2024

River Ecology 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 ecology metrics can be compared across the region and over time[1].

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

Key findings

Land use impacts stream ecological health

- Stream ecological health was generally poorest in urban streams and best in streams within catchments dominated by either exotic or native forest.
- The macroinvertebrate communities within forested streams were dominated by pollution-sensitive taxa, indicating high water quality.
- Urban streams contained mainly pollution-tolerant macroinvertebrates due to poor water and habitat quality. This is reflected in their lower scores.

The majority of monitoring sites had either 'excellent' or 'good' SEV scores

- Sixty-eight percent of sites had median Stream Ecological Valuation (SEV) scores that placed them within either the 'excellent' or 'good' categories for ecological value. This compares to 44% of sites for the MCI metric and 39% for QMCI, reflecting differences in the attributes measured.

Urban streams had the worst overall ecological quality

- Nine of the 10 worst-ranked sites across all ecological metrics were located in urban catchments, with Tararata Creek, a soft-bottomed urban site located in Māngere, ranking as the worst overall.

[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 ecology monitoring programme

Where	When	How	What
•68 river ecology sites throughout the Auckland Region.[2] •Sites are broadly representative of a range of river and catchment sizes, biophysical classes, and dominant land cover pressures across the region.	•Annually during the summer sampling season (Nov-Apr) for macroinvertebrate sampling. •Every 2-3 years for SEV assessments.	•Sampling stream macroinvertebrates using standardised kick- and sweep-netting methods. •Recording physical and biological parameters within the stream channel and riparian zone for SEV assessments.	•Four metrics derived from counting the number and type of macroinvertebrates found in at each site. •An SEV score that represents the overall ecological value of each site.

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.

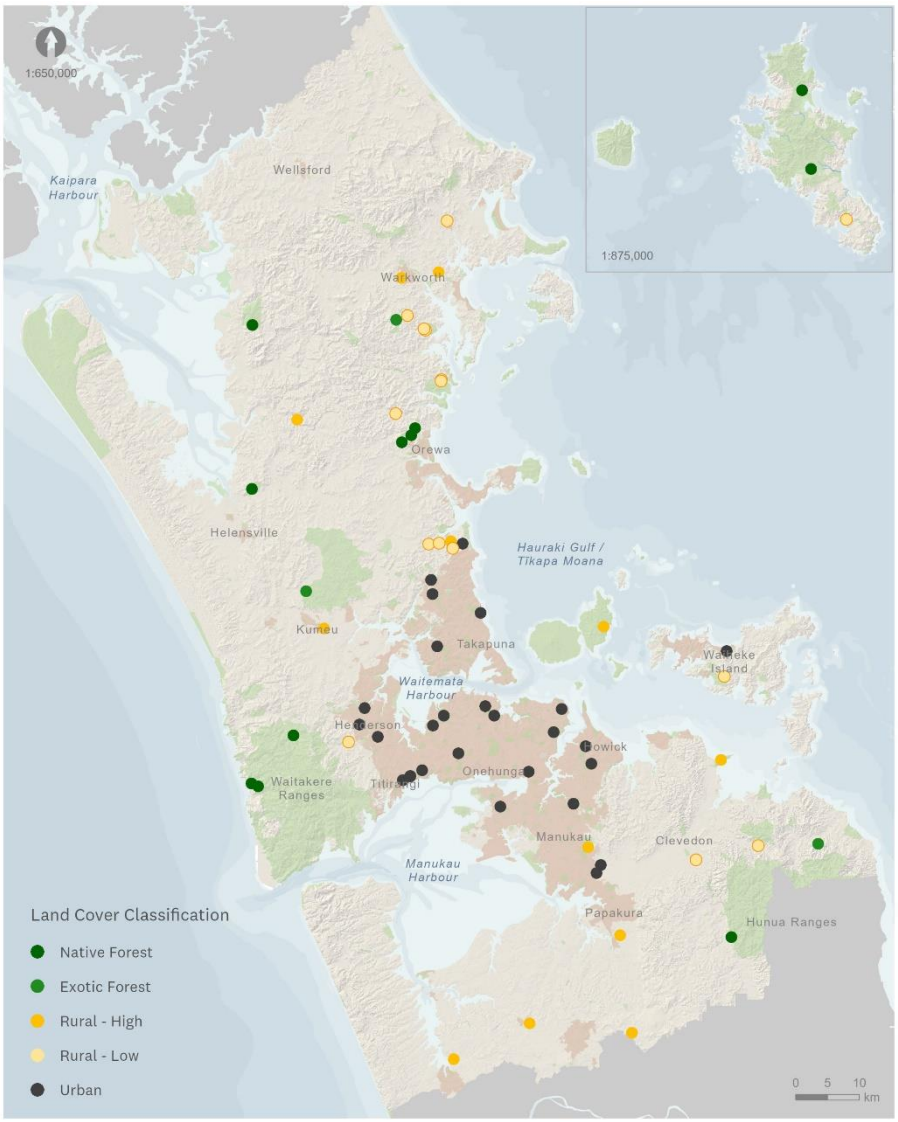

Figure 1: Land cover classification and location of sites monitored around the region from 2019 to 2024.

[2] There are currently a total of 68 river ecology sites in Auckland Council's SoE monitoring network. Not all of these sites have yet generated sufficiently large datasets for reporting purposes, hence the discrepancy between this number and the number of sites reported on for the macroinvertebrate metrics (n=59) and SEV assessments (n=62).

Macroinvertebrate Community Index (MCI)

The Macroinvertebrate Community Index (MCI) uses macroinvertebrates (aquatic insects) as bioindicators of water and habitat quality, as they are present in all freshwater environments, can be easily sampled, and exhibit a range of sensitivities to pollution.

Each macroinvertebrate taxon is assigned a score depending on how pollution-tolerant they are, with the MCI calculated based on the average tolerance score of all taxa found at a site. Sites with a high proportion of pollution-tolerant taxa have lower MCI scores, indicating poor water quality, while those with high MCI scores generally have better water quality and in-stream habitat.

MCI scores can range from 0 to 200, although in practice it is uncommon to find scores greater than 150 or less than 50. MCI scores can be interpreted using the quality classes shown in Table 1, which give a general overview of the ecological conditions at the site.

Table 1: Interpretation of Macroinvertebrate Community Index (MCI) scores (Stark & Maxted 2007)[3]

MCI score	Quality Class	Description
>119	Excellent	River in excellent ecological condition. Indicative of excellent water quality and habitat conditions.
100-119	Good	River in good ecological condition. Indicative of possible mild pollution and/or good habitat conditions.
80-99	Fair	River in fair ecological condition. Indicative of probable mild pollution and/or fair habitat conditions.
<80	Poor	River in poor ecological condition. Indicative of probable severe pollution and/or poor habitat conditions.

MCI scores ranged from a low of 37 at Ōtara Creek (East), an urban site[4], to a high of 141 at Ōrere Tributary, which is in an exotic forestry catchment[5].

The median MCI score across all sites was 84.5, which falls within the 'Fair' quality class.

The top 10 sites, ranked on their median MCI scores, were predominantly in native forest catchments, although one urban site (Onetangi Stream on Waiheke Island), one exotic forest site, and two rural – low[6] sites were also included. In contrast, nine of the 10 worst-ranked sites were in urban catchments, with the Kumeū River site, classed as rural-high[7], being the only exception.

Seventeen percent of sites (n=10) had median MCI scores that were classed as Excellent (MCI score >119), while 27% (n=16) were Good, 44% (n=26) were classed as Fair, and the remaining 12% (n=7) were assessed as having Poor water quality.

Quantitative Macroinvertebrate Community Index (QMCI)

The QMCI uses the same macroinvertebrate taxa scores as the MCI, with the difference being that this method involves counting the number of specimens in each taxon rather than the more basic presence/absence method used for the MCI. This means that the QMCI is potentially more sensitive than the MCI to subtle changes in water and habitat quality, as it uses the relative proportion of macroinvertebrate taxa in each sample to derive the overall score.

The MCI and QMCI are complementary metrics, with both scores being useful for characterising the water and habitat quality present at a site.

As with the MCI, QMCI scores can also be interpreted using general quality classes (Table 2). The scale of scores for the QMCI is different to those for the MCI, so that both metrics can easily be distinguished from each other.

[3] Stark, J.D. and Maxted, J.R. (2007). A user guide for the Macroinvertebrate Community Index. Prepared for the Ministry for the Environment, 58 p.

[4] A site with more than 7% urban land cover in the upstream catchment

[5] More than 80% exotic forest

[6] A site with more than 50% native or exotic forest in the upstream catchment.

[7] A site with less than 50% native or exotic forest in the upstream catchment.

Table 2: Interpretation of Quantitative Macroinvertebrate Community Index (QMCI) scores (Stark & Maxted 2007)[8]

QMCI score	Quality Class	Description
>5.99	Excellent	River in excellent ecological condition. Indicative of excellent water quality and habitat conditions.
5.00-5.99	Good	River in good ecological condition. Indicative of possible mild pollution and/or good habitat conditions.
4.00-4.99	Fair	River in fair ecological condition. Indicative of probable mild pollution and/or fair habitat conditions.
<4.00	Poor	River in poor ecological condition. Indicative of probable severe pollution and/or poor habitat conditions.

QMCI scores ranged from a low of 0.91 at Kumeū River, a rural-high site, to a high of 7.95 at Ōrere Tributary, an exotic forest site. The median score for all sites was 3.9, which falls within the 'Poor' quality class.

The top 10 sites, ranked on their median QMCI scores, were mainly in native forest (n=5) and exotic forest (n=2) catchments, although there were also two rural-low sites and one urban site (located at the Auckland Domain), completing the list. The 10 sites with the lowest median QMCI scores were in urban catchments, apart from Kumeū River which is classed as rural-high.

Overall, 39% of sites had median QMCI scores within either the Excellent or Good categories, with the majority (54%, n=32) being classed as Fair and four sites (7%) classified as Poor.

Stream Ecological Valuation (SEV)

The Stream Ecological Valuation (SEV) methodology involves collecting a range of data over a 100-metre-long stream reach, including measures of instream habitat quality and abundance, channel morphology, and riparian vegetation cover, to produce a score that represents the overall ecological value of the site.

SEV scores range from 0 to 1.00 and can be interpreted into general quality classes as per Table 3.

Table 3: Interpretation of Stream Ecological Valuation (SEV) scores (Chaffe, 2021)[9]

SEV score	Quality Class	Description
≥0.81	Excellent	River in excellent ecological condition. Indicative of ecological function and habitat conditions close to or at reference condition.
0.61-0.81	Good	River in good ecological condition. Indicative of good habitat conditions, few stream functions are impaired. Low deviation from reference state.
0.41-0.60	Fair	River in fair ecological condition. Indicative of fair habitat quality, some stream functions are impaired. Moderate deviation from reference state.
<0.40	Poor	River in poor ecological condition. Indicative of poor habitat condition, several stream functions are impaired. Substantial deviation from reference state.

A slightly different dataset was used for the SEV analysis compared to the rest of the ecology metrics. There were two sites where macroinvertebrate metrics were reported but no SEV assessments were undertaken between 2020 and 2024, and so these are not included here. There were also five sites where we undertook SEV assessments at least once during the 2020-2024 period, but where there was no sampling for the full suite of macroinvertebrate metrics. This resulted in a total of 62 sites within the SEV dataset for 2020-2024.

The highest SEV score recorded was 0.95 at Marawhara Stream, a native forest site, while the urban Newmarket Stream site had the lowest score of 0.26. The median SEV score across all sites was 0.59, which falls within the Fair quality class.

[8] Stark, J.D. and Maxted, J.R. (2007). A user guide for the Macroinvertebrate Community Index. Prepared for the Ministry for the Environment, 58.

[9] Chaffe, A. (2021). River ecology state and trends in Tāmaki Makaurau / Auckland 2010- 2019. State of the environment reporting. Auckland Council technical report, TR2021/05

Overall, 26% of sites (n=16) were in the Excellent category, 42% (n=26) were Good, 13% (n=8) were Fair, and 19% (n=12) were classed as Poor.

The top 10 sites, ranked on their median SEV scores, were predominantly in native forest catchments, with exotic forest and rural-low catchments each having one site represented. Of the 10 bottom-ranked sites, eight were urban sites and two were in catchments classified as rural-high land cover (Duck Creek and Kumeū River). Six of the bottom-ranked sites were within the Poor category, with the remainder classed as Fair.

SEV scores across all sites showed a similar pattern to the other ecology metrics, with sites in native forest catchments having the best habitat quality and urban sites showing the most ecological degradation.

%EPT taxa richness

EPT stands for Ephemeroptera, Plecoptera and Trichoptera, otherwise known as mayflies, stoneflies and caddisflies. These types of macroinvertebrates are generally highly sensitive to pollution, so a high proportion of EPT taxa is an indicator of good stream health.

The percentage of EPT taxa richness is calculated as a proportion of the number of EPT taxa to the total number of all taxa within the sample. Two caddisfly genera, *Oxyethira* and *Paroxyethira*, are excluded from this calculation as, unlike other EPT taxa, they are highly pollution-tolerant.

The highest %EPT taxa richness score recorded across all sites was 69% at Ōrere Tributary, while five sites recorded no EPT taxa at all. All five of these sites are located within heavily urbanised catchments, with the complete absence of pollution-sensitive EPT taxa indicating degraded water quality.

Average Score per Metric (ASPM)

The ASPM index incorporates the mean of three separate metrics – MCI, EPT taxa richness, and %EPT abundance – to produce an overall average score. Of the component metrics, EPT taxa richness is defined as being the number of EPT taxa recorded in a sample, while %EPT abundance is calculated from relative abundance data as the percentage of individual macroinvertebrates that belong to EPT taxa. Note that both of these metrics are calculated differently to %EPT taxa richness, as outlined above.

The highest ASPM score of 0.78 was recorded at Ōrere Tributary, which was also consistent with the highest MCI, QMCI and EPT% taxa richness scores recorded during this period. The lowest score of 0.06 was recorded at two sites within urban catchments, Tararata Creek and Ōtara Creek (East).

When ranked in order of median ASPM scores, six of the top 10 sites were in native forest, one was in exotic forest, and three were in rural-low catchments. For the bottom 10 sites, nine were in urban catchments and one was in a rural-high catchment. Overall, the findings from this score further demonstrate that streams in native forest have more diverse macroinvertebrate communities and more sensitive species. Urban catchments are more likely to have lower scores reflecting the absence of sensitive species and greater abundance of pollution tolerant species.

Site rankings

The subset of 57 sites that had the full suite of both macroinvertebrate and SEV data were each ranked according to their median scores for each of the five metrics (SEV, QMCI, MCI, ASPM, %EPT taxa richness). The sum of these rankings for each site were then sorted into descending order to give an overall ranking for all sites across all metrics.

From these rankings it was determined that Ōrere Tributary, a hard-bottomed site located in an exotic forest catchment, had the highest overall ecological quality, followed by Wairoa Tributary and Marawhara Stream, both of which are hard-bottomed sites in native forest catchments.

All seven native forest sites were ranked within the top 10 sites overall, with the remainder consisting of one exotic forest site, Ōrere Tributary, and two rural-low sites, Cascades Stream on Waiheke Island and Dyers Creek (Forest).

The worst-ranked site overall was Tararata Creek, preceded by Ōmaru Creek and Anns Creek. All three of these sites are soft-bottomed streams in urban catchments. Of the 10 worst-ranked sites overall, nine were in urban catchments, with one, Kumeū River, located in a rural-high catchment.

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

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