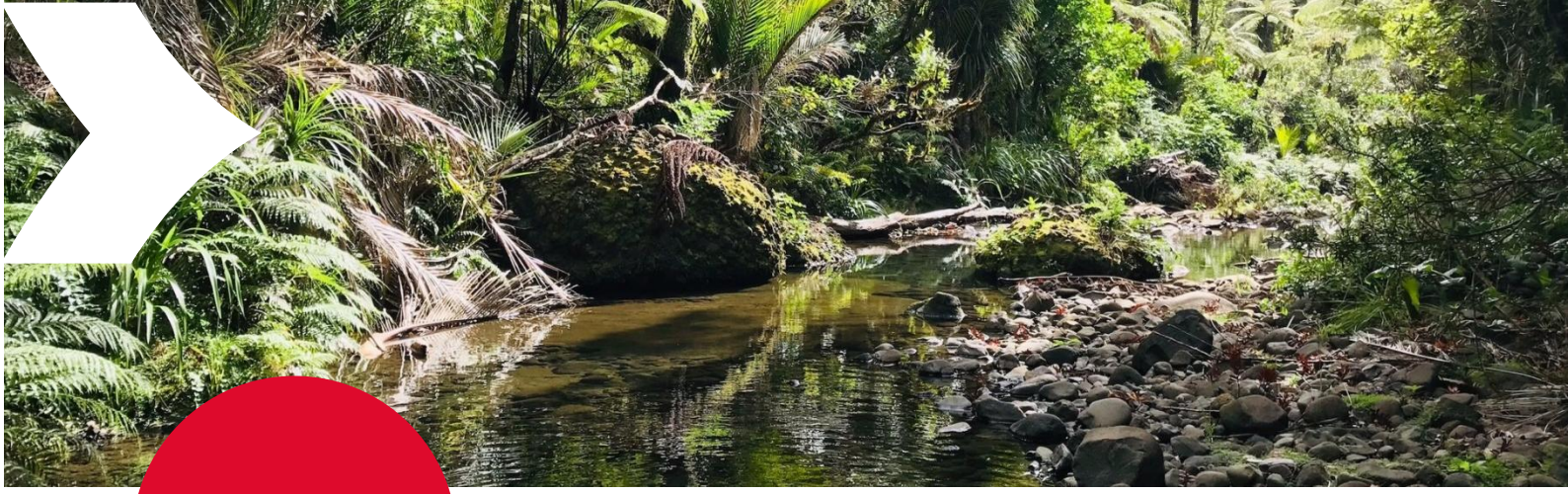

2024

River Water Quality in Tāmaki Makaurau: Annual Data Summary

Auckland Council's online interactive Water Quality and River Ecology Data Explorer presents State of the Environment (SoE) monitoring data for rivers, lakes, groundwater and the coast. River water quality can be compared across the region, by season, and over time.[1]

This report provides a summary of **river water quality** monitoring results for **July 2019 to June 2024**.

Key findings

Land use impacts stream health

- Water quality was generally poorest in urban streams and best in native forest streams.
- Streams within native forest catchments had smaller fluctuations in temperature, pH, and dissolved oxygen levels and lower concentrations of nutrients and faecal indicator bacteria compared with other streams, and metal contaminants were rarely detected.
- Variation in turbidity and suspended solids concentrations between sites was better explained by biophysical units based on climate and geology than by land cover classes.

Water quality varies with seasons

- There were clear seasonal patterns in several water quality measures though these patterns can vary between locations and peak concentrations may occur in different seasons. For example, dissolved forms of nitrogen were higher in winter than in summer at most, but not all sites, where higher concentrations were measured in spring.

Some issues are localised or site specific

- There were specific issues at some sites and in some areas such as continued high nitrate concentrations in rural streams around Pukekohe; indications of wastewater contamination in Newmarket Stream and Botany Creek (East) with high nutrients and bacteria; continued high ammonia concentrations in Pakuranga Stream.

[1] This does not include the detailed statistical analysis that is required to assess trends in water quality over time and is reported in our five-yearly State of the Environment reports.

Our river water quality monitoring programme

Where	When	How	What
•37 water quality sites. •Monitoring networks are broadly representative of a range of river and catchment sizes, biophysical classes, and dominant land cover pressures across the region.	•Monthly, undertaken in groups of sites over a two week period. •Each site sampled at approximately the same time of day each month.	•Water quality measures directly in stream using a hand held meter. •Bottles of stream water collected and sent for laboratory analysis.	•Different measures of water quality including physical factors, nutrients, bacteria, sediments and water clarity, and metals.

See the '[Water Quality and River Ecology Data Explorer Methodology]' report for more information on the water quality parameters we monitor, how we collect and analyse samples, how we analysed the data, and how to use the data explorer.

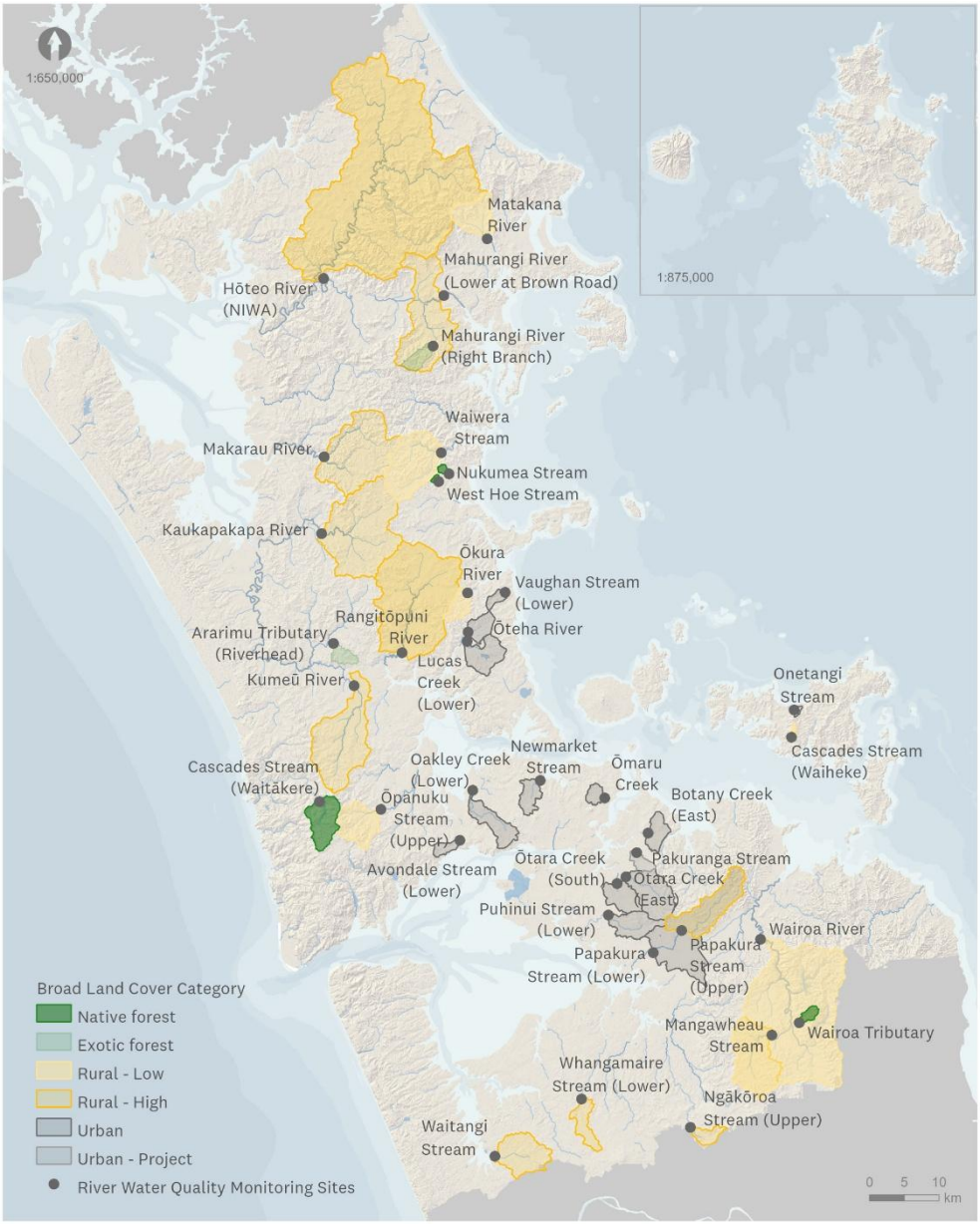

Figure 1: Land cover category, catchment boundary and location of river water quality sites monitored around the region from 2019 to 2024.

Sediment and Turbidity

Total suspended solids (TSS) measure the weight of solids in the water column, which can come from sediment and organic matter. Turbidity is an index of water cloudiness, or how suspended solids in the water column scatter light. Turbidity in rivers is measured in two complementary ways: in the field (FNU) and in the laboratory (NTU). Field measurements are more precise, but we have a longer historical record of laboratory analysis, as field measurements started in 2015. Storm events can trigger soil erosion and landslides, adding sediment into streams, leading to higher TSS and turbidity levels. Spikes in TSS & turbidity were observed at some (but not all) locations after the extreme weather events in 2023, though these spikes were not above the range previously measured.

Among rural sites, median turbidity (FNU) ranged from 1.8 FNU in Waitangi Stream to 12.8 FNU in Ōkura River, while median TSS concentrations ranged from 1 mg/L to 7.4 mg/L. Urban sites varied over similar ranges.

Biophysical units based on climate and geology provide better insights to describe variation in turbidity and TSS than land cover classes. Streams with the highest median turbidity and TSS typically had soft-sediment stream beds (denoted SS in the data explorer), whereas those underlain by volcanic-acidic (VA) geology in the wider Pukekohe area, and Cascades Stream (Waitakere) were the clearest.

Ōkura River, Avondale Stream and Kumeu River had the highest median turbidity and TSS levels. The Ōkura and Kumeu River sites are located in catchments that have undergone extensive development over the past 5–10 years, which may have contributed to elevated turbidity and TSS levels.

Ōkura River also experienced multiple spikes in turbidity and TSS over the past five years that coincided with heavy rainfall events. Nearby streams—such as Lucas Creek, Ōteha River, and Vaughan Stream—have also shown turbidity and TSS spikes but to a lesser extent than the Ōkura River.

Nutrients

Nitrogen and phosphorus are essential nutrients that influence ecosystem functions in streams. High concentrations of nutrients can change the growth and composition of algae and plants, which can have further impacts on macroinvertebrate and fish communities and other measures of water quality like dissolved oxygen levels. Dissolved forms of nutrients (dissolved inorganic nitrogen, DIN and dissolved reactive phosphorus, DRP) are particularly important as they can be more readily taken up by plants.

The highest concentrations of dissolved inorganic nitrogen (DIN) were found in the three monitored streams in the Pukekohe area, with the highest concentrations observed at Whangamaire Stream. The median DIN concentration at these sites exceeded 2 mg/L, with most of the nitrogen being in the form of nitrate. Nitrate is also high in the groundwater in this area of Auckland.[2] Median DIN concentrations in other rural streams were less than 0.5 mg/L. Concentrations were even lower at reference streams (<0.07 mg/L). Some urban catchments also showed higher median DIN concentrations (ranging from 0.05 to 1.5 mg/L). DIN concentrations were typically higher in winter at most sites.

A higher proportion of DIN was in the form of ammoniacal nitrogen at Pakuranga Creek. Investigations in this catchment have identified a point source discharge to the stream, connected to the Greenmount landfill. This site has been identified in the data explorer as an ongoing ‘project site’ due to this unique management issue.

Dissolved reactive phosphorus concentrations were highly variable across the region, with median concentrations ranging from 0.003 to 0.03 mg/L in rural and urban streams. Newmarket Stream had a median concentration double that recorded at other urban streams (0.08 mg/L). DRP concentrations were lower at the three streams in the wider Pukekohe area than other rural streams.

[2] See data explorer or groundwater annual report: Buckthought, L. (2025) Groundwater quality in Tāmaki Makaurau: Annual data summary 2024. Auckland Council.

DRP concentrations were notably higher at Wairoa Tributary than at other reference native forest sites. There were no clear seasonal patterns in DRP across the region.

Several outlier events of high DIN and DRP were also observed at Newmarket Stream, Botany Creek (East), Avondale Stream, and Ōkura River. The greatest outlier events recorded at Newmarket Stream and Botany Creek were associated with wastewater contamination observed at the time of sampling. Elevated nutrient conditions persisted over September 2021 to January 2022 at Avondale Stream and over February to May 2024 at Ōkura River. No visible signs of pollution were observed, and the cause of these issues was not identified.

Physico-chemical results

Water temperature, dissolved oxygen and other physico-chemical water quality parameters vary over daily, seasonal, and annual cycles.[3] Peak temperatures, and the lowest dissolved oxygen levels, may not be recorded by monthly monitoring.

Temperature and dissolved oxygen within a site were generally more stable at native forest sites with larger fluctuations over time in rural and urban streams. For example, at native forest sites, the difference between the lowest and highest dissolved oxygen levels was no more than 3 mg/L. In contrast, urban sites varied by up to 10 mg/L. The highest temperature at a native forest site was 20.4°C, while at an urban site (Botany Creek (East)), it exceeded 30°C. Botany Creek flows through a shallow, unshaded concrete channel. Median summer temperatures at this site were almost 5°C higher than the next warmest urban stream. Very high dissolved oxygen levels were also observed at Botany Creek. These are likely linked to photosynthesis (producing oxygen) by the dense periphyton (algae) mats that cover the channel's shallow waters. As photosynthesis switches to respiration (consuming oxygen), it is possible that hypoxic (low oxygen) conditions could occur overnight at this location.

Hypoxic conditions (<2 mg/L) were observed on some occasions across five rural streams and one urban stream. The lowest dissolved oxygen levels were typically recorded in summer but also occurred in autumn, particularly in larger waterbodies, such as the Hōteo and Rangitōpuni Rivers.

pH indicates how acidic or alkaline the water is. It can affect the health of aquatic life and the solubility of certain contaminants. Median pH levels across all streams ranged from 6.8 to 7.7 pH units except for Ararimu Tributary (Riverhead) which had more acidic water (median pH 6.6). pH at any single site typically varied by less than 0.5 pH units between the 25th to 75th percentiles (within the box). However, outliers (both higher and lower) were common at most sites. The greatest variability in pH over time was observed at urban streams, particularly Botany Creek (East) and Ōtara Creek (South).

Native forest streams and streams in the Wairoa catchment had soft water.[4] Most rural streams had soft to moderately hard water, and most urban streams had moderately hard to hard water. Pakuranga Creek had hard to very hard water.

Dissolved organic carbon (DOC) is a form of organic matter in streams that provides food for aquatic life. It can affect light, colour, and water clarity in streams and the bioavailability of metal contaminants. Median DOC levels were <1.6 mg/L in native forest reference streams, while median concentrations ranged from 2.2 to 7.2 mg/L in urban and rural streams. The three streams monitored in the Pukekohe area had lower DOC compared to other rural streams. Two extreme outliers were recorded at Pakuranga Stream with values >40 mg/L. Both of these outliers coincided with observed pollution events where the water appeared cloudy and foamy, and a detergent-like smell was noted.

[3] Continuous monitoring of dissolved oxygen and temperature is undertaken at a subset of locations to further understand diurnal and seasonal patterns. For further information see Casanovas, P., E. Goodwin, J. Schattschneider, J. Kamke, C. Grant, R. Ingley, S. Fraser, R. Young (2022). Dissolved oxygen and ecosystem metabolism in Auckland rivers 2004-2020. State of the environment reporting. Auckland Council technical report, TR2022/18. Prepared by the Cawthron Institute for Auckland Council.

[4] Soft (<60 mg/L CaCO), Moderate (60-119 mg/L CaCO3), Hard (120-179 mg/L CaCO3), Very Hard (180-240 mg/L CaCO3) (ANZECC 2000)

Metals

The dissolved or soluble fraction of metals more closely represents the bioavailable portion that may be taken up by plants and animals in rivers. However, water chemistry factors like pH, hardness and organic matter can also influence how readily metals are taken up.

Both copper and zinc were typically undetectable at native forest reference sites except for Cascades Stream (Waitākere) which had slightly higher copper concentrations.

Soluble metal concentrations, particularly zinc, were generally higher in urban streams than rural streams. Concentrations of zinc also tended to be higher in winter. The highest concentrations of metals were observed at Newmarket Stream where median concentrations of soluble copper and zinc were approximately double those found at most urban streams except for Ōmaru Creek. Ōmaru Creek also had notably higher soluble zinc levels than other urban streams.

For the rural streams, particularly low levels were found in the three streams in the wider Pukekohe area. A high proportion of samples from these sites were below the limit of detection. Zinc concentrations were notably higher at Ararimu Tributary (Riverhead forest) than all other rural, exotic forest, or native forested streams. There were seasonal patterns observed at this site with higher zinc concentrations in winter to spring and lowest in autumn. The reasons for this are unknown.

E. coli

Escherichia coli bacteria indicate possible faecal contamination from humans and animals.

At native forest reference stream sites, median *E. coli* levels were typically less than 50 cfu/100 ml. *E. coli* levels were also typically in this range for the streams on Waiheke Island despite influences from rural and urban land uses. In most rural streams, median *E. coli* concentrations were more than 50 cfu/100 ml but less than 1000 cfu/100 ml, while in urban streams median concentrations typically exceeded this upper level.

The highest *E. coli* levels recorded in urban and rural streams were commonly >10,000 cfu/100 mL. At some sites, *E. coli* levels were an order of magnitude greater, coinciding with wastewater contamination events. Newmarket Stream showed higher *E.coli* levels compared to other urban streams . Botany Creek (East) had the second highest median level of *E. coli* and the highest outlier levels recorded (coinciding with observed wastewater overflows). *E. coli* levels tended to be the highest in spring across rural streams.

Overall, these results are consistent with known issues of elevated *E. coli* levels across the region. Further investigations were initiated in 2024 by Auckland Council's Environmental Evaluation and Monitoring Unit to track the sources of *E. coli* within selected streams. Identifying whether the sources of *E. coli* are dominated by human inputs, livestock, or other animals such as ducks can help to inform management actions.

Disclaimer

Find out more:

Visit the Data Explorer: https://environmentauckland.org.nz/Data/Dashboard/456

Read the methodology report: https://www.knowledgeauckland.org.nz/publications/water-quality-and-river-ecology-data-explorer-methodology-supplementary-report/

For more information and data, contact: EnvironmentalData@aucklandcouncil.govt.nz

This report can be cited as: Ingley, R., N. Dikareva (2025) River water quality in Tāmaki Makaurau: Annual data summary 2024. Auckland Council.

Auckland Council
Te Kaunihera o Tāmaki Makaurau