

Monitoring phosphorus in rivers

Phosphorus is an essential nutrient for the growth and development of plants and animals. It occurs naturally as phosphate bound to rocks and soil, and during weathering processes it is dissolved and released into water in a plant-available form (dissolved reactive phosphorus). While total phosphorus (TP) and dissolved reactive phosphorus (DRP) occur naturally in rivers, lakes and groundwater, higher than natural concentrations occur due to land use impacts and discharges.

Deforestation and erosion lead to sediment entering waterways, with phosphate bound to the sediment. Phosphorus is a key component of fertiliser, so can enter rivers and streams through leaching processes. Domestic wastewater and animal waste also contains phosphorus, so wastewater discharges can contribute to elevated instream phosphorus concentrations.

High phosphorus concentrations in waterways can cause eutrophication (excess nutrients). Eutrophication can lead to extensive growth of aquatic plants and algae, which can impact the ecological health, recreational, cultural and food-gathering values of the river.



Phosphorus can enter rivers as phosphate bound to sediment. Streambank erosion can therefore contribute to elevated phosphorus in rivers

How do we monitor phosphorus in waterways?

Phosphorus monitoring in rivers and streams involves taking water samples and sending them to a laboratory for testing. For information on how to collect, store and transport river water samples for analysis in a laboratory, see the relevant National Environmental Monitoring Standard¹.

EMERGING TECHNOLOGIES

Unfortunately, at the moment, there are no sensors suitable to monitor phosphorus at the concentrations typically present in New Zealand rivers. However, this is an area of developing technology and high-frequency phosphorus sensors may be available in the future.

At some locations, a correlation between instream turbidity and TP exists. This can potentially be used to estimate TP concentrations, where turbidity is monitored at a high frequency using a sensor (see the Monitoring water clarity and turbidity in rivers factsheet). Analysis of TP and turbidity in samples taken under a range of conditions (flow, season, temperature, etc.) would first be required to establish a statistical relationship between the two indicators.



¹ National Environmental Monitoring Standards - Water Quality Part 2 of 4: Sampling, Measuring, Processing and Archiving of Discrete River Water Quality Data. Available from <https://nems.org.nz/documents/>

How much will it cost?

The cost of carrying out a phosphorus monitoring programme at a river site will depend on how often samples are collected, the location of the monitoring site and laboratory charges for analysing the samples. Some approximate costs for a single sampling occasion, based on average results from a survey of regional councils and commercial laboratories in New Zealand in 2022, are shown in the table (excluding the cost of purchasing a vehicle). Using these estimates, monthly monitoring of TP and DRP will cost about \$2,700 per year.

For more information on the cost of running a phosphorus monitoring programme, see the [Monitoring](#)

Costs document on the [Monitoring Freshwater Improvements](#) website.

	Cost per sampling occasion
Laboratory testing	\$25 for TP \$20 for DRP
Staff time – sampling and subsequent data processing	\$140
Operational costs – mileage* and consumables (courier charges, ice)	\$40
Total per sampling occasion	\$225

**Based on regional council estimates of average distance to a monitoring site. In addition to these operational costs, some equipment may need to be purchased.*

Elevated phosphorus in rivers can lead to extensive growth of aquatic plants and algae.



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