Nutrient Inputs

Algal growth in the Rotorua lakes is dependent on a variety of essential elements, called nutrients. The two most common nutrients are nitrogen and phosphorus. These nutrients can be dissolved (soluble), solid (insoluble), or found in organic matter.

Nitrogen and phosphorus need to be dissolved in a water body, like a lake or stream, before algae can use them. Most nitrogen and phosphorus in a lake is not dissolved but is found in solid particles and organic matter. As this material begins to break down the nutrients dissolve.

Sometimes algal growth can be slowed down or stopped when a nutrient becomes completely used up. In Lake Rotorua this can happen to both nitrogen and phosphorus at different times.

Nitrogen and phosphorus levels in many of the Rotorua lakes need to decrease to reduce algae numbers and blooms in those lakes.

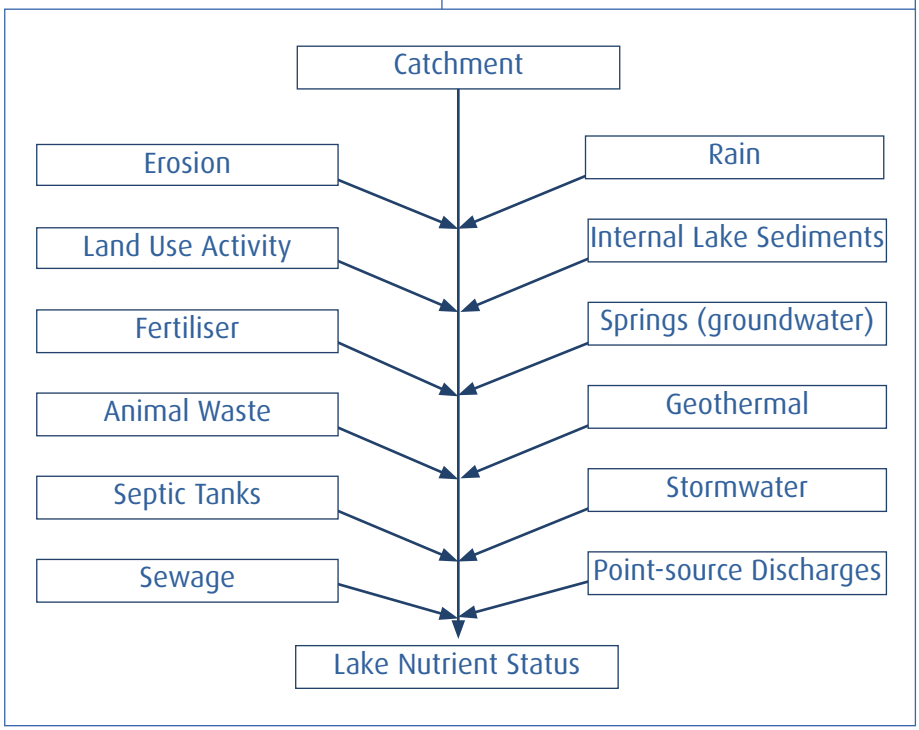
To do this it is important to know where nitrogen and phosphorus in the Rotorua lakes come from. The diagram below lists the main nutrient sources.

Erosion

Erosion can take many forms, such as slips, stream bank erosion, and runoff from tilled land. Phosphorus is the main nutrient released by erosion, as it is attached to soil particles.

Land use activity

All land use puts nutrients into waterways, even areas of native bush. But native bush and exotic forestry only leach small amounts of nutrients, while intensive farming, horticulture and cropping can export large amounts of phosphorus and nitrogen into waterways and lakes. Nutrient release from a property can be decreased with best management practices.



The Rotorua Lakes Problem

- Many of Rotorua's lakes have too many nutrients, caused by activities such as farming and residential settlement.
- These nutrients (nitrogen and phosphorus) feed algal growth, which degrades water quality.
- The Rotorua Lakes Protection and Restoration Action Programme is initially tackling water quality problems in five lakes in the Rotorua district
- Some long-term solutions focus on land management and include new wetlands, restricting nutrients "outflows" from properties, and changes in land use.
- More urgent solutions include sewerage reticulation, structures to divert flows, and the use of mineral products to lock up nutrients.

Fertiliser
Most fertiliser applied to land stays in the soil, so does not have a major effect on a lake unless it is applied excessively or into a waterway. Storm runoff and over-application of fertiliser can wash or leach excess nutrients into streams and lakes.

Animal waste
Urine from livestock is a major source of nitrogen that easily leaches into groundwater, especially when soils are saturated with water. Dung also has high nitrogen and phosphorus concentrations. When livestock wade in a stream or lake edge they are five times more likely to urinate and defecate in the water than on land. When this happens, large quantities of nutrients are released directly into the water, which algae can use.

Septic tanks
Traditional septic tanks do not remove nitrogen or phosphorus from human effluent, aside from plant uptake and scum and solid settling in the tank. The Rotorua district's volcanic soils generally absorb phosphorus, so nitrogen is the main nutrient leached from septic tanks.

Sewage
Reticulated sewerage treatment plants in the Rotorua district are designed to remove most nitrogen and phosphorus from effluent. However reticulated sewage disposal is still a small source of nutrients to lakes.

Rain
Raindrops collect nitrogen compounds from the air as nitrate and ammonium. Rainfall on the lake is a direct, though relatively small input of nitrogen.

Internal lake sediments
During summer, many of the Rotorua lakes separate into two layers – a warmer upper layer and a colder bottom layer. These two layers do not mix, so oxygen from the air is not transferred into the bottom layer of water. When algae die, they sink to the bottom of the lake. Oxygen in the bottom layer is used up as they decompose. If there is a large lake algae population, the bottom layer can lose all its oxygen. When this happens, the chemical make-up of lakebed sediments change and nitrogen and phosphorus compounds are released from the sediments. When the lake remixes again in cooler, windier periods these nutrients are distributed throughout the lake.

Springs (groundwater)
Land development in the Rotorua district since the mid-1940s has leached nitrogen into large underground water reservoirs. Some of these groundwater reservoirs store water for a few years, while other areas (like the Mamaku plateau) can hold a unit of water for more than 100 years. Nitrogen (in nitrate form) from land use slowly leaches through the soil to groundwater. Now increasing concentrations of nitrate are showing up in groundwater-fed springs and reflect land use from decades ago. Springs in the Rotorua area can also contain high levels of dissolved phosphorus, leached from volcanic rock underneath the ground.

Geothermal
Nutrients from geothermal flows vary a lot. Some geothermal outputs have high phosphorus concentrations; a few have high ammonium nitrogen concentrations. In some of the Rotorua lakes geothermal inputs are a significant source of nutrients to the lakes.

Stormwater
Stormwater from urban areas can carry heavy metals, hydrocarbons, sediment, and nutrients into waterways from construction sites, deposits of rubbish, roads, industrial areas and other urban sources.

Point source discharges
Point source discharges of nutrients in the Rotorua district are very small, compared to nutrient inflows from the sources above. Examples of a point source discharge: an industrial or food processing plant pipe discharge, or a dairy farm discharge of cowshed runoff to a stream. Major point source discharges of nutrients are controlled by rules in regional plans and conditions in resource consents.

For further information and advice, contact your local soil conservator at Environment Bay of Plenty:

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