FACT SHEET

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Science behind the nitrogen limit: Lake Rotorua

Draft rules have been developed to limit nitrogen losses from rural land in the Lake Rotorua catchment. The purpose of the draft rules is to help achieve a total nitrogen load of 435 tonnes per year.

This load is considered to be the "sustainable nitrogen limit" for the lake and is expected to meet a water quality objective set by the community based on the level of water quality experienced in the 1960s.

The science to support the sustainable nitrogen limit has been developed over a long period of time and from a range of experts. The sustainable nitrogen limit was first identified in 1986 and has been reassessed and confirmed three times.

For more than ten years a Water Quality Technical Advisory Group (WQTAG) has been in place to provide technical advice on lake science and management to help reach the water quality targets for Lake Rotorua and other nearby lakes.

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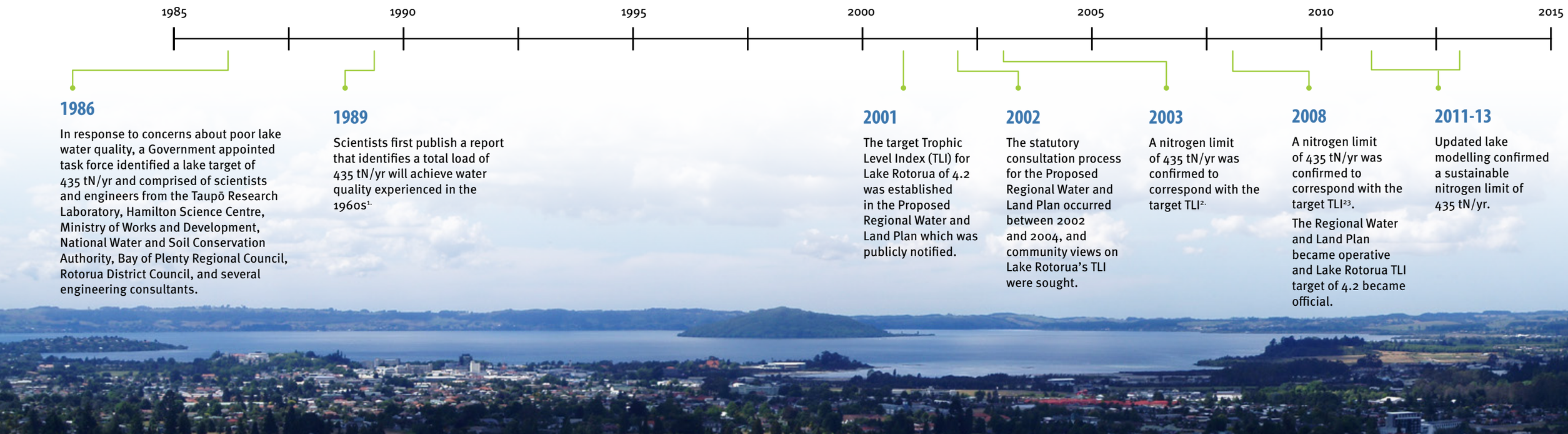
History of 435 tonne nitrogen limit and water quality target



1986

In response to concerns about poor lake water quality, a Government appointed task force identified a lake target of 435 tN/yr and comprised of scientists and engineers from the Taupō Research Laboratory, Hamilton Science Centre, Ministry of Works and Development, National Water and Soil Conservation Authority, Bay of Plenty Regional Council, Rotorua District Council, and several engineering consultants.

1989

Scientists first publish a report that identifies a total load of 435 tN/yr will achieve water quality experienced in the 1960s[1].

2001

The target Trophic Level Index (TLI) for Lake Rotorua of 4.2 was established in the Proposed Regional Water and Land Plan which was publicly notified.

2002

The statutory consultation process for the Proposed Regional Water and Land Plan occurred between 2002 and 2004, and community views on Lake Rotorua's TLI were sought.

2003

A nitrogen limit of 435 tN/yr was confirmed to correspond with the target TLI[2].

2008

A nitrogen limit of 435 tN/yr was confirmed to correspond with the target TLI[2][3].

The Regional Water and Land Plan became operative and Lake Rotorua TLI target of 4.2 became official.

2011-13

Updated lake modelling confirmed a sustainable nitrogen limit of 435 tN/yr.

Lake Rotorua's current water quality and impact of alum dosing

For the last two years Lake Rotorua has had improved water quality and has been at or very close to its TLI target.

This has been achieved despite the current nitrogen load being more than the sustainable limit of 435 tN/yr and a significant trend of increasing nitrogen in most major inflows to the lake[4].

Lake modelling in late 2013 indicated that the reason Lake Rotorua was meeting its TLI target was due mostly to alum dosing in the Utuhina and Puarenga streams. The alum "locks up" phosphorus to stop it being available for algal growth. This effectively removes about 15 tP/yr from these stream inflows and from within the lake by limiting lake-bed sediment releases of phosphorus.

Phosphorus limiting or nitrogen limiting

Specific tests have been done to examine whether the growth of algae in the lake is nitrogen or phosphorus limited.

Alum dosing has resulted in very low concentrations of dissolved phosphorus in the lake. It is likely that algae in Lake Rotorua is now phosphorus limited for large parts of the year.

Even with alum dosing there may be times of the year when algae in the lake are nitrogen limited.

The Water Quality Technical Advisory Group advises that a strategy where both nitrogen and phosphorus are managed to provide co-limitation of algae will provide the best long term outcome for the lake.

Actions to reduce phosphorus

Lake Rotorua has a phosphorus target load of 37 tonnes per year set through a non-statutory Action Plan. This is not the focus of the draft rules because mitigation actions to reduce nitrogen losses from pastoral land will often provide associated phosphorus reductions. Examples of mitigation actions that reduce both nitrogen and phosphorus losses include reduced fodder cropping, lower stocking rates, especially during winter, and conversion of some pastoral land to trees.

A large proportion of Lake Rotorua's phosphorus load comes from geological sources and is difficult to remove before it enters the lake. At this stage there are no known practical ways to manage phosphorus to the same level that is occuring with alum dosing. To maintain water quality improvements in the long term reductions are needed in both nitrogen and phosphorus losses from the wider catchment.

It is important to note that alum dosing was only ever intended as a short-term. The resource consents allowing the use of alum expire in 2019. The intervention carries some risks, including:

- Potential impacts on lake pH (the acidity/alkalinity balance)
- Potential impacts on organisms in the lake from long term applications of alum, although at this stage our monitoring is showing no adverse effects on the lake ecology
- Lack of long-term community support.

Ecological and environmental monitoring are undertaken to assess some of the above risks and to identify possible problems associated with alum dosing.

[1] *Rutherford, J.C., Pridmore, R.D., White, E. (1989), Management of phosphorus and nitrogen inputs to Lake Rotorua, New Zealand, Journal of Water Resources Planning & Management 115 (4): 431-439.*

[2] *Rutherford, K., (2003), Lake Rotorua Nutrient Load Targets, NIWA Client Report: HAM2003-155.*

[3] *Rutherford, K. (2008), Nutrient load targets for Lake Rotorua - a revisit, NIWA Client Report: HAM2008-080.*

[4] *Bay of Plenty Regional Council (2013) Trends and state of nutrients in Lake Rotorua streams, Environmental Publication 2013/08 ISSN: 1175-9372 (Print), ISSN: 1179-9471 (Online).*

Ko te wai te ora o ngā mea katoa

Water is the life giver of all things

Fact sheets in this series:

1 Draft rules - how they could affect landowners
2 Nitrogen Discharge Allowances
3 Draft rules - Q&A
4 Support and incentives
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Current scientific advice and future reviews

The Water Quality Technical Advisory Group has considered all the currently available science. Its advice remains that to achieve a long-term TLI of 4.2, no more than 435 tonnes of nitrogen and 37 tonnes of phosphorus should enter Lake Rotorua each year.

It is important to keep updating the science to ensure nutrient reduction policies are soundly based. Therefore Lake Rotorua science reviews are scheduled for 2017 and every five years after that.

More information

Please see the following reports on www.rotorualakes.co.nz for up to date science and modelling information.

> Predicting the effects of nutrient loads, management regimes and climate change on water quality of Lake Rotorua 2012 (David P. Hamilton, , Deniz Özkundakci, Chris G. McBride, Wei Ye, Liancong Luo, Warwick Silvester and Paul White)

> Prediction of nitrogen loads to Lake Rotorua using the ROTAN model 2011 (Kit Rutherford, Chris Palliser and Sanjay Wadsha)

> Trends and state of nutrients in Lake Rotorua streams 2013 (BOPRC Environmental Publication 2013/08)

Want to know more?

For more information on the draft rules see the Have Your Say brochure or supporting information on www.rotorualakes.co.nz

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