

WATERWAYS MONITORING REPORT 2022

Introduction

This section focuses on the continuation of the Water Quality Monitoring Framework (WQMF) in Waiutuutu/Okeover Stream, consistent with last year's report. This framework was created in 2018 to provide a standardized monitoring framework for tracking the health of waterways on campus, including several parameters that are important aspects of waterway health (Figure 1). As part of the framework, data collected by other groups has been collated to provide a picture of the streams' health prior to 2021, which is before standardised monitoring was conducted under this framework.

Stream flow

Stream flow is measured as the volume of water that flows through a stream every second, and is important for how it influences other aspects of water quality. Stream flow has been relatively consistent since 2021, ranging from 0.016 m³/s at the headwaters to 0.09 m³/s downstream behind the greenhouses. The slight increase in flow is likely due to fluctuations associated with air conditioning discharge into Okeover stream.

Temperature

Temperature controls a number of important aspects, including what can live in a stream and how fast things grow. Temperatures below 20°C are ideal, while Okeover has consistently remained at an average of 15°C since 2000.

Water Clarity and Turbidity

Turbidity describes how much suspended solids are in the water, which affects both visibility for aquatic animals and the visual appeal of the water. It is measured in NTUs, with water above 5 NTUs being just slightly cloudy. Turbidity continues to decrease since 2002, and now ranges 0.007 to 0.38 NTUs, which is very clear due to the source of flow from groundwater at the top of campus.

Chemistry | Dissolved oxygen

Oxygen is essential for fish, eels and insects to survive. Dissolved oxygen can be measured via what percentage of the water is oxygenated; typically, healthy systems contain at least 80%

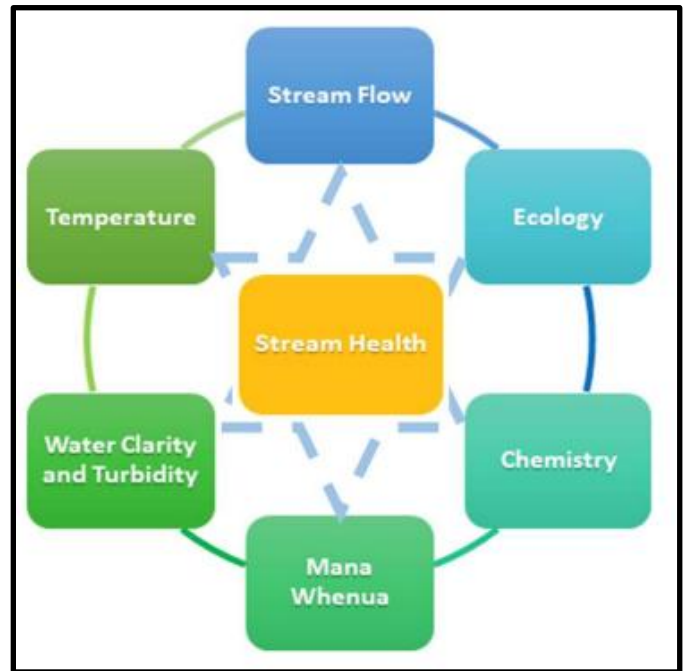


Figure 1: Stream health monitoring framework as proposed in a GEOG309 report (2021), by UC students J. Bird, J. McMecking, R. Painter, Z. Shadbolt, and Blake Woods.

dissolved oxygen. Dissolved oxygen continues to fluctuate between 76-90%, which is sufficient for aquatic life. However, it is worth noting these measurements taken during the day are higher due to photosynthesising plants and algae than oxygen levels at night.

Chemistry | Heavy metals

Urban streams are often polluted with heavy metals that runoff from surrounding roofs, roads and other impermeable surfaces. In high concentrations, heavy metals can impair the growth of and kill aquatic life. Previous sampling in 2009 revealed copper exceeded threshold value while lead and zinc were below threshold values. Samples collected in October 2021 and March 2022 revealed copper and aluminium exceeded levels that 80% of aquatic species can tolerate, while zinc exceeded levels that 95% of aquatic species can tolerate. Aluminium and zinc concentrations increased downstream, while copper was highest at the headwaters.

Ecology

A diverse range of insects and other invertebrates live in freshwater. Some of these are more sensitive to poor water quality than others, so identifying which insects are missing can be used to assess the water quality of the stream. The sensitivity of the invertebrates found in a stream is summarized by the Macroinvertebrate Community index (MCI). Based on this index, the water quality in Okeover has fluctuated between severe and moderate pollution (Figure 2). Results from 2022 monitoring continue to fail to meet the biodiversity target set in the 2019-2024 UC Biodiversity Plan, which aims to reach scores representative of mild pollution or above.

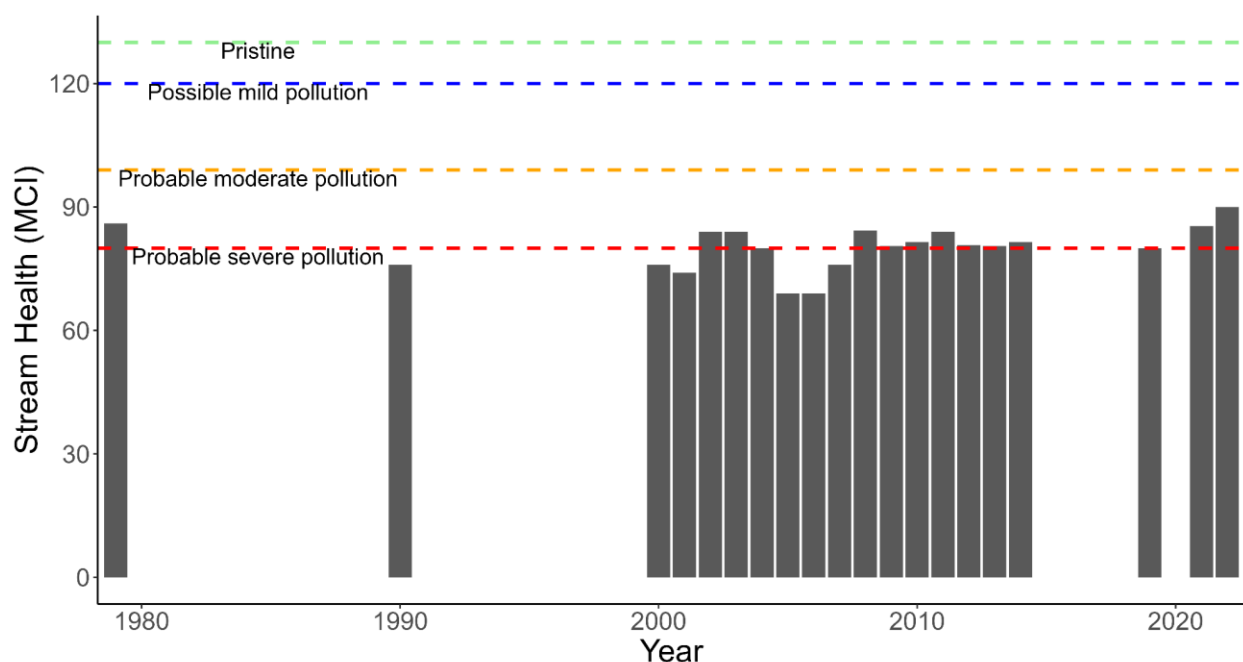


Figure 2: Average MCI scores taken across three sites in Okeover Stream, University of Canterbury, from 1979 to 2022. The red, orange, blue and green dashed lines represent threshold values for pollution categories (<90 = severe pollution, ≥90 and <110 = moderate pollution, ≥110 and <130 = mild pollution, ≥130 = pristine conditions) as outlined in the National Policy Statement for Freshwater Management (2020). Gaps between bars represent years where data was not available.

Summary

While water flow, temperature, dissolved oxygen and clarity are within acceptable values, the ecology of the Okeover still suggests severe to moderate pollution. Copper, aluminium and zinc exceed levels that are optimal for aquatic life, highlighting one area of stream health that needs further improvement. Stormwater samplers are currently being installed in the Okeover, which will enable us to monitor heavy metal levels following heavy rainfall events when contamination is most severe. This should help identify specific areas of campus that are contributing the most heavy metal contamination, and help focus any future work that reduces heavy metals. The continued development of the WQMF will provide a clear picture of waterway health over time to inform the sustainable management of our freshwater.