N/A	↑↑ N/A	↑↑ N/A
RS42	C	41	0.006	0.031		→ N/A	↓ N/A
RS45	C	39	0.015	0.033	→ -0.0001	↓↓ 0.0004	↓ 0.0001
RS46	D	55	0.025	0.145		→ N/A	↑↑ -0.0007
RS48	B	55	0.010	0.023		↑↑ -0.0004	↑↑ -0.0003
RS50	D	55	0.023	0.082		↑↑ -0.0028	↑↑ -0.0042
RS51	B	52	0.009	0.027			↓ N/A
RS53	C	49	0.011	0.019		↓↓ 0.0006	↓↓ 0.0002
RS55	A	52	0.003	0.004		↑ N/A	↑↑ N/A

Site code	State	n	Median	95th percentile	Raw trends		
					5 yr	10 yr	15 yr
RS57	D	58	0.027	0.049	↑↑ -0.0010	↓↓ 0.0004	
RS58	C	58	0.012	0.030	↓ 0.0005		
RS59	C	52	0.016	0.030		↓↓ 0.0005	↑ 0.0000
RS60	B	48	0.007	0.028			
RS61	C	57	0.014	0.017	↑↑ -0.0002		
RS62	A	50	0.003	0.007		→ N/A	↓↓ N/A

Metals

Table A2.10: **Dissolved copper (mg/L)** results for the period 2020/21 to 2022/23 benchmarked against GWRC toxicity guidelines. **n** refers to the number of samples and units are **mg/L** unless otherwise noted.

Site code	State	n	Median	95th percentile
RS02	C	33	0.0009	0.0028
RS10	A	33	0.0003	0.0003
RS15	C	35	0.0010	0.0027
RS16	C	35	0.0010	0.0031
RS18	D	35	0.0014	0.0047
RS19	C	34	0.0014	0.0035
RS21	A	35	0.0003	0.0006
RS22	A	35	0.0003	0.0007
RS40	A	35	0.0003	0.0007
RS57	C	35	0.0011	0.0038

Table A2.11: **Dissolved zinc (mg/L)** results for the period 2020/21 to 2022/23 benchmarked against GWRC toxicity guidelines. **n** refers to the number of samples and units are **mg/L** unless otherwise noted.

Site code	State	n	Median	95th percentile
RS02	B	33	0.0025	0.0087
RS10	A	33	0.0005	0.0005
RS15	B	35	0.0033	0.0114
RS16	C	35	0.0058	0.0340
RS18	D	35	0.0184	0.0440
RS19	B	34	0.0051	0.0150
RS21	A	35	0.0005	0.0028
RS22	A	35	0.0005	0.0026
RS40	A	35	0.0005	0.0009
RS57	D	35	0.0129	0.0478

Microbiology

Table A2.12: ***E. coli*** **(cfu/100ml)** results for the period 2018/19 to 2022/23 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		
							5 yr	10 yr	15 yr
RS02	E	56	88	100	1,300	9,000	↑↑ -171.2	→ N/A	↓↓ 47.4
RS04	E	56	71	95	1,000	4,620	↑ -80.0	↓↓ 27.1	↓↓ 41.1
RS05	A	56	0	0	14	130	↓↓ 0.5		
RS06	A	55	2	4	30	190	↓ 0.5	↓↓ 1.3	→ N/A
RS07	E	56	91	100	1,500	11,800	↓ 126.1	↓↓ 80.0	↓↓ 91.5
RS10	A	56	2	4	39	251	↓ 0.7	↓↓ 1.0	↓↓ 1.0
RS13	E	55	16	51	270	1,075	↑ -23.3	↑↑ -15.7	→ N/A
RS14	E	56	32	68	315	2,150	↓↓ 31.9	↓↓ 12.6	↓↓ 4.4
RS15	E	58	50	78	535	9,600	→ 8.3		
RS16	E	58	86	97	1,400	18,200	↓↓ 201.8	→ N/A	↓↓ 58.8
RS17	E	58	41	60	355	7,920	↓↓ 45.4	↓ 5.0	↓↓ 14.3
RS18	E	58	97	98	2,150	10,600	↓ 90.1	↓↓ 132.8	↓↓ 82.7
RS19	E	57	79	95	1,700	11,300	↓↓ 261.2	↓↓ 124.4	↓↓ 73.3
RS20	A	58	3	10	40	424	↓ 2.3	↓↓ 2.4	↓↓ 0.8
RS21	D	58	21	33	125	2,100	↓ 4.0	↓↓ 4.6	↓ 0.8
RS22	D	58	17	33	130	2,620	↓ 5.7	↓↓ 9.2	↓↓ 3.6
RS23	D	56	14	21	120	2,440	→ N/A	↓↓ 4.7	↓↓ 2.3
RS24	E	57	35	60	340	5,740	→ -23.3	↓↓ 15.0	↓↓ 10.0
RS25	C	56	11	18	100	1,200	→ N/A	↓↓ 5.0	↓↓ 3.2
RS26	A	55	5	9	30	505	↓ 1.3	↓↓ 2.5	↓↓ 1.3
RS28	A	57	0	0	15	152	↓↓ 1.6	↓↓ N/A	↓↓ N/A
RS29	D	57	19	35	185	2,360	↑ -11.3	↓↓ 12.0	↓↓ 6.9
RS31	A	48	0	2	10	93		↓ N/A	
RS32	D	58	14	24	105	1,600	↓↓ 22.8	↓↓ 9.5	↓ 1.4
RS33	B	57	5	16	60	664	↓ 2.1	↓↓ 2.6	→ N/A
RS34	D	57	11	23	60	1,995	↓↓ 6.7	↓↓ 3.4	↑ -0.9
RS37	D	53	23	32	160	3,535		↓ 3.4	↓↓ 3.2
RS38	D	57	18	37	220	3,455	↓ 4.7	↓ 5.0	↑↑ -4.4
RS39	D	55	20	27	130	17,000	↑ -9.2	↑ -5.0	↑↑ -15.0
RS40	D	58	12	24	90	2,320	↑↑ -20.3	↓↓ 3.4	↓↓ 2.4
RS41	A	58	2	7	30	342	↑ -0.7	↓↓ 1.6	→ N/A
RS42	D	41	29	39	190	12,050		↑↑ -12.0	→ -0.2
RS45	A	39	0	8	22	354	→ N/A	↓ 1.0	↓ 0.6
RS46	E	55	40	62	390	9,400		↓ 11.5	→ N/A
RS48	C	55	11	20	110	1,140		↓↓ 9.0	↓↓ 3.1
RS50	D	55	18	36	200	3,380		↓ 4.4	↓ 2.1

Site code	State	n	% > 540 cfu/100ml	% > 260 cfu/100ml	Median	95th percentile	Raw trends		
							5 yr	10 yr	15 yr
RS51	D	52	6	12	100	1,220		↓ 2.7	↓ 0.9
RS53	D	49	6	20	110	2,665		↓↓ 5.2	↓ 1.0
RS55	A	52	0	2	35	188		↓↓ 1.5	↓↓ 1.0
RS57	E	58	69	90	1,000	16,650	→ 27.6	↓↓ 60.9	
RS58	D	58	12	22	70	2,340	↓ 5.5		
RS59	D	50	20	36	190	7,000		↓↓ 23.6	↓↓ 7.2
RS60	D	48	17	33	140	1,220			
RS61	A	57	0	4	22	222			
RS62	A	50	2	6	10	284			↓↓ N/A

Sediment

Table A2.13: **Water clarity (m)** results for the period 2018/19 to 2022/23 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	1.05	↑ 0.03	↑↑ 0.05	↑↑ 0.05			
RS04	3	D	59	0.78	↓↓ -0.11	→ -0.01	↑↑ 0.02			
RS05	3	A	59	4.42	→ 0.02	↑ 0.05	↑↑ 0.08	↓↓ -0.41	→ 0.02	↑ 0.05
RS06	3	A	58	3.40	→ -0.11	↑ 0.07	↑↑ 0.11			
RS07	2	C	59	0.67	↓↓ -0.17	↓↓ -0.03	↑↑ 0.01			
RS10	3	A	59	5.18	↑ 0.06	↑↑ 0.13	↑↑ 0.21			
RS13	3	C	59	2.55	↓↓ -0.16	↑ 0.04	↑↑ 0.08		↑↑ 0.06	↑↑ 0.06
RS14	3	C	59	2.23	→ 0.04	↑↑ 0.07	↑↑ 0.09	↑↑ 0.12	↑↑ 0.14	↑↑ 0.12
RS15	3	D	59	2.18	→ -0.03					
RS16	2	A	59	2.16	→ -0.04	↑↑ 0.05	↑↑ 0.04			
RS17	3	D	59	1.41	↓ -0.05	↓↓ -0.03	↑↑ 0.01			
RS18	3	A	59	3.08	↑ 0.18	→ N/A	↑↑ 0.09			
RS19	3	A	59	3.07	↓↓ -0.19	↓ -0.07	↑↑ 0.11			
RS20	3	A	59	3.60	→ -0.05	→ -0.03	↑↑ 0.09	↑↑ 0.20	→ 0.00	↑↑ 0.08
RS21	3	C	59	2.48	→ 0.05	↓ -0.02	↑↑ 0.07	↑ 0.07	→ 0.01	↑↑ 0.08
RS22	3	C	59	2.50	→ -0.02	→ 0.02	↑↑ 0.07	↓ -0.06	→ 0.01	↑↑ 0.06
RS23	3	A	59	4.34	↑ 0.17	→ 0.03	↑↑ 0.13			
RS24	3	D	60	1.39	→ -0.01	→ -0.01	↑↑ 0.04	↑ 0.02	↑↑ 0.02	↑↑ 0.04
RS25	3	A	59	4.17	↑↑ 0.29	↓ -0.04	↑↑ 0.08	↑ 0.10	→ -0.04	↑↑ 0.08
RS26	3	A	59	3.31	↑↑ 0.24	↓ -0.06	↑↑ 0.09			
RS28	3	A	59	3.82	→ -0.02	↑↑ 0.11	↑↑ 0.12			
RS31	3	A	59	6.58		↑↑ 0.15	↑↑ 0.31		↑ 0.06	↑↑ 0.17
RS32	4	A	59	3.36	↓ -0.17	↑↑ 0.12	↑↑ 0.14			
RS33	3	B	58	2.82	↓ -0.19	↑↑ 0.10	↑↑ 0.14			
RS34	4	A	59	1.64	↓↓ -0.33	→ -0.01	↑↑ 0.05	→ 0.02	↓ -0.03	↑ 0.01
RS37	2	B	59	0.86	↓↓ -0.08	↓↓ -0.04	↑↑ 0.02			
RS38	4	A	59	1.84	→ 0.02	↑ 0.03	↑↑ 0.08	↑ 0.05	↑↑ 0.06	↑↑ 0.08
RS39	2	A	57	0.95		↓ -0.01	↑↑ 0.03			
RS40	3	A	59	4.02	↑↑ 0.47	↑↑ 0.12	↑↑ 0.14			
RS41	3	A	59	5.08	↑↑ 0.64	↑↑ 0.31	↑↑ 0.25			
RS42	2	D	55	0.55		↑ 0.02	↑↑ 0.02		→ -0.01	
RS45	1	A	56	2.43	↑ 0.17	↓↓ -0.09	↓ -0.04			
RS46	1	C	58	1.48		→ -0.01	↑↑ 0.07		→ 0.02	↑↑ 0.07
RS48	3	D	58	1.66		↓ -0.05	→ 0.01		↓↓ -0.06	↓ -0.01
RS50	3	D	58	1.95		↑ 0.03	↑↑ 0.07			
RS51	2	A	58	2.57	↓ -0.14	↓ -0.02	↑↑ 0.09			
RS53	2	A	57	1.78		↑ 0.04	↑↑ 0.04			

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	1.21	→ -0.03	↑ 0.02				
RS58	4	A	59	1.96	↓ -0.12					
RS59	3	B	58	2.57		→ -0.03				
RS60	4	A	57	1.51						
RS61	3	A	60	3.33	↓↓ -0.36					
RS62	3	A	58	4.36		↑↑ 0.19	↑↑ 0.15		↑↑ 0.19	↑↑ 0.14

Table A2.14: **Deposited fine sediment (% cover)** results for the period 2018/19 to 2022/23 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	0
RS06	4	A	58	3
RS10	4	A	59	10
RS13	4	A	59	8
RS14	4	D	59	70
RS15	4	A	59	6
RS16	2	A	59	3
RS17	4	D	59	52
RS18	4	A	59	7
RS19	4	A	59	6
RS20	4	A	59	0
RS21	4	A	59	2
RS22	4	A	59	10
RS23	4	A	59	2
RS24	4	A	60	2
RS25	4	A	59	4
RS26	4	A	59	5
RS28	4	A	59	2
RS29	4	A	59	4
RS31	4	A	59	1
RS32	2	A	59	5
RS33	4	A	58	4
RS34	2	A	59	0
RS37	3	B	59	14
RS38	2	A	59	2
RS39	3	D	57	35
RS40	4	A	59	0
RS41	4	A	59	0
RS42	3	D	55	45
RS48	4	A	58	1

Site code	Class	State	n	Median (% cover)
RS51	3	A	58	3
RS53	3	B	57	10
RS55	4	A	58	5
RS57	2	D	59	60
RS58	2	A	59	6
RS59	4	A	58	2
RS60	2	C	57	22
RS61	4	A	60	1
RS62	4	A	58	0

Table A2.15: **Suspended sediment concentration (g/m^3)** results for the period 2020/21 to 2022/23. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	33	5.0	5.0	72.0
RS04	33	5.0	5.5	60.0
RS05	33	5.0	5.0	40.0
RS06	33	5.0	5.0	73.0
RS07	33	5.0	6.0	81.0
RS10	33	5.0	5.0	43.0
RS13	32	5.0	5.0	75.0
RS14	33	5.0	5.0	142.0
RS15	35	5.0	5.0	157.0
RS16	35	5.0	5.0	109.0
RS17	35	5.0	5.5	360.0
RS18	35	5.0	5.0	51.0
RS19	34	5.0	5.0	320.0
RS20	35	5.0	5.0	240.0
RS21	35	5.0	5.0	320.0
RS22	35	5.0	5.0	270.0
RS23	33	5.0	5.0	670.0
RS24	35	5.0	5.0	420.0
RS25	33	5.0	5.0	6.0
RS26	32	5.0	5.0	18.0
RS28	34	5.0	5.0	5.5
RS29	34	5.0	5.0	36.0
RS31	30	5.0	5.0	65.0
RS32	34	5.0	5.0	650.0
RS33	35	5.0	5.5	340.0
RS34	35	5.0	5.5	210.0
RS37	31	5.0	5.5	230.0
RS38	35	5.0	5.0	210.0
RS39	34	5.0	5.0	490.0
RS40	35	5.0	5.0	42.0
RS41	35	5.0	5.0	55.0
RS42	22	5.0	5.5	520.0

Site code	n	Min	Median	Max
RS45	21	5.0	5.0	102.0
RS46	33	5.0	5.0	48.0
RS48	33	5.0	5.0	176.0
RS50	33	5.0	5.5	590.0
RS51	32	5.0	5.0	121.0
RS53	32	5.0	5.0	810.0
RS55	32	5.0	5.0	280.0
RS57	34	5.0	5.0	34.0
RS58	35	5.0	5.5	320.0
RS59	33	5.0	5.0	510.0
RS60	27	5.0	5.5	108.0
RS61	34	5.0	5.0	27.0
RS62	30	5.0	5.0	33.0

Table A2.16: **Total suspended solids (g/m^3)** results for the period 2020/21 to 2022/23. **n** refers to the number of samples and units are **g/m^3** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	33	1.0	3.0	75.0
RS04	33	1.0	6.0	55.0
RS05	33	1.0	1.0	47.0
RS06	33	1.0	1.0	59.0
RS07	33	1.0	8.0	83.0
RS10	33	1.0	1.0	27.0
RS13	32	1.0	3.0	67.0
RS14	33	1.0	2.0	133.0
RS15	35	1.0	2.0	127.0
RS16	35	1.0	2.0	102.0
RS17	35	1.0	6.0	360.0
RS18	35	1.0	1.0	51.0
RS19	34	1.0	1.0	191.0
RS20	35	1.0	1.0	176.0
RS21	35	1.0	1.0	240.0
RS22	35	1.0	1.0	220.0
RS23	33	1.0	1.0	460.0
RS24	35	1.0	1.0	320.0
RS25	33	1.0	1.0	10.0
RS26	32	1.0	1.0	13.0
RS28	34	1.0	1.0	7.0
RS29	34	1.0	1.5	36.0
RS31	30	1.0	1.0	69.0
RS32	35	1.0	1.0	660.0
RS33	35	1.0	2.0	350.0
RS34	35	1.0	6.0	220.0
RS37	31	1.0	8.0	240.0
RS38	35	1.0	3.0	166.0

Site code	n	Min	Median	Max
RS39	34	1.0	6.0	420.0
RS40	35	1.0	1.0	38.0
RS41	35	1.0	1.0	63.0
RS42	22	1.0	8.0	530.0
RS45	21	1.0	1.0	76.0
RS46	33	1.0	5.0	56.0
RS48	33	1.0	3.5	165.0
RS50	33	1.0	3.5	520.0
RS51	32	1.0	3.0	119.0
RS53	32	1.0	3.5	810.0
RS55	32	1.0	1.0	120.0
RS57	34	1.0	5.0	33.0
RS58	35	1.0	4.0	360.0
RS59	33	1.0	2.0	540.0
RS60	27	1.0	3.0	114.0
RS61	34	1.0	1.0	28.0
RS62	30	1.0	1.0	29.0

Other water quality variables

Table A2.17: **Dissolved oxygen (mg/L)** summer (1-Nov to 30-Apr) sampling results for the period 2020/21 to 2022/23. **n** refers to the number of samples and units are **mg/L** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	36	3.6	6.9	10.4
RS04	36	6.5	8.8	10.8
RS05	36	9.5	11.0	12.7
RS06	36	9.7	10.9	12.4
RS07	36	4.9	7.7	9.5
RS10	36	8.9	10.5	12.0
RS13	36	9.4	10.6	13.3
RS14	36	8.3	9.9	12.8
RS15	36	9.0	10.5	12.5
RS16	36	9.2	10.6	12.5
RS17	36	8.5	10.4	101.2
RS18	36	9.2	10.3	11.4
RS19	36	9.4	10.3	11.9
RS20	36	9.7	11.0	12.3
RS21	36	9.1	10.7	12.3
RS22	36	7.6	10.5	13.3
RS23	36	7.4	10.3	11.7
RS24	38	9.5	10.8	11.7
RS25	36	9.5	10.8	12.6
RS26	36	9.8	10.9	12.6
RS28	36	9.4	10.7	11.7
RS29	36	9.3	10.3	11.4
RS31	36	9.5	10.9	12.3
RS32	36	9.4	10.5	11.9
RS33	36	9.4	10.3	15.4
RS34	36	8.9	10.3	13.0
RS37	36	7.4	9.6	12.8
RS38	36	8.1	10.6	14.6
RS39	36	1.0	10.7	17.9
RS40	36	8.9	10.7	12.3
RS41	36	8.5	9.9	11.6
RS42	35	7.9	9.3	11.5
RS45	34	6.3	7.1	8.4
RS46	36	6.5	10.8	11.7
RS48	36	8.7	10.4	12.4
RS50	36	8.5	10.0	13.6
RS51	36	8.8	11.3	15.3
RS53	36	4.2	10.6	13.1
RS55	36	9.2	10.6	12.6
RS57	36	5.3	10.5	16.8

Site code	n	Min	Median	Max
RS59	36	1.5	9.4	13.0
RS60	35	8.2	10.1	13.2
RS61	37	9.7	10.8	12.2
RS62	36	9.8	11.0	12.4

Table A2.18: **Dissolved oxygen (% saturation)** results for the period 2020/21 to 2022/23. **n** refers to the number of samples and units are **% saturation** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	36	36.7	69.9	95.0
RS04	36	63.0	87.4	97.1
RS05	36	97.8	100.2	102.8
RS06	36	98.7	102.0	115.9
RS07	36	49.4	74.9	85.5
RS10	36	96.3	100.0	111.8
RS13	36	96.7	101.9	112.4
RS14	36	86.4	95.9	102.6
RS15	36	96.6	102.8	118.3
RS16	36	96.5	102.0	116.4
RS17	36	89.2	96.4	123.5
RS18	36	93.6	99.5	108.5
RS19	36	93.3	99.3	113.4
RS20	36	98.0	101.6	105.4
RS21	36	98.9	102.9	152.4
RS22	36	81.8	100.9	160.2
RS23	36	77.4	98.1	102.6
RS24	38	96.4	101.2	123.4
RS25	36	100.1	101.5	106.7
RS26	36	100.3	102.5	109.6
RS28	36	96.0	99.3	100.9
RS29	36	92.2	100.1	113.5
RS31	36	97.9	100.7	102.7
RS32	36	97.6	100.5	120.8
RS33	36	95.1	100.5	168.8
RS34	36	91.1	98.6	136.5
RS37	36	76.4	90.6	134.7
RS38	36	81.4	98.2	161.9
RS39	36	10.4	99.4	206.2
RS40	36	97.9	104.2	121.0
RS41	36	76.5	99.4	112.2
RS42	35	83.2	93.4	100.2
RS45	34	62.1	69.6	76.6
RS46	36	76.6	104.9	126.3
RS48	36	88.6	100.5	126.4
RS50	36	88.5	95.3	140.3
RS51	36	93.7	111.1	154.4

Site code	n	Min	Median	Max
RS53	36	45.0	99.8	123.7
RS55	36	96.7	98.9	109.8
RS57	36	59.4	104.9	181.0
RS58	36	92.9	101.6	138.5
RS59	36	14.4	91.5	111.5
RS60	35	89.8	97.5	144.1
RS61	37	97.7	99.7	100.6
RS62	36	96.9	100.1	102.4

Table A2.19: **pH** results for the period 2020/21 to 2022/23. **n** refers to the number of samples and units are **measured pH** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	33	6.8	7.0	7.5
RS04	33	6.6	7.0	7.6
RS05	33	6.8	7.3	7.6
RS06	33	6.7	7.3	7.6
RS07	33	6.7	7.1	7.5
RS10	33	6.8	7.3	8.7
RS13	32	7.0	7.4	7.7
RS14	33	6.8	7.3	7.6
RS15	35	6.7	7.6	8.2
RS16	35	6.8	7.4	8.1
RS17	35	6.9	7.4	7.8
RS18	35	7.0	7.3	7.6
RS19	34	7.1	7.6	8.1
RS20	35	6.4	7.3	7.9
RS21	35	6.5	7.2	8.9
RS22	35	6.5	7.2	9.3
RS23	33	6.5	7.0	7.5
RS24	35	6.3	7.1	7.5
RS25	33	6.5	7.3	7.5
RS26	32	6.8	7.4	7.7
RS28	34	6.3	7.2	7.7
RS29	34	6.5	7.3	7.7
RS31	30	6.7	7.4	7.7
RS32	35	6.9	7.7	8.3
RS33	35	6.8	7.5	8.8
RS34	35	6.8	7.5	8.3
RS37	31	6.9	7.9	8.2
RS38	35	7.3	7.9	8.5
RS39	34	7.1	7.6	8.3
RS40	35	6.8	7.4	8.2
RS41	35	6.6	7.3	7.8
RS42	22	7.4	8.0	8.3
RS45	21	6.6	6.7	7.3

Site code	n	Min	Median	Max
RS46	33	7.0	7.5	8.8
RS48	33	6.8	7.1	7.7
RS50	33	6.6	7.0	7.6
RS51	32	7.3	8.1	8.6
RS53	32	7.5	8.1	8.5
RS55	32	6.6	7.3	7.8
RS57	35	6.4	7.0	7.5
RS58	35	6.9	7.6	8.3
RS59	33	6.7	7.1	7.4
RS60	27	7.3	7.9	8.1
RS61	34	6.7	7.2	7.5
RS62	30	6.8	7.2	7.7

Table A2.20: **Electrical conductivity (µS/cm)** results for the period 2020/21 to 2022/23. **n** refers to the number of samples and units are **µS/cm** unless otherwise noted.

Site code	n	Min	Median	Max
RS02	36	152	197	218
RS04	36	95	151	238
RS05	36	48	63	78
RS06	36	48	66	81
RS07	36	122	189	246
RS10	36	87	104	157
RS13	36	157	207	1,004
RS14	36	143	176	207
RS15	36	106	234	262
RS16	36	120	249	270
RS17	36	160	258	309
RS18	36	43	210	260
RS19	36	116	258	292
RS20	36	46	68	84
RS21	36	59	88	125
RS22	36	61	91	114
RS23	36	38	83	90
RS24	38	59	103	118
RS25	36	62	81	92
RS26	36	88	113	124
RS28	36	76	107	120
RS29	36	117	142	155
RS31	36	20	50	65
RS32	36	43	127	206
RS33	36	45	116	167
RS34	36	43	143	203
RS37	36	216	428	545
RS38	36	146	301	395
RS39	36	169	382	470

Site code	n	Min	Median	Max
RS40	36	80	113	143
RS41	36	34	62	79
RS42	35	317	610	732
RS45	34	141	163	188
RS46	36	121	147	184
RS48	36	37	77	95
RS50	36	68	110	146
RS51	36	239	411	493
RS53	36	307	445	534
RS55	36	50	70	93
RS57	36	84	224	257
RS58	36	44	141	227
RS59	36	77	114	144
RS60	35	219	338	420
RS61	37	59	87	95
RS62	36	29	57	68

Macroinvertebrates

Table A2.21: **Macroinvertebrate community index (MCI)** results for the period 2020/21 to 2022/23 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 (2022/23)	Median MCI (3-yr)	n (3-yr)	MCI class	PNRP objective	State	Raw trends	
							10 yr	15 yr
RS02	93	93	3	C	Not meeting	C	↑↑ 0.9	↑↑ 1.7
RS04	77	77	3	D	Not meeting	D	↓↓ -0.8	↓↓ -0.8
RS05	127	127	3	B	Not meeting	B	↓ -1.0	↓↓ -1.0
RS06	124	124	3	B	Not meeting	B	↑ 1.7	↑ 0.6
RS07	69	69	3	D	Not meeting	D	→ 0.4	↑ 0.3
RS10	115	115	3	B	Not meeting	B	↑ 0.6	→ -0.2
RS13	115	114	3	B	Meeting	B	→ 0.7	→ -0.2
RS14	108	104	3	C	Not meeting	C	→ 0.5	→ -0.2
RS15	105	102	3	C	Not meeting	C	→ 0.3	↑ 0.4
RS16	103	99	3	C	Not meeting	C	↑↑ 1.8	↑ 0.5
RS17	98	110	3	B	Meeting	B	→ -0.6	↓↓ -0.9
RS18	92	92	3	C	Not meeting	C	↑ 0.4	→ 0.1
RS19	95	95	3	C	Not meeting	C	→ 0.4	↑ 0.4
RS20	137	137	3	A	Meeting	A	→ -0.1	↓↓ -0.4
RS21	123	112	3	B	Not meeting	B	↓↓ -1.9	↓ -0.4
RS22	110	114	3	B	Not meeting	B	↑ 1.0	↑ 0.8
RS23	138	122	3	B	Not meeting	B	↑ 0.4	↓ -0.6
RS24	116	116	3	C	Not meeting	C	→ -0.7	→ -0.2
RS25	129	137	3	A	Meeting	A	↑ 1.2	↑ 0.2
RS26	134	134	3	A	Meeting	A	→ 0.1	→ -0.1
RS28	133	133	3	A	Meeting	A	↓ -0.5	↓↓ -0.4
RS29	102	102	3	C	Not meeting	C	↓↓ -1.4	→ -0.1
RS31	148	147	3	A	Meeting	A	→ 0.5	↓↓ -0.7
RS32	114	118	3	B	Meeting	B	↑ 1.1	↑↑ 0.8
RS33	102	102	3	C	Not meeting	C	→ -0.2	→ 0.1
RS34	96	100	3	C	Not meeting	C	→ 0.0	↓ -0.2
RS37	97	97	3	C	Not meeting	C	↑ 0.3	↑ 0.2
RS38	102	100	3	B	Meeting	B	↑ 0.6	↑ 0.2
RS39	80	61	3	D	Not meeting	D	↑ 0.3	↑↑ 0.7
RS40	120	101	3	C	Not meeting	C	↑ 0.6	↑ 0.5
RS41	127	127	3	B	Not meeting	B	↑↑ 2.5	↑↑ 0.8
RS45	103	100	3	B	Meeting	B	↑ 0.6	↓ -0.2
RS46	94	90	3	C	Not meeting	C	↑ 0.8	↑↑ 1.1
RS48	118	109	3	C	Not meeting	C	→ -0.2	→ -0.2
RS50	124	109	3	C	Not meeting	C	→ 0.2	↑↑ 1.2

Site code	Latest MCI (2022/23)	Median MCI (3-yr)	n (3-yr)	MCI class	PNRP objective	State	Raw trends	
							10 yr	15 yr
RS53	140	99	3	C	Not meeting	C	→ 0.2	↑ 0.8
RS55	131	117	3	B	Not meeting	B	↑↑ 1.2	→ 0.2
RS57	54	55	3	D	Not meeting	D	↑ 0.9	
RS58	101	101	3	C	Not meeting	C		
RS59	119	113	3	B	Meeting	B	↑ 1.1	↑↑ 1.3
RS60	92	92	3	C	Not meeting	C		
RS61	130	138	3	A	Meeting	A		
RS62	127	139	3	A	Meeting	A		

Table A2.22: **Quantitative and standard macroinvertebrate community index (QMCI & MCI)** results for the period 2018/19 to 2022/23 benchmarked against National Objectives Framework (NOF) guidelines.

Site code	State	n	Median MCI (5-yr)	Median QMCI (5-yr)
RS02	D	5	89	4.5
RS04	D	5	78	5.1
RS05	B	5	127	7.3
RS06	B	5	124	6.5
RS07	D	5	65	4.1
RS10	B	5	115	6.0
RS13	C	5	107	5.0
RS14	D	5	104	2.9
RS15	C	5	102	5.7
RS16	C	5	94	4.5
RS17	C	5	110	4.7
RS18	D	5	91	3.1
RS19	D	5	92	3.5
RS20	A	5	131	7.9
RS21	B	5	112	6.8
RS22	C	5	114	5.1
RS23	B	5	123	7.0
RS24	B	5	119	6.4
RS25	A	5	135	8.0
RS26	A	5	131	6.9
RS28	A	5	133	7.3
RS29	C	5	103	5.4
RS31	A	5	140	8.1
RS32	B	5	124	7.4
RS33	C	5	102	6.2
RS34	C	5	100	6.2
RS37	D	5	97	4.3
RS38	C	5	96	4.5
RS39	D	5	61	2.4

Site code	State	n	Median MCI (5-yr)	Median QMCI (5-yr)
RS41	B	5	119	5.8
RS42	D	4	82	2.4
RS45	C	5	101	4.6
RS46	D	5	90	4.4
RS48	C	5	109	7.1
RS50	C	5	109	5.5
RS51	C	5	95	5.7
RS53	C	5	99	6.1
RS55	B	5	117	6.9
RS57	D	5	68	2.8
RS58	C	5	105	6.9
RS59	B	5	113	5.7
RS60	C	5	92	6.5
RS61	A	5	136	7.9
RS62	A	5	139	7.9

Table A2.23: **Average score per metric (ASPM)** results for the period 2018/19 to 2022/23 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	A	5	0.6
RS13	A	5	0.6
RS14	B	5	0.4
RS15	B	5	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	A	5	0.6
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	0.5
RS41	B	5	0.5
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	B	5	0.4
RS53	C	5	0.3
RS55	A	5	0.6
RS57	D	5	0.1
RS58	B	5	0.5
RS59	B	5	0.4
RS60	B	5	0.5
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 2020/21 to 2022/23.

Site code	Substrate	n	Median %	Median count
RS02	Soft	3	35.7	5
RS04	Soft	3	25.0	4
RS05	Hard	3	57.1	11
RS06	Hard	3	54.6	12
RS07	Soft	3	10.5	2
RS10	Hard	3	47.1	15
RS13	Hard	3	50.0	13
RS14	Soft	3	34.4	12
RS15	Hard	3	44.0	10
RS16	Hard	3	36.7	10
RS17	Hard	3	47.6	10
RS18	Hard	3	30.4	7
RS19	Hard	3	31.0	9
RS20	Hard	3	62.5	15
RS21	Hard	3	54.5	12
RS22	Hard	3	47.4	9
RS23	Hard	3	59.3	16
RS24	Hard	3	48.6	12
RS25	Hard	3	68.2	15
RS26	Hard	3	63.6	15

Site code	Substrate	n	Median %	Median count
RS29	Hard	3	42.3	11
RS31	Hard	3	70.0	10
RS32	Hard	3	53.3	9
RS33	Hard	3	50.0	7
RS34	Hard	3	35.3	6
RS37	Hard	3	33.3	6
RS38	Hard	3	40.9	9
RS39	Soft	3	12.5	3
RS40	Hard	3	41.7	10
RS41	Hard	3	53.3	8
RS42	Soft	2	15.9	2
RS45	Hard	3	34.8	7
RS46	Hard	3	31.3	6
RS48	Hard	3	38.5	9
RS50	Hard	3	45.5	10
RS51	Hard	3	30.4	7
RS53	Hard	3	33.3	5
RS55	Hard	3	52.4	11
RS57	Soft	3	6.7	1
RS58	Hard	3	35.3	6
RS59	Hard	3	50.0	11
RS60	Hard	3	41.7	7
RS61	Hard	3	60.5	16
RS62	Hard	3	66.7	13

Periphyton & Cyanobacteria

Table A2.25: **Periphyton biomass (Chlorophyll a mg/m^2)** results for the period 2020/21 to 2022/23 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	48	0
RS10	Default (8%)	B	36	4	103	0
RS13	Default (8%)	C	36	30	255	1
RS16	Default (8%)	B	36	8	128	0
RS19	Default (8%)	C	36	28	213	1
RS22	Default (8%)	A	36	2	160	0
RS24	Default (8%)	C	36	36	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	64	322	3
RS46	Default (8%)	D	36	35	429	3
RS48	Default (8%)	A	36	3	160	0
RS50	Default (8%)	D	36	49	359	3
RS51	Productive (17%)	D	36	101	520	8
RS53	Default (8%)	A	10	6	35	0
RS58	Default (8%)	B	36	11	302	1
RS60	Default (8%)	A	4	3	5	0

Table A2.26: **Periphyton weighted composite cover (WCC)** results for the period 2020/21 to 2022/23 benchmarked against a GWRC periphyton nuisance guideline of 30%.

Site code	n	Max WCC (%)	n ≥ 30%
RS05	36	9.8	0
RS06	36	46.8	2
RS10	36	61.8	1
RS13	36	78.3	5
RS15	36	32.0	1
RS16	36	76.3	2
RS17	36	21.3	0
RS18	36	30.9	1
RS19	36	41.7	3
RS20	36	5.0	0
RS21	36	65.3	1
RS22	36	82.5	3
RS23	36	26.8	0

Site code	n	Max WCC (%)	n ≥ 30%
RS25	36	41.6	1
RS26	36	20.0	0
RS28	36	16.1	0
RS29	36	27.4	0
RS31	36	8.3	0
RS32	36	12.9	0
RS33	36	73.5	2
RS34	36	29.6	0
RS37	36	31.3	1
RS38	36	60.8	9
RS40	36	87.5	2
RS41	36	31.9	1
RS45	34	11.4	0
RS46	36	54.0	4
RS48	36	41.5	1
RS50	36	93.1	5
RS51	36	88.0	17
RS53	36	97.3	11
RS55	36	49.9	2
RS58	36	50.8	4
RS59	36	37.0	3
RS60	35	47.8	4
RS61	37	1.1	0
RS62	36	5.8	0

Table A2.27: **Cyanobacteria mats (% coverage)** results for the period 2020/21 to 2022/23.

Site code	n	Max cover (%)	n 20-50%	n >50%
RS02	36	0.0	0	0
RS04	36	0.0	0	0
RS05	36	3.6	0	0
RS06	36	6.0	0	0
RS07	36	0.0	0	0
RS10	36	13.3	0	0
RS13	36	3.1	0	0
RS14	36	0.0	0	0
RS15	36	0.0	0	0
RS16	36	0.0	0	0
RS17	36	0.5	0	0
RS18	36	0.8	0	0
RS19	36	10.5	0	0
RS20	36	3.8	0	0
RS21	36	40.5	4	0
RS22	36	25.3	1	0
RS23	36	7.5	0	0
RS24	38	7.5	0	0

Site code	n	Max cover (%)	n 20-50%	n >50%
RS25	36	10.8	0	0
RS26	36	11.3	0	0
RS28	36	1.3	0	0
RS29	36	31.8	1	0
RS31	36	1.6	0	0
RS32	36	0.5	0	0
RS33	36	19.3	0	0
RS34	36	25.5	1	0
RS37	36	0.0	0	0
RS38	36	21.8	1	0
RS39	36	0.0	0	0
RS40	36	33.5	3	0
RS41	36	0.5	0	0
RS42	35	0.0	0	0
RS45	34	0.0	0	0
RS46	36	0.3	0	0
RS48	36	11.0	0	0
RS50	36	6.8	0	0
RS51	36	30.7	1	0
RS53	36	0.0	0	0
RS55	36	0.0	0	0
RS57	36	0.0	0	0
RS58	36	9.5	0	0
RS59	36	0.0	0	0
RS60	35	0.0	0	0
RS61	37	0.8	0	0
RS62	36	0.8	0	0

Habitat quality

Table A2.28: **Habitat quality** results for 2022/23. 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	63.0	1.0	6.0	1.0	8.0	8.0	2.0	9.0	8.0	10.0	10.0
RS04	52.0	1.0	8.0	1.0	10.0	9.0	1.0	7.0	3.0	6.0	6.0
RS05	88.0	10.0	9.0	9.0	8.0	9.0	10.0	10.0	8.0	10.0	5.0
RS06	80.0	8.0	9.0	8.0	7.0	9.0	10.0	10.0	7.0	10.0	2.0
RS07	41.0	1.0	2.0	1.0	4.0	9.0	1.0	9.0	3.0	7.0	4.0
RS10	86.0	9.0	10.0	9.0	10.0	9.0	8.0	10.0	6.0	10.0	5.0
RS13	73.5	9.0	9.0	9.0	6.0	9.0	8.0	8.0	2.0	9.5	4.0
RS14	68.5	1.0	8.0	2.0	10.0	9.0	4.0	9.5	6.0	10.0	9.0
RS15	67.0	7.0	6.0	5.0	8.0	7.0	6.0	8.0	6.0	9.0	5.0
RS16	50.0	8.0	5.0	3.0	4.0	5.0	3.0	9.0	2.0	9.0	2.0
RS17	62.0	1.0	6.0	3.0	10.0	9.0	2.0	9.0	6.0	9.0	7.0
RS18	74.5	9.0	8.0	6.0	8.0	8.0	6.0	9.5	8.0	7.0	5.0
RS19	68.5	7.0	6.0	3.0	6.0	5.0	6.0	7.5	9.0	10.0	9.0
RS20	84.5	10.0	10.0	10.0	5.0	10.0	10.0	7.5	8.0	10.0	4.0
RS21	69.5	8.0	8.0	8.0	10.0	8.0	3.0	9.5	3.0	10.0	2.0
RS22	74.5	9.0	10.0	8.0	9.0	9.0	7.0	6.0	5.0	9.5	2.0
RS23	80.5	9.0	9.0	9.0	8.0	9.0	7.0	10.0	7.0	7.5	5.0
RS24	70.0	9.0	6.0	6.0	8.0	5.0	7.0	10.0	5.0	9.0	5.0
RS25	94.5	8.0	10.0	9.0	10.0	10.0	10.0	10.0	10.0	9.5	8.0
RS26	93.0	8.0	10.0	9.0	10.0	9.0	10.0	10.0	10.0	10.0	7.0
RS28	96.0	9.0	10.0	9.0	10.0	9.0	10.0	10.0	10.0	10.0	9.0
RS29	72.0	9.0	10.0	4.0	8.0	8.0	6.0	9.0	5.0	10.0	3.0
RS31	89.0	10.0	10.0	10.0	7.0	8.0	10.0	10.0	10.0	10.0	4.0
RS32	70.0	9.0	8.0	4.0	8.0	6.0	7.0	8.5	7.0	7.5	5.0
RS33	75.0	9.0	9.0	5.0	9.0	8.0	8.0	9.0	5.0	10.0	3.0
RS34	54.5	9.0	5.0	5.0	6.0	5.0	3.0	6.0	3.0	9.5	3.0
RS37	44.5	7.0	6.0	1.0	7.0	5.0	7.0	5.5	2.0	1.0	3.0
RS38	61.0	9.0	9.0	2.0	8.0	5.0	9.0	5.0	5.0	5.0	4.0
RS39	51.0	3.0	8.0	1.0	6.0	5.0	7.0	4.0	4.0	7.0	6.0
RS40	66.0	9.0	10.0	6.0	9.0	0.0	8.0	8.0	4.0	10.0	2.0
RS41	63.5	7.0	8.0	8.0	6.0	5.0	9.0	5.5	4.0	10.0	1.0
RS45	77.0	9.0	10.0	1.0	8.0	7.0	2.0	10.0	10.0	10.0	10.0
RS46	58.0	8.0	8.0	4.0	4.0	4.0	7.0	8.0	3.0	4.0	8.0
RS48	70.5	10.0	9.0	3.0	6.0	8.0	8.0	7.0	7.0	9.5	3.0
RS50	55.5	9.0	6.0	1.0	7.0	5.0	3.0	6.5	4.0	10.0	4.0
RS51	63.5	8.0	8.0	6.0	7.0	3.0	8.0	7.5	5.0	9.0	2.0
RS53	50.0	7.0	6.0	1.0	4.0	4.0	4.0	6.5	5.0	9.5	3.0
RS55	71.5	7.0	8.0	7.0	8.0	5.0	7.0	10.0	6.0	9.5	4.0

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
RS57	47.0	1.0	6.0	1.0	6.0	9.0	1.0	9.0	2.0	8.0	4.0
RS58	56.5	9.0	6.0	4.0	6.0	4.0	3.0	7.5	6.0	9.0	2.0
RS59	69.0	7.0	9.0	4.0	9.0	8.0	8.0	8.0	6.0	4.0	6.0
RS60	73.0	9.0	9.0	5.0	9.0	8.0	9.0	6.0	6.0	9.0	3.0
RS61	98.5	9.0	10.0	10.0	10.0	10.0	10.0	9.5	10.0	10.0	10.0
RS62	86.0	10.0	10.0	7.0	9.0	9.0	10.0	10.0	9.0	10.0	2.0