THE ROTORUA LAKES

Protection and Restoration Action Programme

Lake Tikitapu (the Blue Lake) Action Plan

ISSN: 1175 9372 (Print)

ISSN: 1179 9471 (Online)

Environmental Publication 2011/09
June 2011

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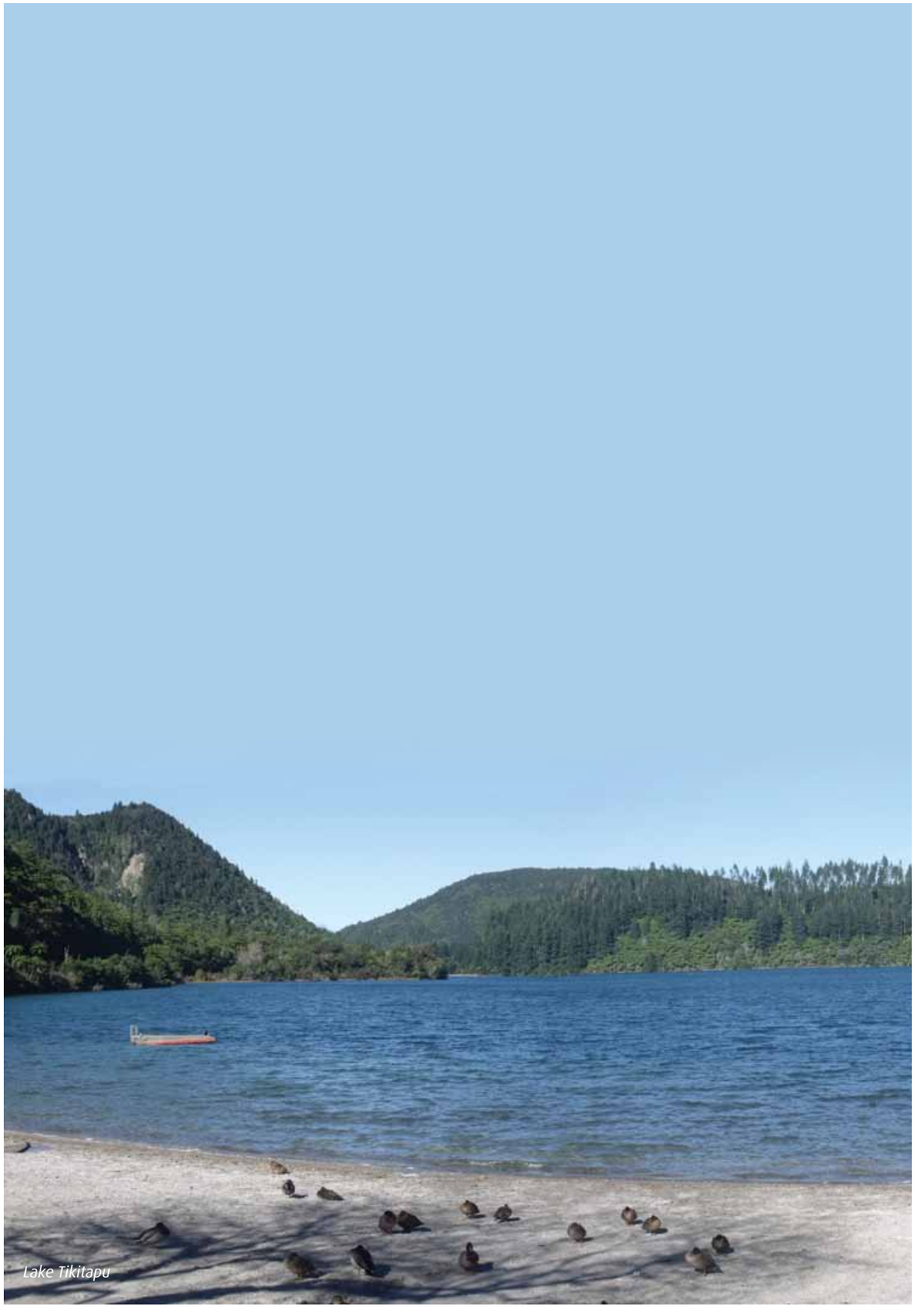


Lake Tikitapu

Summary

Pressures on water quality at Lake Tikitapu

- Lake Tikitapu (the Blue Lake) has a steep catchment comprised of 92 percent native and exotic forest; seven percent pasture and one percent urban area.
- Since Regional Council monitoring began in 1992 water quality at Lake Tikitapu has shown a decline. The Trophic Level Index at Lake Tikitapu is 3.1[1] and needs to come down to 2.7. TLI is an indicator of lake water quality. The lower the TLI, the higher the water quality.
- There are more people visiting Lake Tikitapu every year, and this is placing stress on the old septic tank facilities (both campground and public facilities) which causes nutrients to leach into the lake.

Why water quality is important

- Lake Tikitapu is a popular lake for recreation. Good lake water quality is important to this community.
- Good water quality contributes to the sense of “pride, place, mana, status and culture involved in achieving excellence in managing the lakes” for Te Arawa people[2].
- People enjoy lakes less if the water quality is poor. Rotorua Lakes are a tourist attraction to the area and poor lake water quality can affect the Rotorua economy.

Improving water quality at Lake Tikitapu

- Nutrients going into the lake from old sewage systems have been identified as the main problem and fixing this is the most important action.
- Rotorua District Council reticulated the existing toilet blocks at Lake Tikitapu and in the campground in October 2010. This is likely to reduce the lake water nutrients by the amount required to return the TLI to 2.7.
- The next Regional Policy Statement is proposing that nutrient discharge limits be set in the Water and Land Plan for all Rotorua Te Arawa lakes. This will include Lake Tikitapu.
- The Bay of Plenty Regional Council, Rotorua District Council and Te Arawa Lakes Trust will ensure that a vision for Lake Tikitapu, strategic direction and co-ordinated planning for the lake is achieved[3].
- An adaptive management approach to manage water quality at this lake is required. The Bay of Plenty Regional Council will continue to monitor water quality at Lake Tikitapu.

Youngsters prepare to paddle a waka on the lake.

[1] *Bay of Plenty Regional Council (2009/2010) Rotorua Lakes TLI Update*

[2] *Bay of Plenty Regional Council, Rotorua District Council and Te Arawa Lakes Trust Board (2000) Strategy for the Lakes of the Rotorua District*

[3] *Bay of Plenty Regional Council, Te Arawa Lakes Trust, Rotorua District Council and key lake stakeholders (2010) Lake Tikitapu Water Quality Workshop, Session 3*

Purpose

This document describes the current state of water quality at Lake Tikitapu; where water quality should be; how it will get there and by when; and future risks to water quality in this lake catchment.

Why have we created an action plan?

We need to improve water quality at Lake Tikitapu. Current knowledge tells us that there is one action that will improve water quality to the required level: reticulation of septic tanks. This action was completed in October 2010; and Bay of Plenty Regional Council will continue to monitor water quality at this lake.

We have created this action plan to ensure that we will meet the water quality requirements at Lake Tikitapu by:

- Identifying any other actions that will complement reticulation (such as monitoring the effects of reticulation on water quality).
- Ensuring we have actions in place to allow an adaptive management approach in case things change.
- Talking with the community to make sure we've covered everything.
- Looking toward the future and assessing other potential risks to water quality at this lake.

The Lake

Lake Tikitapu

Lake Tikitapu is one of the 12 Rotorua Te Arawa Lakes. It is a small, pear-shaped lake framed by native bush and forestry.

Famous for its striking colour, it is known as "Blue Lake" and is adjacent to the slate-green coloured "Green Lake", or Lake Rotokakahi. With a pontoon and an easy walking track around the lake, it is a popular location for family outings.

Lake Tikitapu was formed 13,500 years ago by volcanic activity. The maximum depth of the lake is 27.5 metres, and the average depth is 18 metres.

There are no surface flows from the lake; however subsurface flow is thought to drain towards Lake Tarawera, via Lake Rotokakahi.

Lake Tikitapu has a small catchment area of 5.7 km² and has 1.4 km² of surface water. Ninety two percent of the catchment bordering the lake comprises native and exotic forest and scrub. Seven percent of the lake catchment is in pasture and one percent is urban. Steep inclines along the lake catchment allow fast run-off of rain water into the lake.

What do people want for the Rotorua Te Arawa Lakes?

The Bay of Plenty Regional Council has worked with the regional community to identify the community's aspirations for management of the environment.

The community outcomes related to water quality across the region are:

- A clean and protected environment
- Healthy and safe communities
- A prosperous and sustainable economy
- Respected culture and heritage

The Bay of Plenty Regional Council, Te Arawa Lakes Trust and Rotorua District Council worked with the community to develop a strategy for the Rotorua Te Arawa Lakes and identified a long-term vision for the Rotorua Te Arawa Lakes. The vision is:

The lakes of the Rotorua district and their catchments are preserved and protected for the use and enjoyment of present and future generations, while recognising and providing for the traditional relationship of Te Arawa with their ancestral lakes[4].

The Strategy for the Lakes of the Rotorua District also states a fundamental community value for iwi is "The principle of guardianship… and the protection of the mauri of the environment".

[4] *Bay of Plenty Regional Council, Te Arawa Lakes Trust, Rotorua District Council (2000) Strategy for the Lakes of the Rotorua District*

What does the lake community want for Lake Tikitapu?

Lake Tikitapu has strong cultural and spiritual values for iwi. It is the most popular recreation lake of all the Rotorua Lakes, and hosts significant water-based events in the region. The Ministry for the Environment describes Lake Tikitapu as a lake of national importance to recreation[5].

Key stakeholders described their desires for this lake in a workshop at Apumoana Marae, Rotorua on 4 November 2010.

"We value the pristine, crystal-clear condition of this lake and its deep local culture; the unique, deep-blue colour and rain-like composition of its water; the semi-remote recreation experiences that the lake provides close to a major city centre and the beauty of the lake and its surrounding forests[6]."

The community strongly values the beauty of the lake surrounds and wishes this amenity value to remain.

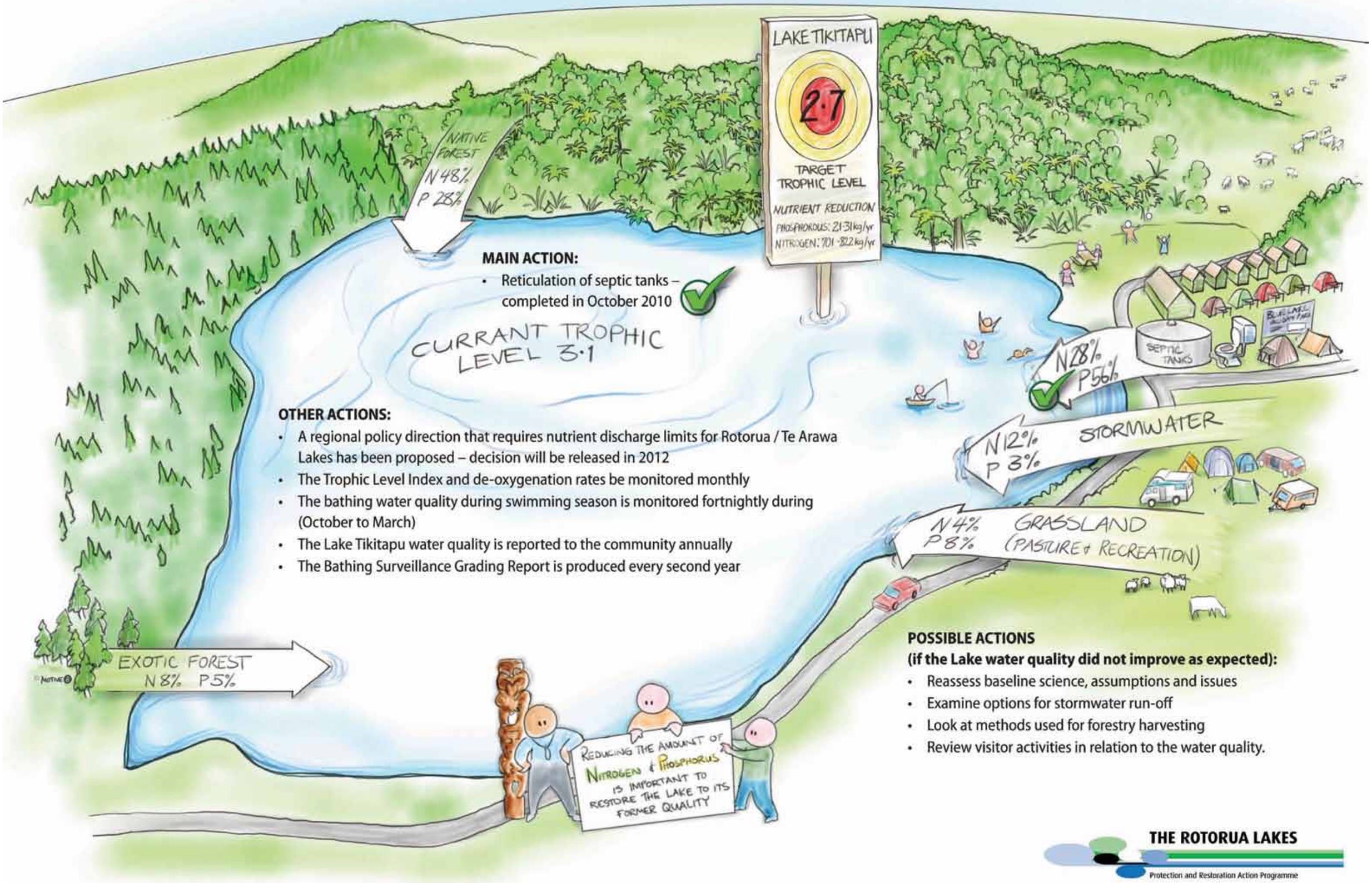
In order to achieve the regional community outcomes, the vision for the Rotorua Te Arawa Lakes and the desires of local stakeholders, the Regional Water and Land Plan (RWLP) has rules to protect the water quality of the Rotorua Te Arawa Lakes. The Trophic Level Index (TLI) as described in Objective 11 is used in this Plan to benchmark community expectations for water quality[7].

[5] *Ministry for the Environment (2010) Potential Water Bodies of National Importance*

[6] *Bay of Plenty Regional Council, Te Arawa Lakes Trust, Rotorua District Council and key lake stakeholders (2010) Lake Tikitapu Water Quality Workshop, Session 2*

[7] *Bay of Plenty Regional Council (2008) Bay of Plenty Regional Water and Land Plan*

Lake Tikitapu Action Plan



MAIN ACTION:

- Reticulation of septic tanks – completed in October 2010

OTHER ACTIONS:

- A regional policy direction that requires nutrient discharge limits for Rotorua / Te Arawa Lakes has been proposed – decision will be released in 2012
- The Trophic Level Index and de-oxygenation rates be monitored monthly
- The bathing water quality during swimming season is monitored fortnightly during (October to March)
- The Lake Tikitapu water quality is reported to the community annually
- The Bathing Surveillance Grading Report is produced every second year

POSSIBLE ACTIONS
(if the Lake water quality did not improve as expected):

- Reassess baseline science, assumptions and issues
- Examine options for stormwater run-off
- Look at methods used for forestry harvesting
- Review visitor activities in relation to the water quality.

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Water quality in the lake

Water quality in the Rotorua Te Arawa Lakes, as measured by the TLI, is deteriorating. Increasing pressures from development, land use and other activities have contributed to a decline in water quality.

Lake Tikitapu has the fourth best water quality of the 12 Rotorua Lakes in the Bay of Plenty region[8]. The lake is safe for swimming 100 percent of the time. However, some indicators suggest that Lake Tikitapu's water quality has been getting worse since monitoring began in 1992.

The Rotorua Lakes Water Quality Report 2009 describes Lake Tikitapu's water condition using the TLI. The TLI is an indicator of lake water quality. An increase in TLI can indicate the increasing possibility of nuisance biological growths such as algal blooms, resulting in declining aspects of water quality[9].

The Regional Water and Land Plan, Objective 11, defines the maximum acceptable trophic level for each of the 12 Rotorua Lakes. The maximum trophic level acceptable at Lake Tikitapu is 2.7[10]. Currently, Lake Tikitapu's TLI is 3.1. Something needs to be done to reduce the TLI.

[8] *Scholes, P., Bay of Plenty Regional Council (2009) Rotorua Lakes Water Quality Report*

[9] *Noel M. Burns (2000) Trophic Level Index Baselines and Trends for 12 Rotorua District Lakes, 1992 to 2000*

[10] *Bay of Plenty Regional Council (2008) Bay of Plenty Regional Water and Land Plan, The Integrated Management of Land and Water, Objective 11*

What's causing the problem?

There is too much nitrogen and phosphorous in Lake Tikitapu's water. Increasing phosphorous, in particular, has been causing the TLI to increase.

The TLI has remained relatively stable over the past five years, but is above the acceptable level described in Objective 11 in the Regional Water and Land Plan.

The current annual nutrient load for Lake Tikitapu is:

- Nitrogen: 2,502 kilograms per year
- Phosphorous: 125 kilograms per year

The contributors of nitrogen and phosphorous to Lake Tikitapu are[11]:

Land Use	*% N entering lake*	*% P entering lake*
Exotic Forest	8%	5%
Native Forest	48%	28%
Grassland (pasture)	3%	6%
Grassland (recreation)	1%	2%
Stormwater	12%	3%
Septic Tanks	28%	56%
Total	100%	100%
N = Nitrogen, P = Phosphorous		

The amount of land covered by native and exotic forest has not significantly changed since the TLI was first recorded. The steep nature of the lake catchment and dominance of forest land cover results in a steady flow of nutrients to the lake water. Farming remains stable, and contributes minor amounts of nutrients to the lake. Some gorse is present in the catchment mainly associated with pastoral land, and this is likely to be contributing a minor quantity of nitrogen to the lake. In general, these land uses are unlikely to have caused the TLI to be greater than the Regional Water and Land Plan objective.

Lake Tikitapu has seen significant changes in recreation activities since 2005. Swimming increased by up to 47 percent at Swimming Beach over five years, and boating has doubled[12]. Nearly half (45 percent) of all recorded recreation on a Rotorua Lake occurs at Lake Tikitapu[13]. The lake also hosts 63 percent of all water-based Rotorua Lake events, attendees and participants. These increases have placed high pressure on the old on-site ablution blocks.

The current ablution blocks are on-site disposal units (septic tanks). These tanks slowly leach nitrogen and phosphorous into the ground and gradually into the lake water. High use causes more severe leaching into the lake as the septic tank facility becomes overfull. Increasing use of ablution blocks and storm water run-off from the carpark (and road) have increased nitrogen and phosphorous levels in the lake[14]. In particular, increasing people using old septic tank facilities has caused high relative increases in phosphorous to the lake and has most likely caused a rise in lake TLI.

[11] *John McIntosh (2010) nutrient budget for Lake Tikitapu*

[12] *APR Consultants (2010) Rotorua Lakes Review: Analysis of Recreational Use and Pressures on Supporting Infrastructure*

[13] *Excludes freshwater fishing*

[14] *Bay of Plenty Regional Council (2005) Lakes Quality Assessment and Action Plan Prioritisation*

What are our assumptions?

We have had to make some assumptions in our estimates of what is causing the TLI to increase.

The most significant assumption is that the science used to establish the nutrient budget for Lake Tikitapu is correct[15]. Other important assumptions are:

- The science developed for other lake and coastal water bodies where septic tanks were reticulated is similar to Lake Tikitapu.
- Septic tank performance at Lake Tikitapu is similar to established and accepted septic tank performance measures.
- Nutrient loading from various land uses is similar to that measured around other Rotorua Lakes' catchments.
- No significant change (other than use of the lake) for land use has been identified in the Lake Tikitapu catchment.

[15] *The Technical Advisory Group (TAG) is made up of lakes water quality experts. This group developed the nutrient budget for Lake Tikitapu*

Community views: What else could be causing water quality issues

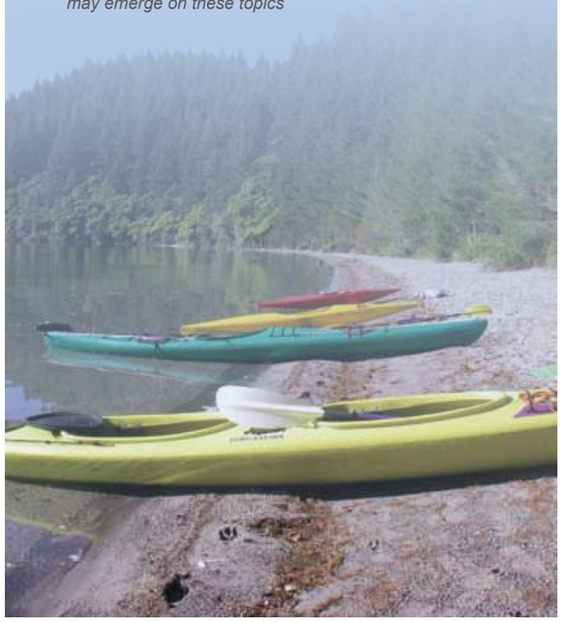
The community identified other factors that could be affecting water quality at Lake Tikitapu[16]. They were:

- Run-off from storm water pipes into the lake.
- Human activity on the lake (swimming and boating) has increased significantly[17].

The community also identified a concern that, without vision, strategic direction and coordinated planning for this lake the ability to respond to water quality issues would be hampered.

[16] *Bay of Plenty Regional Council, Te Arawa Lakes Trust, Rotorua District Council and key lake stakeholders (2010) Lake Tikitapu Water Quality Workshop, Session 3*

[17] *Bay of Plenty Regional Council, Te Arawa Lakes Trust, Rotorua District Council and key lake stakeholders (2010) Lake Tikitapu Water Quality Workshop, Session 3. Stakeholders identified these as possible factors influencing water quality. However, we currently have little scientific evidence to support this statement, and stakeholders agreed that the science team should remain up to date regarding any new scientific information that may emerge on these topics*



What if we did nothing?

Action has been taken to reduce the TLI through reticulation of septic tanks. Without this action the TLI would likely increase and water quality at Lake Tikitapu would become noticeably poorer.

If oxygen depletion rates increased in the lake, then the increased length of low oxygen in the lake would result in higher phosphorous levels. If this were to occur the TLI would likely become worse.

Lake Tikitapu is a popular recreation lake and is estimated to host 95,000 visitors every year. Deteriorating water quality is consistent with drops in recreation activity at other lakes and may occur at Lake Tikitapu in the future if water quality issues were not addressed. This could also have an economic impact. When algal blooms shut Lakes Rotorua and Rotoiti in the summer of 2002/2003 it was estimated that $900,000 was lost to the Rotorua economy[18].

[18] *Nimmo-Bell (2004) The Rotorua Lakes Evaluation of Less Tangible Values*

What do we need to do?

Reduce the nitrogen and especially the phosphorous in the lake. The table below describes the current amount of nutrient going into the lake and the amount we need to take out of the lake to meet required levels.

	Nitrogen (kilograms per year)	*Phosphorous (kilograms per year)*
Current lake nutrient amounts	2,502	125
How much nutrient we need to take out of the lake	701 – 822	21 – 31

How can we do it?

The required nutrient reduction could be met by upgrading from septic tanks to sewage reticulation.

Reticulation should reduce nitrogen by 700 kilograms and phosphorous by 70 kilograms[19]. This reduction adequately meets the amount required. Reticulation of septic tanks is therefore the single most likely action to return TLI to 2.7.

Rotorua District Council completed reticulation at Lake Tikitapu in October 2010 as part of the Lake Ōkāreka reticulation project.

[19] *John McIntosh (2010) Lake Tikitapu Nutrient Budget*

What other actions will we do to ensure water quality standards are met?

Bay of Plenty Regional Council, Te Arawa Lakes Trust, Rotorua District Council and key stakeholders identified some solutions other than the main action: reticulation of the septic tanks. These actions are described in the table below and on the next page as adaptive management actions:

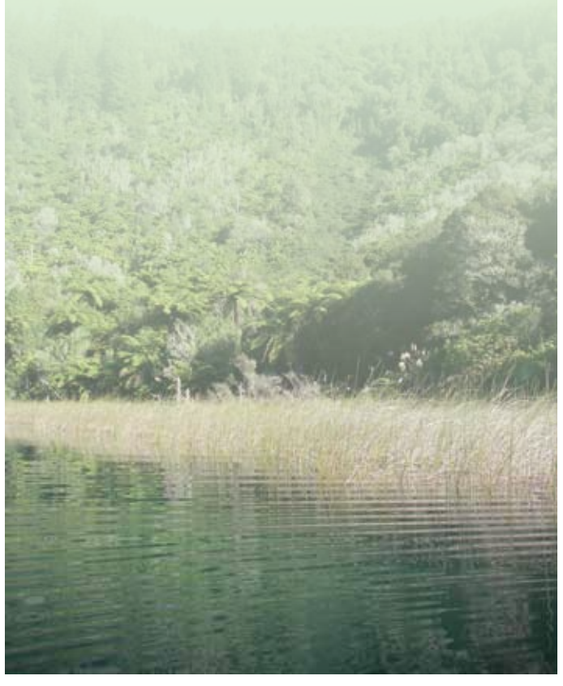
What else will we do?	*How will we know if it's working?*	*When will we complete it?*	*Who will do it?*
Propose a policy direction that requires nutrient discharge limits to be set in the Water and Land Plan for all of the Rotorua Te Arawa Lakes	Regional Policy Statement monitoring framework	Regional Council's decisions released in 2012	Bay of Plenty Regional Council
Actively engage in any update of the Strategy for the Lakes of the Rotorua District	Stakeholders are actively engaged in any update	Future	Bay of Plenty Regional Council, Te Arawa Lakes Trust, Rotorua District Council
Monitor the Trophic Level Index, bathing water quality and de-oxygenation rates at Lake Tikitapu	Monitoring of TLI and de-oxygenation rates Monitoring bathing water quality indicators at Lake Tikitapu in the swimming season	Ongoing monthly Ongoing, fortnightly from October to March	Bay of Plenty Regional Council
Report to the community on Lake Tikitapu water quality	The Rotorua Lakes Water Quality Report is produced The Bathing Surveillance Grading Report is produced	Ongoing annually Ongoing biennially	Bay of Plenty Regional Council

Action Plan review: When will we see a difference?

Even though reticulation is now in place to improve water quality it can take many years before a change occurs in TLI.

This is usually due to the nature of the soil in the catchment, the scale of the problem, and the type of land use that has been contributing to nutrient inputs. Lake Tikitapu has low overall nutrient levels, a small catchment and problematic nutrient sources are limited in scale and nature. This means that we could see a positive movement towards the required TLI in as little as four to six years (2013/2014 - 2015/2016)[20].

[20] *Bay of Plenty Regional Council science team believe that septic tank reticulation will show much faster results than those expected from agricultural nutrient reductions*



Action Plan review: What will we do if circumstances change?

When implementing the action plan we are operating under assumptions of current knowledge and behaviour. Sometimes these things change.

We will therefore take an adaptive management approach, and will be prepared to change if circumstances demand it. This could require:

- Reassessing baseline science, assumptions and issues
- Examining options for stormwater run-off and new and existing technologies and solutions (such as wetland development)
- Looking at methods used for forestry harvesting and new technologies and solutions
- Reviewing lake visitor activities in relation to the water quality.

Monitoring and engagement with the community will inform us of the need to look at these options.

Photo by Shane Iremonger

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