ROTORUA TE ARAWA LAKES PROGRAMME

Urban wastewater and Lake Rotorua water quality

Nutrients effecting lake water quality come from a range of sources which include agricultural activities, urban wastewater, native and exotic forests, and rain.

Meeting water quality targets for Lake Rotorua is a priority for the Rotorua Te Arawa Lakes Programme, a partnership of Bay of Plenty Regional Council, Rotorua District Council and Te Arawa Lakes Trust. A programme of works is underway consisting of in-lake and land-based interventions to reduce nutrients to Lake Rotorua to meet the community's expectations for water quality.

Treated wastewater was the first source targeted for reductions, and over the last twenty years the Wastewater Treatment Plant has provided significant reductions in both the nitrogen and phosphorus loads to Lake Rotorua.

A Trophic Level Index of 4.2 is in place as the water quality target for the Lake. The sustainable nitrogen load to achieve this water quality target is 435 tonnes annually and this limit must be reached by 2032. To achieve this sustainable limit Bay of Plenty Regional Council is developing rules and incentives for land-use and land-management change.

History of Rotorua's wastewater

Upgrades of the Wastewater Treatment Plant and the inclusion of land treatment have made a significant reduction to the nitrogen and phosphorus loads to Lake Rotorua and have helped improve water quality.

In the 1980s the community became concerned with Lake Rotorua's water quality due to the increased frequency of algal blooms.

At this time treated sewage was discharged through sand filters into the Puarenga Stream which flows into Lake Rotorua and contributed 150 tonnes of nitrogen annually to the lake.

Rotorua District Council upgraded the Wastewater Treatment Plant and installed the Land Treatment System in 1990 to reduce nitrogen to Lake Rotorua for water quality objectives and public health benefits. This stopped treated sewage being discharged into the stream.

Rotorua District Council and the community have spent $60 million dollars since 1990 on the Wastewater Treatment Plant and Land Treatment System.

Consent conditions

The treated wastewater from the Wastewater Treatment Plant is irrigated to the Land Treatment System. This is regulated by a resource consent under the Resource Management Act. When the Land Treatment System was installed the resource consent stipulated an objective that the Waipa Stream at the downstream measuring site shall not exceed 2.5 tonnes phosphorus and 24.5 tonnes nitrogen per annum.

In 2001, a new resource consent was issued stating that the Wastewater Treatment Plant and Land Treatment System must operate to ensure sewage-derived nitrogen and phosphorus in the Waipa Stream did not exceed 30 tonnes and 3 tonnes respectively during any 12-month period. These nutrient limits were in line with the original scientific paper which identified a 30 tonne limit for sewage-derived nitrogen to Lake Rotorua.

Due to the increase in the sewage load to the plant over the last 20 years and a reduction in the ability of the Land Treatment System to retain nitrogen, the resource consent limits cannot be met.

Increased nitrogen load

Since 1990 nitrogen from urban sources to the Wastewater Treatment Plant has increased by 110 tonnes, an increase of 50%. This coupled with other factors has led to a reduction in the ability of the Land Treatment System to retain nitrogen, leading to an increase in nitrogen measured in the Waipa Stream.

What	Why
Growth in population	The size of urban Rotorua has increased by 8% (approximately 6,500 people) since 1991.
Reticulation of lakeside communities	2,200 lakeside properties (approximately 6,900 people) have joined the town sewerage system.
Increased rainfall	Over the last three years the average rainfall has increased in Rotorua by 40%. This means more water is causing increased flushing of nitrogen through the Land Treatment System.
Intensification of land-use	Agricultural land-use has intensified in the wider catchment. This has contributed to the increase in nitrogen concentrations measured at the Waipa Stream monitoring point.
Reduction in land for irrigation	300 hectares of crown forest land was identified in the original design for irrigation of treated wastewater in 1990. Due to buffer zones, roads and harvesting operation this has reduced the available hectares to 198. The less land available means higher application rates resulting in more nitrogen entering Lake Rotorua.
Forestry harvesting changed	Forestry management practices can have a significant impact upon the ability to remove nitrogen in the land treatment system.

It estimated that over the next 40 years an additional 55-65 tonnes of nitrogen per year will enter the Wastewater Treatment Plant due to reticulation of lakeside communities and population growth.

What action has been taken?

Rotorua has one of the most advanced wastewater treatment systems in New Zealand.

Meeting the resource consent and water quality objectives is a priority for the Rotorua District Council and the operation of the Wastewater Treatment Plant.

The original upgrade to the Plant and the installation of the Land Treatment System cost the community $32 million.

An additional $28 million has been invested on subsequent upgrades during 1990 to 2012 to accommodate the additional sewage and to reduce the nitrogen in the treated wastewater for water quality improvements and public health benefits. Rotorua now has one of the most advanced systems to remove nitrogen. When compared with other cities in New Zealand, Rotorua has the best quality treated wastewater in terms of nitrogen.

The combined treatment process of plant and land irrigation now removes 90% of nitrogen from wastewater. This has stopped between 120 and 290 (current) tonnes of nitrogen annually reaching Lake Rotorua and contributed significantly to improvements in lake water quality. Without the advanced plant and irrigation system, the improvements we have seen in Lake Rotorua's water quality would not have been possible.

Short-term change in consent for nitrogen limit

Concerted effort at a considerable cost to the community has been made to remove nitrogen from the wastewater to meet the consent limit. However, given the current load to the plant and available technology, it is not possible to meet the nitrogen limit in the current resource consent that will expire in 2021.

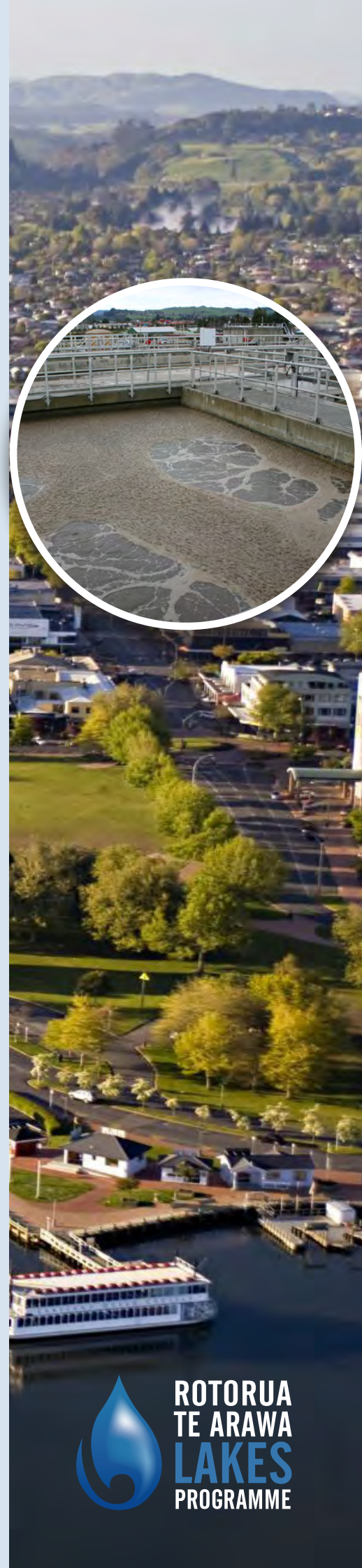
The Rotorua District Council is applying for changes to the current resource consent. The changes include:

What	Why
1. Move the compliance point for nitrogen from the Waipa Stream to the outlet at plant	The current compliance point for both nitrogen and phosphorus is located at the Waipa Stream. The District Council does not have control or is responsible for all nitrogen that is measured in the Waipa Stream and therefore the compliance point for nitrogen should be moved.
2. Set the nitrogen limit in the treated effluent at plant outlet to 51 tonne	With the current urban sewage load and existing technology the plant cannot meet the current nitrogen limit in Waipa Stream. By increasing the limit and changing the compliance point from the Waipa Stream to the Wastewater Treatment Plant until 2021, it allows the Land Treatment System to operate while an alternative solution is found.
3. Increase phosphorus limit to 4 tonne	In peak storm events that are outside the control of the district council, phosphorus limits may be exceeded. Increasing the limit takes into account events that are outside control of the Plant.

The District Council have added a condition that commits to an action programme to provide a long term solution for the discharge of treated wastewater.

Achievements for water quality

Significant improvements in water quality have been made by the Land Treatment System and upgrades over the past 20 years, even with the current resource consent limit not presently being met. Lake water quality and public health have benefited from plant upgrades and reticulation of lakeside communities.



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ROTORUA TE ARAWA LAKES PROGRAMME

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Contributions to water quality improvements

Project	Outcome
Plant upgrades and Land Treatment System	Prevented between 120 and 290 tonnes of nitrogen and around 30 tonnes of phosphorus entering Lake Rotorua annually
Lake Rotorua lakeside communities reticulation	Prevented 13 tonnes of nitrogen and around 2 tonnes of phosphorus entering Lake Rotorua annually

Nitrogen from urban wastewater in perspective

The current urban population is approximately 67,000. The nitrogen from urban wastewater only contributes a small percentage of the nitrogen load to the lake. Total nitrogen to the lake from all urban sources is 12%, and the treated wastewater only contributes 3.9% of this. Even with the increasing the limit to 51 tonne from the Plant, this would equate to just over 5% of the nitrogen entering the lake.

Nitrogen sources to Lake Rotorua – 2010 ROTAN modelling		
	% of total nitrogen	% of total catchment
Agriculture/lifestyle	70%	45.7%
Geothermal	4%	0.1%
Rain	4%	n/a
Forest	10%	45.7%
Urban1	12%	8.5%

[1] Including urban, urban open space and treated sewage.

What's next?

The current resource consent expires in 2021, so the change in resource consent conditions will be requested for an eight year period. A new resource consent will be needed from 2021.

Work is underway to attempt to find an alternative solution for the treated wastewater. Options are being identified to either modify the existing Land Treatment System or find an alternative discharge location and system.

Once the options are known and the costs identified, the Rotorua community will be consulted to determine their preference. Given the potential high cost of alternative options it may be more cost effective for nutrients to be removed through other mechanisms.

What does this mean for long-term water quality?

Lake Rotorua met its water quality target in 2012 and had the best water quality in decades. This is likely due to short-term in-lake actions such as alum dosing which has reduced phosphorus well below Lake Rotorua's long term phosphorus target. The Land Treatment System and sewerage reticulation of lakeside communities have contributed to the trend of nitrogen reductions in the lake that has improved water quality. As nitrogen inputs into the lake overall are well above the sustainable limit there is an on-going risk that lake water quality could decline in the coming years.

This application to increase the nitrogen limit is for the short-term, and well before the sustainable load needs to be met by 2032. The community has spent $60 million on wastewater treatment and reticulation to improve lake water quality since 1990.

The Wastewater Treatment Plant is now at a level that can remove 90% of the nitrogen load. Given the high level of investment by council and the community, the wastewater treatment plant is now at the limit of technology and it may not be economically feasible to remove any additional nitrogen. The changes to the consent conditions provides the time to identify alternative discharge solutions, determine the associated costs and consult with the community on the best way forward for wastewater treatment and lake water quality.

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