

Information Document - Lake Rotorua



Te Rotorua nui a Kahumatamomoe

**Improving water quality in Lake Rotorua:
Information on the way land is used**

Lake Rotorua's poor water quality is impacting on the people of Rotorua who place great significance on their lake for its aesthetic, cultural and recreational values.



Strategic Policy Publication 2012/03

ISSN: 1176 4112 (print)
1178 3907 (online)

February 2012

Bay of Plenty Regional Council
5 Quay Street
PO Box 364
Whakatāne 3158
NEW ZEALAND

Summary

Fixing Lake Rotorua water quality is a priority issue for the Bay of Plenty Regional Council and our communities.

The Regional Council has set the strategic framework for future Lake Rotorua direction through the Proposed Regional Policy Statement and draft Ten Year Plan 2012-2022.

The Council has been serious in its intent to find a solution to a problem of local, regional and national significance.

Recent decisions made by the Regional Council set out a new direction for achieving Lake Rotorua water quality goals.

The way land is used needs to change. We have announced through our current draft Ten Year Plan a \$45.5 million programme to work with landowners over the next eight years to change land use.

We have a statutory obligation to investigate ways of improving the water quality of Lake Rotorua. We have:

- Set targets and timelines for nutrient reduction in the Proposed Regional Policy Statement. This means reaching water quality limits by 2022.
- Approved the development of regional rules to reduce nutrient discharges and meet this limit.

All of these recent decisions consolidate a substantial amount of research and analysis that's been undertaken during the past several years.

We endeavour to encourage feedback through the draft Ten Year Plan. We genuinely want to know what you think. We have an information document to help and we have material on our website. We will continue to inform communities of future Council decisions and how these are implemented.

Improving the water quality of Lake Rotorua will take time. It took more than half a Century to create this problem, and it will take time to fix it.

Introduction

This information document consolidates a substantial amount of research and analysis that has been undertaken during the past several years. This includes work on how to reduce nutrient loss in catchments throughout the country, the economics of changing farm practices and detailed modelling on nutrients in the Lake Rotorua catchment.

This document sets out recent decisions made by Bay of Plenty Regional Council and how it has set a new direction for achieving the water quality goals for Lake Rotorua.

Recent decisions are included in:

- The draft Ten Year Plan 2012-2022 - \$45.5 million deed funding
- The Proposed Regional Policy Statement; and
- Development of Regional Rules.

Lake Rotorua's poor water quality is impacting on the people of Rotorua who place great significance on their lake for its aesthetic, cultural and recreational values.

The Rotorua community has made it clear that they would like the lake's water quality to be similar to that enjoyed in the 1960s. Back then, people used and enjoyed the lake for a range of activities including swimming and fishing.

The water quality target in place to realise the community's aspirations is the Trophic Level Index (TLI), set at 4.2 in the Bay of Plenty Regional Council Regional Water and Land Plan following community consultation.

Currently there is approximately 755 tN/yr (tonnes of nitrogen per year) going into the lake, so a reduction of approximately 320 tN/yr is needed to reach community expectations.

A significant package of works and investment is currently dedicated to cleaning up the Rotorua Te Arawa Lakes, including Lake Rotorua.

Despite this package of works and investment already underway, it is unlikely that the nitrogen load will be reduced by 320 tN/yr in the timeframes outlined in the Proposed Regional Policy Statement (i.e. 2022).

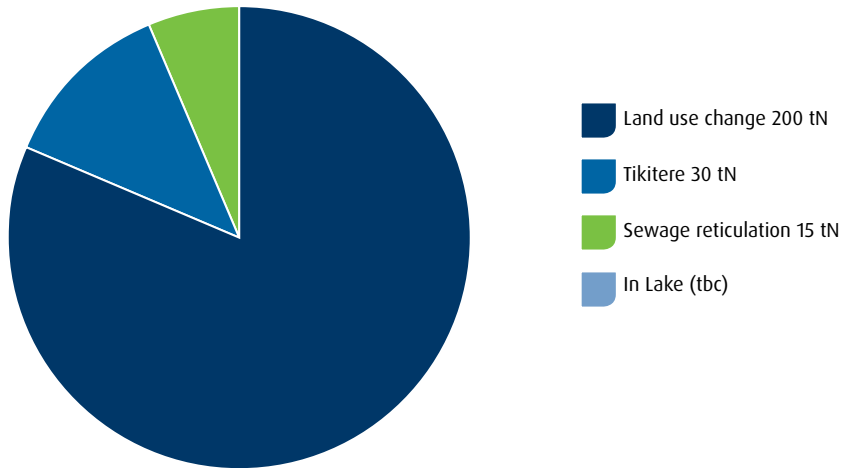
The Bay of Plenty Regional Council has investigated a number of ways in which we could speed up the work to improve Lake Rotorua's water quality.

A number of approaches were investigated and it was found that addressing the pastoral land use would be the most effective. Pastoral farming contributes 79.5 percent of the total amount of nitrogen entering the lake.

Bay of Plenty Regional Council adopted two position statements in October 2011. *The Council Position Statement: Land Use Change in the Lake Rotorua Catchment* and *The Council Position Statement: Land Management Change in the Lake Rotorua Catchment*. These position statements outline Council's rationale for how it will approach land use change.

The Bay of Plenty Regional Council draft Ten Year Plan 2012-2022 outlines a plan to fund land use change using the \$45.5 million already allocated to the project through the Deed of Funding Agreement.

Ten Year Plan Funded nitrogen reduction in Lake Rotorua (tonnes)



This approach sees Bay of Plenty Regional Council working with landowners and industry to reduce nutrient loss from farmland by 200 tN/yr and reducing the amount of nutrients entering the lake through a mix of regulatory and incentivised voluntary approaches.

This information document is being released at the same time as the Proposed Bay of Plenty Regional Policy Statement (RPS) and the draft Ten Year Plan 2012-2022

The RPS provides high-level direction for regional, district and city plans across the region on water, land use and the coastal environment. It specifically sets the targets and timelines for nutrient reduction in the Rotorua lakes.

Bay of Plenty Regional Councillor Raewyn Bennett, who chairs the Proposed RPS Hearing Committee, said the coastal environment, water quality and land use decisions were released early to enable the draft Ten Year Plan process to have greater certainty.

“We’d like people who make submissions on the draft Ten Year Plan 2012-2022 to be informed on the policy context of this significant spending,” she said.

There are many different ways to implement our approach. This includes setting rules, sharing the costs of change between various groups, rewarding people when they make changes, agreements between groups to look after the lake and other actions taken by the community.

This document provides information on Councils position on land use change and land management in the Rotorua Catchment.

We encourage you to make a submission to the draft Ten Year Plan 2012-2022.

The draft Ten Year Plan and Proposed RPS are available on the Regional Council website www.boprc.govt.nz.

Draft Ten Year Plan submissions opened on **Tuesday 27 March 2012** and close at **4pm on Friday 27 April 2012**.

Supporting information is available at www.boprc.govt.nz.

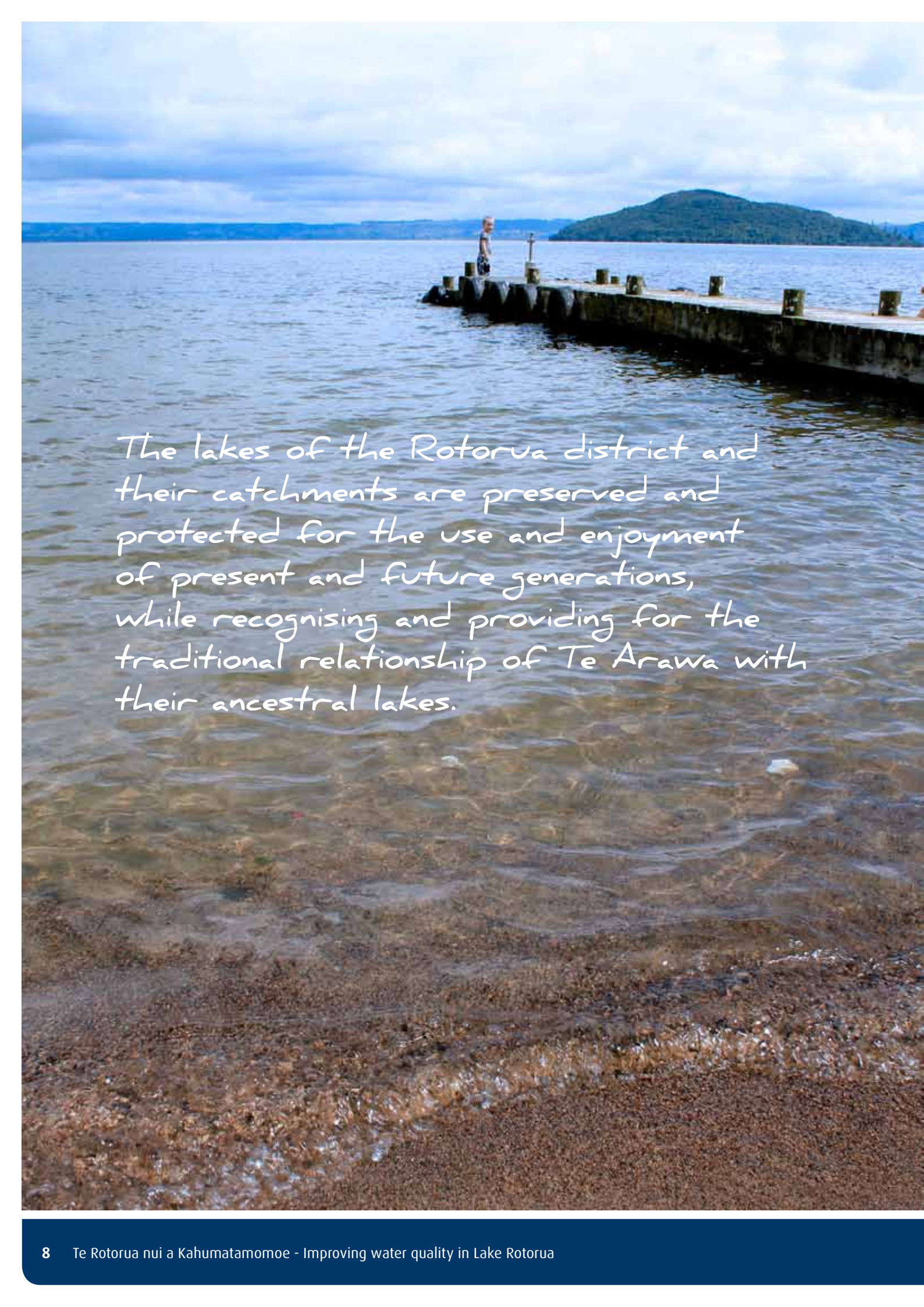


Lake Rotorua Te Rotorua nui a Kahumatamomoe

“Lake in a basin”. A number of the Rotorua lakes were named by Ihenga - a grandson of the captain of the Arawa canoe Tamatekapua. He named the largest lake, Te Rotorua nui a Kahumatamomoe, in honour of his father-in-law and uncle, Kahumatamomoe. “Rotorua nui” refers to the large basin-like lake.

Contents

Summary	3
Introduction	4
The vision for the lakes of the Rotorua district	9
Outcomes and targets that need to be achieved	11
The current situation	13
The nutrients	13
The science	14
Work underway	15
Are the targets being met?	17
Bay of Plenty Regional Council's approach to improving water quality	19
A: Change land management practices	21
B: Change the way land is used	24
Conclusion	31
Supporting information	33
Appendices	35
Appendix 1 - Continue on with what's being done approach	35
Appendix 2 - Look for other alternatives approach	37



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.

The vision for the lakes of the Rotorua district

The vision for all of the Rotorua lakes has been identified in the Strategy for the Lakes of the Rotorua District (the Strategy). The vision is to ensure that:

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.

The Strategy was adopted in 2000 by the Te Arawa Lakes Trust, Rotorua District Council and the Bay of Plenty Regional Council. It sets out why people value the Rotorua lakes, their concerns with the current situation and a vision for the future of the lakes. The Strategy doesn't contain rules, but it does guide the way the lakes are managed.


One of the key goals in the Strategy is addressing water pollution, the longest-running environmental issue for Lake Rotorua. Water quality in the lake declined from the late 1960s through to 1990 and although it hasn't worsened since this time, it still remains poor.

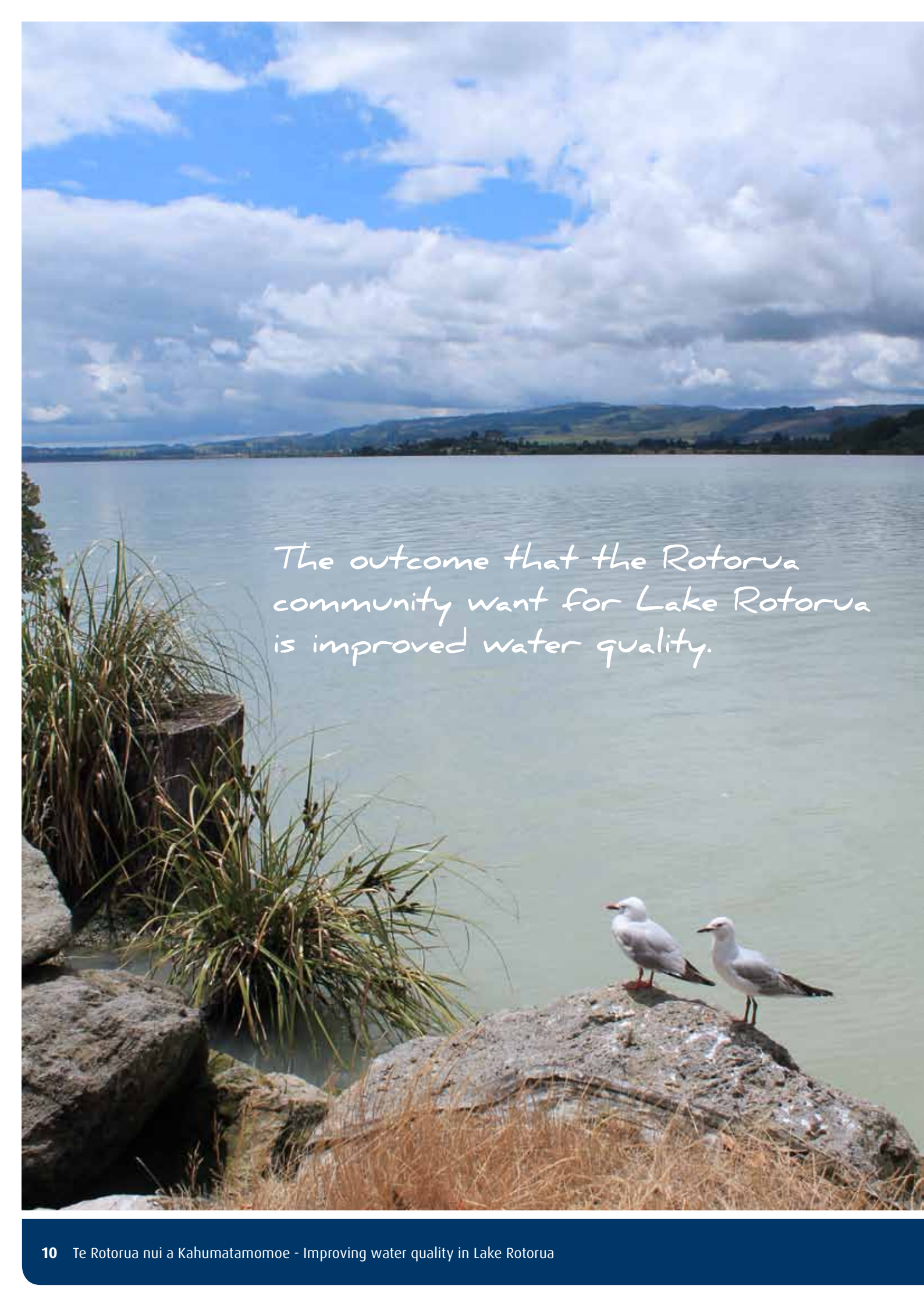
The decline is associated with large amounts of nitrogen and phosphorus that have come from increased use of the land surrounding the lake, such as residential settlement and farming.

Poor water quality in Lake Rotorua has many impacts. Importantly, it impacts on the people of Rotorua who place great significance on their lake for its aesthetic, cultural and recreational values. It may also impact on issues such as fisheries and tourism, and their associated revenue for the district.

The community wants the decline in water quality in Lake Rotorua to be addressed. This is particularly important for Te Arawa, who own the lakebed, and whose relationship with the Te Arawa lakes continues to be the foundation of their cultural identity, cultural integrity, wairua, tikanga and kawa.

The community have made it clear they want water quality in Lake Rotorua to be similar to what it was in the 1960s. In order for this to happen, the amount of nitrogen and phosphorus going into the lake every year needs to be controlled and reduced.

Lake Rotorua	At a glance
	<p>Lake size: 8,060 ha Catchment area (surface): 42,000 ha Catchment area (including groundwater): 46,376 ha Elevation: 280 metres Average depth: 11 metres Deepest point: 45 metres Formed: 140,000 years ago Has geothermal input</p>
<p>“Lake in a basin.” A number of the Rotorua lakes were named by Ihenga - a grandson of the captain of the Arawa canoe Tamatekapua. He named the largest lake, Te Rotorua nui a Kahumatamomoe, in honour of his father-in-law and uncle, Kahumatamomoe. “Rotorua nui” refers to the large basin-like lake.</p>	

A scenic view of Lake Rotorua under a cloudy sky. In the foreground, two seagulls are perched on a large, grey rock. To the left, there are some green plants and a wooden stump. The water is a light, milky green color. In the background, there are rolling hills and a blue sky with white clouds.

The outcome that the Rotorua community want for Lake Rotorua is improved water quality.

Outcomes and targets that need to be achieved

Target	Reference
TLI = 4.2 (currently 4.6)	Regional Land and Water Plan
Nitrogen load = 435 tN/yr by 2022	Proposed Regional Policy Statement
Nitrogen reduction = approx. 320 (tN/yr)	Science modelling
Freshwater objectives and water quality limits in place	National Policy Statement for Freshwater Management

The outcome that the Rotorua community want for Lake Rotorua is improved water quality.

The water quality target in place to achieve this outcome is the Trophic Level Index (TLI), set in the Regional Water and Land Plan. The TLI for Lake Rotorua is 4.2, a target based on community consultation and a desire for the level of water quality enjoyed in the 1960s.

The Proposed Regional Policy Statement for the Bay of Plenty has set out a clear policy direction for the management of Lake Rotorua. It proposes that nitrogen going into the lake from the land must not exceed 435 tonnes of nitrogen per year (tN/yr) by 2022. This nitrogen load is considered to be the 'sustainable nitrogen load' required to meet the lake's target TLI of 4.2.

A 'sustainable phosphorus load' has also been estimated at 37 tonnes per year (tP/yr) although this has not been formalised in any statutory planning document.

National requirements have been set that apply to Lake Rotorua. The National Policy Statement for Freshwater Management requires that all regional councils must set objectives and water quality limits for all bodies of freshwater in their regions. These requirements must be in place as soon as reasonably practicable, or no later than 31 December 2030.

Reaching these outcomes and targets will be difficult and will come at a cost locally, regionally and nationally, however the community has made it clear that they want the water quality of Lake Rotorua improved. The target TLI of 4.2 has been confirmed through consultation and a sustainable nitrogen load has been identified.

What is the Trophic Level Index?

The Trophic Level Index (TLI) is a way of measuring water quality based on the amount of total nitrogen, total phosphorus and algae present in a lake, as well as the clarity of the water.

A TLI less than 2 indicates very good water quality. A TLI greater than 5 indicates very poor water quality. The higher the TLI, the greater risk of environmental problems like algal blooms and unusual foams.

The TLI is accepted throughout New Zealand as a tool to indicate water quality. The Ministry for the Environment uses the TLI as a national level lake water quality indicator.

'Poor water quality in Lake Rotorua is a priority issue locally, regionally and nationally.'



The current situation

Poor water quality in Lake Rotorua is a priority issue locally, regionally and nationally. Reducing the amounts of nitrogen and phosphorus that are entering the lake is the most important step in reducing excessive algal growth, improving water quality and meeting the targets that are in place for the lake.

This section outlines what is known about the water quality problem in the lake and the work that is currently being done to fix the problem. It also identifies why more work still needs to be done.

The nutrients

Nutrients affecting Lake Rotorua can be grouped into three broad sources:

- Nutrients already in the lake and its sediments;
- Nutrients currently entering the lake; and
- Nutrients in groundwater yet to reach the lake.

Large amounts of nutrients from activities such as agriculture and sewage have historically entered Lake Rotorua. Some of these nutrients remain within the bottom sediments of the lake. Natural processes in the lake can cause these nutrients to be released into the water column several times a year which can cause undesirable, and sometimes toxic, algal blooms.

A significant amount of nutrients still enter the lake every year due to activities that take place on the land in the catchment. Although forestry (commercial and native) is the most common type of land use in the Lake Rotorua catchment, pastoral activities are the largest source of nutrients (dairy farming and drystock farming¹).

Nutrients from the catchment will sometimes take a long time to travel through groundwater to the lake. Changes in the way land is used have the potential to take many years before they are effective in decreasing nutrient loads to the lake.

What are nutrients and why are they bad?

Nutrients are substances that naturally occur in our soils and waters and are important for human, plant and animal growth. Two nutrients in particular, nitrogen and phosphorus, are important for plant growth.

Like most things, nutrients are harmful if present in very large amounts. Too many nutrients in lakes mean too much plant growth, especially of algae. When there is too much algae, water becomes cloudy and blocks light to underwater grasses. These are very important to many animals for food and shelter, and without light they die.

Another problem can occur when large amounts of algae die and fall to the bottom of lake. Bacteria decompose these dead plants and use up a lot of oxygen in the process. When oxygen levels drop, fish and other aquatic life will die.

Some algae can also be harmful to human and animal health when they occur in large quantities.

¹ Including sheep, beef, and deer

The science

The target TLI for Lake Rotorua is 4.2; the current TLI (based on a three-year average) is 4.6.

Recent modelling undertaken by the National Institute of Water and Atmospheric Research (NIWA) indicates that the nitrogen load entering Lake Rotorua from the catchment is approximately 725 tN/yr (see table: *Where is the nitrogen and phosphorus coming from below*). Approximately 30 tN/yr comes from rainfall, making the current nitrogen load to the lake approximately 755 tN/yr.

To achieve the target TLI of 4.2 the amount of nitrogen entering the lake should not exceed 435 tN/yr. This is the 'sustainable nitrogen load' and is the limit that has been set in the Proposed Regional Policy Statement.

This means the nitrogen entering Lake Rotorua needs to be reduced by approximately 320 tonnes a year to achieve the sustainable nitrogen load.

Analysis also indicates that the sustainable phosphorus load for Lake Rotorua is 37 tP/yr. The current phosphorus load that is entering the lake is approximately 40 tP/yr. However, there is a large internal load of up to 36 tP/yr. A reduction of 10 tP/yr is seen as achievable and is aimed at decreasing this internal load.

Where is the nitrogen and phosphorus coming from? ³						
Land use	Area in use (ha)	% of total catchment	Total tN/yr (in 2010)	% of total N	Total tP/yr (in 2007)	% of total P
Dairy	5050	10.9	273	36.2	4.1	10.5
Drystock ⁴	15072	32.5	236	31.3	12.8	32.7
Forest	21182	45.7	75.4	10.0	2.2	5.6
Urban ⁵	3961	8.5	93.4	12.4	3.8	9.7
Lifestyle	1053	2.3	16.7	2.2	0.5	1.3
Geothermal	59	0.1	30.3	4.0	1.4	3.6
Lake & rain	n/a	n/a	30	4.0	1.3	3.3
Springs	n/a	n/a	n/a	n/a	13	33.2
TOTAL	46377	100	755	100	39.1	100

² Nitrogen figures are based on the most up to date ROTAN modelling work done in April 2011; Phosphorus figures are based on the Proposed Action Plan for Lakes Rotorua and Rotoiti

³ Including sheep, beef, horticulture and cropping

⁴ Including urban, urban open space, sewage and sewage treatment

Work underway

A significant package of works and investment is already dedicated to cleaning up the Rotorua Te Arawa lakes, including Lake Rotorua.

The package of works is led by a policy programme that includes:

- Providing the strategic direction for the lakes in the Strategy for the Lakes of the Rotorua District (currently being updated);
- Setting specific policies for water quality outcomes in the lakes through the Proposed Regional Policy Statement;
- Identifying water quality objectives for the lakes in the Regional Water and Land Plan; and
- Putting rules in place to limit and reduce the nutrients entering the lakes.

Our operational programme delivers the package of works that can be broken down into 'what needs to be done in the catchment to prevent nutrients (mainly nitrogen) reaching the lake' and 'what needs to be done in the lake to remove nutrients (mainly phosphorus) already there'.

The operational programme includes:

- Land use change initiatives such as converting gorse (which can leach high amounts of nitrogen) to forestry and retiring farm land;
- In-lake and in-stream initiatives such as constructing plants to reduce phosphorus, reducing nutrient releases from sediments and building wetlands; and
- Science and research initiatives such as investigating ground water movement, and monitoring and collecting data on water quality changes.

Bay of Plenty Regional Council now operates two alum dosing (p – locking) plants in the Utuhina and Puarenga Streams contributing to Lake Rotorua.

These dosing plants are designed to reduce phosphorus reaching the lake and any residual alum will be available for binding of phosphorus in the lake.

Recent reports (February 2012) suggest that the alum dosing programme is having a beneficial effect on the lake water quality. Monitoring of this programme will be on-going. This will confirm the long-term benefits of the dosing programme. It is important to note that different seasonal effects can contribute to positive results.



Operational work until now has focused on the most significant sources of nitrogen in the catchment. For example, the current focus has been on dealing with point sources (such as sewage) and controlling in-lake releases of nutrients through methods such as capping.

Actions funded through the Funding Deed with the Crown				
Intervention	N removed (t/yr)	P removed (t/yr)	Total cost (\$M)	Implemented or in progress
P-locking – Utuhina		2	3.6	P
P-locking – Puarenga		2	4.05	P
P-locking – Awahou		2	3.8	
Sediment capping		25	25	
Hamurana diversion	50-90	6	16	
Tikitere geothermal treatment	30		4.8	P
Wetlands	Minor		1	P
Land management change	170	6	9.5	P
3 Community wastewater plants*	10.8	0.25	28.5	P
Totals	260 - 300	43.25	96.25	
Expected Government contribution (assuming 50% of all listed actions).			48.125	

*RDC had spent \$3.5M million upgrading the main wastewater treatment plant to remove more nutrients in 2006.



Are the targets being met?

Remember our targets are:				
		Current load (t/yr)	Target sustainable load (t/yr)	Reduction needed (t/yr)
Nitrogen		755	435	320
Phosphorus	From catchment	39.1	37	10
	From lake sediments	36		25

Good progress has been made towards achieving the targets in place for phosphorus reductions in the catchment. The two alum dosing (p-locking plants) are now achieving a reduction of more than four tonnes of phosphorus each year. Several small detention dams to control runoff and trap phosphorus are also in progress across the catchment.

Experience with land use change to date has also shown that many changes to reduce nitrogen have the added benefit of reducing phosphorus loads.

Unfortunately, however, despite the package of works and investment already underway, it is unlikely that the required targets will be met for reducing nitrogen loads in the required timeframes without further focus on land use and land management change.

Implementation of the Hamurana Stream diversion, estimated to reduce up to 55 - 90 tN/yr, will not proceed. Recent scientific advice suggests that removal of the colder oxygenated Hamarana water from the lake may exacerbate nutrient releases from the sediments. In addition, diverting the spring water around the lake shore will have social, visual and landscape impacts.

Information and modelling has indicated that major land use change is the main way nitrogen loads can be reduced to 435 tN/yr by 2022. This modelling indicates that short-term gains can be made to water quality by reducing in-lake releases of nutrients, but it will be necessary to reduce catchment sources of nutrients to sustainable levels to achieve sustainable long-term improvement. It also demonstrates that reducing phosphorus losses to the lake will help improve water quality in the short-term but that it will be necessary to target both nitrogen and phosphorus for long-term sustainable improvements.

In summary, targets for phosphorus in the catchment are on track to be met. Targets for nitrogen, or ultimately the water quality targets overall, are not on track to be met.

*There are a range of actions available
that can reduce the amount of
nitrogen going into Lake Rotorua*



Bay of Plenty Regional Council's approach to improving water quality

There are a range of actions available that *can reduce the amount of nitrogen going into Lake Rotorua, and help achieve the sustainable load required by 2022.*

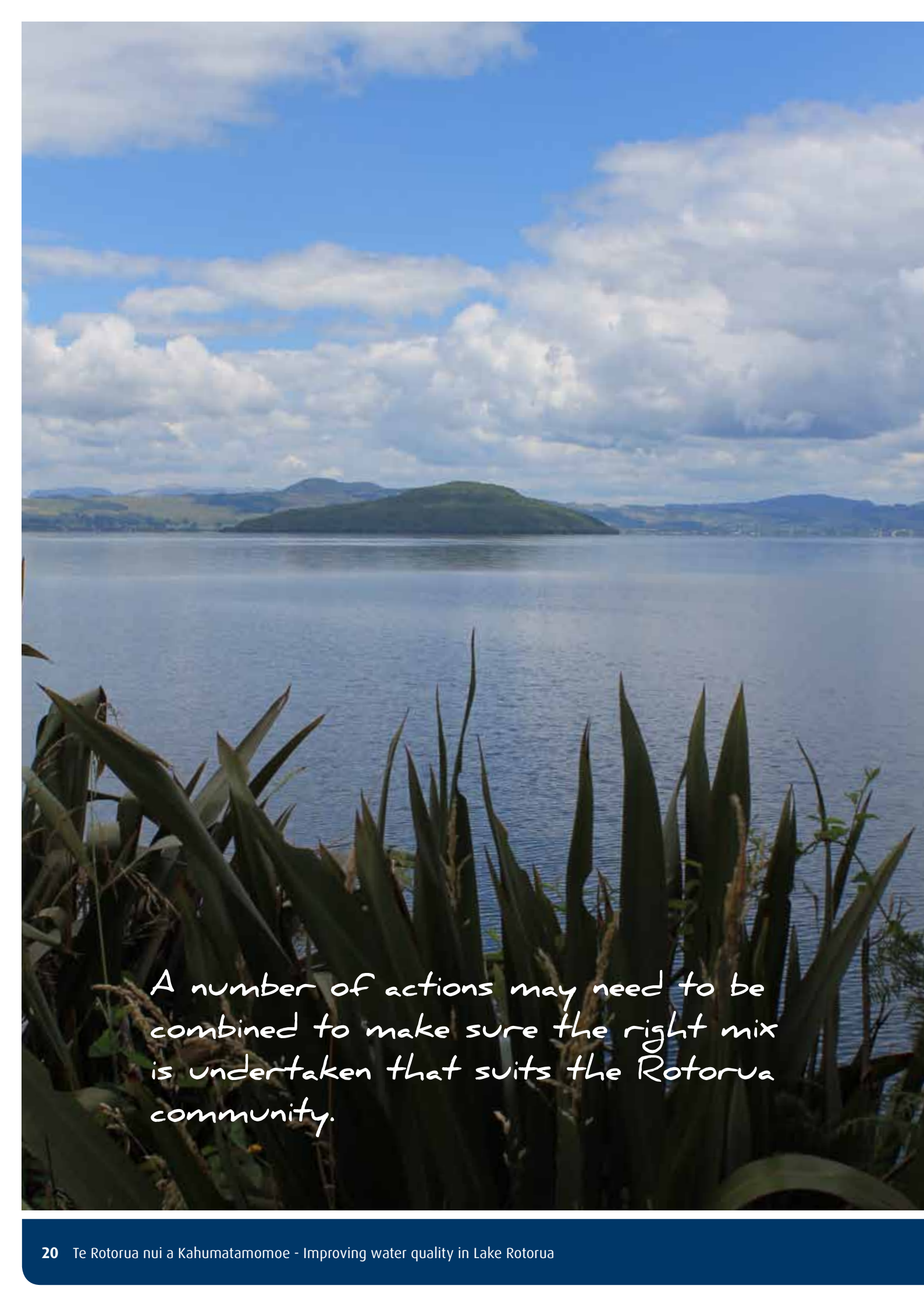
A number of actions may need to be combined to make sure the right mix is undertaken that suits the Rotorua community.

Outlined in this section are the ways that the Regional Council has identified as the best possible means to meet the water quality target. These are:

- A Change land management practices; and
- B Change the way land is used.

Both of these ways is discussed below.

Two alternative approaches – *Continue on with what is already being done and look at other alternatives are set out in Appendix 1. These do not match the rationale of Council's position statements on land management change and land use change.*

A scenic view of Lake Rotorua, New Zealand. The foreground is filled with dark green, pointed reeds. The middle ground shows the calm, blue water of the lake. In the background, there are rolling green hills and mountains under a bright blue sky with scattered white clouds.

A number of actions may need to be combined to make sure the right mix is undertaken that suits the Rotorua community.

A: Change land management practices

Bay of Plenty Regional Council's position is that land management change alone will not achieve the nitrogen load reductions required to reach a sustainable load of 435 tn/yr for Lake Rotorua.

The council sees change in land management practices as part of a suite of works that contributes to a reduction of the sustainable load in Lake Rotorua.

PROPOSAL

Land management practices will be improved to reduce the amount of nitrogen produced by current activities on the land.

EXPLANATION

Current land management practices, such as the way stock are managed during winter, can often result in excessive amounts of nitrogen which go directly into waterways. Many changes can be made on individual farms in the Rotorua catchment to reduce this amount of nitrogen; collectively these changes could reduce the total nitrogen load across the catchment.

There has been a great deal of research throughout New Zealand looking into potential ways that nitrogen can be reduced on farms. There are many possible actions available that can be tailored to the specific requirements of individual farms.

In the Lake Rotorua catchment, farmers have looked at a range of potential actions. These include wintering stock on pads or in shelters, changing stocking rates, use of wetlands and plants such as watercress, retiring portions of land from stock and using different grasses in pasture. This information is available to download at www.boprc.govt.nz

EXAMPLE

Dairy farms - It has been estimated that dairy farms in the Rotorua catchment have an average nitrogen loss rate of approximately 56kg of nitrogen per hectare (N/ha) each year. This figure is an estimate only and nitrogen losses from dairy farms in the Lake Rotorua catchment are likely to range from below 40kg N/ha to above 80kg N/ha each year.

While 56kg N/ha each year is an estimated average only, it is useful to help understand what is happening, and can happen, on dairy farms across the catchments.

Changing management practices on dairy farms has the potential to significantly reduce nitrogen loads every year. It has been estimated that the average farm nitrogen loss rate of 56kg N/ha each year could be decreased to an average rate of 40kg N/ha each year. Collectively, changes in land management across dairy farms in the Rotorua catchment have the potential to achieve more than a 30 percent reduction in the total nitrogen load.

There is no one-size-fits-all suite of actions that can be undertaken on every individual dairy farm. However, examples of actions include:

- Reducing Spring and autumn nitrogen fertiliser by 25 percent, giving a 14 percent reduction in nitrogen loss.
- No nitrogen fertiliser being applied in winter, giving a 4 percent reduction in nitrogen loss.
- No nitrogen fertiliser being applied on the Farm Dairy Effluent area, giving a 4 percent reduction in nitrogen loss.
- Using feed pads.

Sheep and beef farms - It has been estimated that sheep and beef farms in the Rotorua catchment have an average nitrogen loss rate of approximately 16kg N/ha each year. As above, this is an estimated average only but is useful to help understand what is happening, and can happen, on sheep and beef farms across the catchment.

Changing stock and nutrient management practices on the average sheep and beef farm in the Rotorua catchment has the potential to reduce the nitrogen load from 16kg N/ha each year to 14.4kg N/ha each year. Collectively, changes in land management across sheep and beef farms in the Rotorua catchment have the potential to achieve a 10 percent reduction in total nitrogen load.

There is a limited range of actions that can be undertaken on sheep and beef farms compared to dairy farms, for example moving cattle from steeper country and farming exclusively on rolling to flat land.

WHAT COULD THIS APPROACH MEAN FOR YOU?

This approach will require pastoral farmers to change the way they currently manage their farms. How much change is required of any individual farmer depends on their current practices and what kinds of improvements are possible.

COSTS AND WHO MIGHT PAY FOR THIS

For dairy farms, land management changes to reduce nitrogen loss by about 30 percent are expected to result in an 11 percent loss in economic farm surplus. This represents a total of \$1 million a year for dairy farms across the catchment.

For sheep and beef farms, the changes to reduce nitrogen loss by about 10 percent could result in a 16 percent loss in economic farm surplus. This represents a total of \$600,000 for sheep and beef farms across the catchment.

REACHING THE TARGET

Changing land management practices on both dairy as well as sheep and beef farms has the potential to reduce the nitrogen load to Lake Rotorua by up to 100 tonnes each year. This will not achieve the target of 320 tonnes, but could be combined with other measures to make significant progress.

HOW COULD THIS BE ACHIEVED?

The Regional Council has signalled that improving land management practices is the responsibility of landowners.

Requiring changes in land management on farms is likely to be through rules in a Regional Plan made under the Resource Management Act 1991. The authority to do this sits with the Regional Council.



BENEFITS

- It is likely to incorporate a variety of actions that are already being committed to as part of industry best practice
- Technology and innovation may result in methods that reduce impacts on profitability.
- Could be achieved through a regulatory approach by the Regional Council, so would be administratively simple.
- Supported by extensive research regionally as well as nationally.
- Has a long history of discussion in the catchment so landowners are familiar with the concept and actions required.

IMPACTS

- On its own it doesn't reach the target and will need to be combined with other approaches.
- Detailed aspects, such as how much change can be achieved and how much this costs, will be disputed by many landowners.
- Some may think this approach is enough or does not go far enough.
- Likely to have a negative impact on profitability for individual farmers.
- Will require a committed education campaign to ensure landowners are aware of their commitments.
- Not all landowners will have the capacity (knowledge or resources) to implement land management changes.

Regional Council's position on land management change

Bay of Plenty Regional Council's current policy positions on land management change in the Lake Rotorua catchment are that we will:

- Recognise that land management change alone will not achieve the nitrogen load reductions required to reach the sustainable nitrogen load of 435 tN/yr in Lake Rotorua.
- Prioritise Regional Council resource towards affecting land use change in the Lake Rotorua catchment over actions to affect land management change.
- Support and encourage the efforts of landowners in the Lake Rotorua catchment to change their land management practices.
- Actively affect land management change in the Lake Rotorua catchment through Regional Council's primary role as a regulator.



B: Change the way land is used

This is the approach that the Regional Council considers will achieve the sustainable nitrogen load for Lake Rotorua in the timeframes required.

In addition to changing land management practices the council considers that unless current land use in the catchment is changed the targets are unlikely to be met. This approach has the biggest impacts but also the biggest benefits.

PROPOSAL

Change land use in the Rotorua catchment, from high nitrogen loss activities to low nitrogen loss activities.

EXPLANATION

Nitrogen loss from current rural activities in the Lake Rotorua catchment is estimated at:

- Dairy – 56kg N/ha each year;
- Drystock – 16kg N/ha each year;
- Lifestyle – 16kg N/ha each year; and
- Forestry – 4kg N/ha each year.

These are estimates only, and represent an 'average' nitrogen loss from an 'average' farm/property.

There is the potential to decrease the amount of nitrogen leaching into Lake Rotorua by changing rural activities from those with a high nitrogen loss (for example, dairy) to a lower nitrogen loss (for example forestry).

EXAMPLES

There are a number of ways that land use change could be achieved in the Lake Rotorua catchment. These ways could also be used for land management practice change.

A great deal of research has already been undertaken to determine how changes to the way land is used and managed can be achieved, both within the Lake Rotorua catchment and elsewhere.

Recent decisions have indicated that an integrated package of land management change and land use change mechanisms is required. At this stage the Proposed RPS and draft Ten Year Plan 2012-2022 outline:

- Regulatory frameworks; and
- Cost sharing.

Other approaches have been considered and may still be relevant in the future. These may include:

- Reverse auctions;
- Stewardship approaches; and
- Land retirement.

Regional Council's position on land use change

Bay of Plenty Regional Council's current policy positions on land use change in the Lake Rotorua catchment are that we will:

- Accept that Regional Council has an obligation to consider land use change in order to achieve the sustainable nitrogen load of 435 tN/yr in Lake Rotorua.
- Prioritise Regional Council resources towards land use change as a key tool for achieving the sustainable nitrogen load of 435 tN/yr in Lake Rotorua.
- Recognise that there is a local, regional and national willingness to pay for water quality outcomes.
- Take action on land use change quickly in the Lake Rotorua catchment to ensure that opportunities are not lost.

REGULATORY FRAMEWORKS

Regulatory frameworks, such as rules or policies, impose direct costs on landowners by requiring that a specific action must be undertaken before any benefits can be accrued. Regulations affecting land use in the Lake Rotorua catchment could include:

Land use change - that land use change to a lower nitrogen activity is expected/required and that land use change to a higher nitrogen activity is not encouraged/allowed.

Land management change - that practices that reduce nitrogen loss are encouraged/required, and that changes in land management are carried out within a given timeframe.

Recent decisions released on the Proposed Regional Policy Statement.

On 27 March the Regional Council released its decisions on the water quality and land use sections of the Proposed Regional Policy Statement:

- rules will require the managed reduction of any nutrient losses that are in excess of the limits established under by ensuring that:
 - rural production land use activities minimise their loss of nutrients as far as is reasonably practicable by implementing on-farm best management practices;
 - land use change that is required within the Rotorua Te Arawa lakes catchments to achieve the limits takes into account an equitable balancing of public and private costs and benefits; and
 - no discharge of nitrogen onto or into land or water in the Lake Rotorua catchment that results in the exceedence of the limit of 435 tN/yr for that lake is authorised by a rule in a plan or a discharge permit beyond 2022.

For Lake Rotorua, current on-farm best practice alone will not achieve the nitrogen load reduction required to reach the sustainable nitrogen load of 435 tN/yr and land use change will be necessary.

The cost of achieving any further reduction in nutrient losses over and above on-farm best practice in a particular catchment will have a mix of public and private benefits and should be funded accordingly. Consequently, the implementation of policies within the Proposed Regional Policy Statement will require the development of further policy under the Regional Council's Resource Management Act 1991 and Local Government Act 2002 responsibilities.



In general, some changes in land use and land management will be permitted (for example, changing from high nitrogen losses to low nitrogen losses); other changes will not be permitted (for example, changing from low nitrogen losses to high nitrogen losses).

The Regional Council has approved work to develop regional plan rules to manage nutrient discharges to the 12 Rotorua Te Arawa Lakes.

A nutrient trading system as part of a regulatory framework could be established. This system works with the regulatory control.

Nutrient trading controls nutrient loss by setting a total amount of nutrients allowed (equal to the environmental goal, in this case 435 tN/yr). Everyone that contributes to the nutrient loss must monitor their losses and have sufficient allowances to cover their nutrient loss at the end of each trading year. Any source of nutrients can be included in the system, including sewerage plants.

If someone doesn't have enough allowances to cover their nutrient loss, they must purchase additional allowances from the market. If someone has extra allowances, they can sell these. People can therefore receive direct financial benefits for reducing their nutrient loss.

Trading allows those that have high costs associated with achieving nutrient loss reduction to pay those with low costs to undertake the necessary reductions. This ensures that nutrient reductions take place in the most cost-effective locations.

In most trading systems some or all sources of nutrient pollution are regulated, and those that are regulated have to change their behaviour to meet any regulatory requirements. However, there is flexibility in how people meet their obligations which may lower compliance costs and drive innovation in reducing nutrient losses.

COST SHARING

Cost sharing means that the cost of a specific activity is borne by the wider community – including the community that directly benefits from improved lake water quality.

Cost sharing can cover some or all of the start-up and/or installation costs of implementing a new practice that is less polluting. It can also off-set the loss in income that might arise from changing land use. It is often used to encourage the adoption of practices that require initial capital investments. The cost of a nutrient-reducing management practice would generally be shared between the nutrient source (for example, a landowner or a sewerage treatment plant) and another entity (for example, government). It is like a subsidy programme.



Recent decisions released in the draft Ten Year Plan 2012-2022 outline a good example of a cost-sharing framework

Bay of Plenty Regional Council's draft Ten Year Plan is currently out for consultation and outlines a \$45.5 Million budget already designated for land use change in the Lake Rotorua catchment.

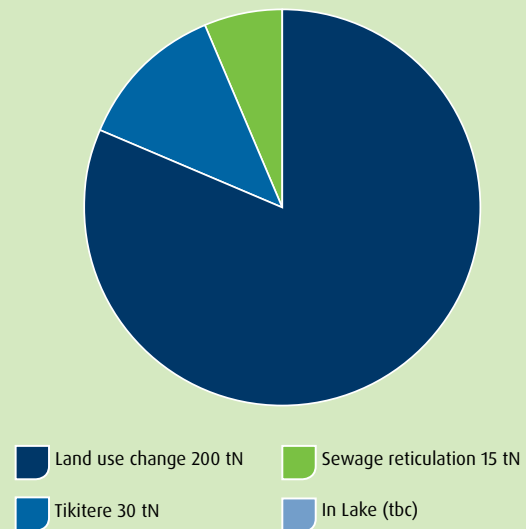
The Bay of Plenty draft Ten Year Plan 2012-2022 outlines the current plan to facilitate land use change using the \$45.5 million already allocated to the project through the Deed of Funding Agreement. This approach sees Bay of Plenty Regional Council working with our partners, landowners and industry to reduce nutrient loss from farmland by 200 tN/yr and reduce the amount of nutrients entering the lake through the purchase of nutrients.

Another good example of a cost-sharing framework is the Lake Taupo Protection Trust. The Trust was established in 2007 to administer public funds directed at achieving an improvement in the water quality of Lake Taupo.

The Taupo District Council, Waikato Regional Council, and the Crown agreed to provide funding of \$81.5 million to the Trust for this work to be undertaken.

The Trust uses the funds provided to encourage and assist land use change, purchase land as well as nitrogen in the Lake Taupo catchment, and to fund any other initiatives that assist landowners to reduce the nitrogen impact of their activities on Lake Taupō.

Ten Year Plan Funded nitrogen reduction in Lake Rotorua (tonnes)



REVERSE AUCTIONS

Reverse auctions are a competitive bidding system with a single buyer and multiple sellers. Unlike standard auctions in which multiple buyers compete to buy goods from a single seller, in reverse auctions multiple sellers compete to sell goods to a single buyer.

Reverse auctions can be used to provide funding to implement practices that reduce nutrient losses from pastoral land. They have been piloted and adopted in a number of areas in Australia for biodiversity outcomes and land retirement.

In theory, the bidding process gives participants the incentive to reveal the minimum compensation they are willing to accept to adopt or change management practices. Because the process is competitive, participants have an incentive not to inflate prices much beyond the minimum price they are willing to accept, as this may lead to not being selected into the programme at all.

Reverse auctions can be an effective tool for allocating funding in programmes with a limited budget. Funding is allocated to the most cost-effective applicants until either the programme has reached its funding allocation limit, or a break point in the cost-effectiveness of bids is reached.

STEWARDSHIP APPROACHES OR COMMUNITY-BASED WORK

Stewardship accords or community-based work are voluntary approaches where two or more parties agree to undertake a certain set of actions. They tend to be grass-roots initiatives where the community identifies that there is a need (for example, to reduce nutrients in a lake), and that they can undertake a practical intervention to do this. The Coast Care initiative is an example of a community-based intervention that implements a dune planting programme. A similar programme could be initiated through community groups around Lake Rotorua to construct, enhance or maintain wetland areas.



LAND RETIREMENT

Land retirement is where an entire farm or a portion of a farm is retired from agricultural use. Land retirement is often considered the best way to achieve permanent nutrient reductions, as land is converted to a lower, typically the lowest, nitrogen loss land use. Land retirement can take many forms, such as conversion to permanent forestry or to lifestyle or urban land use.

Land retirement can involve a number of actions, including:

- Voluntarily retiring part of a farm, usually sensitive land such as areas with steep terrain;
- Retiring the whole farm, including voluntary retirement where the landowner still maintains ownership but no longer farms the land; and
- Placing a covenant on the farm to permanently restrict land use and/or management into the future.

Land retirement can be achieved in a number of ways, including the direct purchase of land by government or local authorities. This land can then be re-sold with the requirement that a lower nitrogen loss land use be established.

How much would direct purchase of land actually cost?

A question commonly asked of the Regional Council is “how much would it cost to just buy out the farms in the Lake Rotorua catchment”?

It is very difficult to estimate direct purchase costs. Prices of farms vary considerably, depending on individual characteristics of the farm, alternative uses, current market values and what a buyer is willing to pay.

A basic estimate can be given using dairy farms as an example. With 4,569 hectares in dairy (effective area⁵) in the Rotorua catchment and using capital value estimates, the direct purchase cost would be approximately \$148 million.

If this area was substantially changed to lower nutrient activities it could be valued at approximately \$111 million.

If this area was changed to very low nutrient activities it could be valued at approximately \$41 million.

However, it is important to note that this direct purchase cost of approximately \$148 million would not be the only cost associated with land retirement. Other costs are still likely to be incurred (e.g. where land use changes are required or planned) and there could be other downstream financial impacts (e.g. job losses and regional economic losses through industry changes).

5

5 The effective area of a dairy farm is that area attributed to farming and grazing minus non-effective areas such as laneways, buildings, drains, hedgerows, waste areas and non-grazing areas.



*'Water quality and changing the way
land is used are complex issues in the
Lake Rotorua catchment.'*

Conclusion

Water quality and changing the way land is used are complex issues in the Lake Rotorua catchment.

Different people have different views of the problem; the science is continually evolving - problems and solutions require actions at every level.

Importantly, changing land use and land management in the catchment has the potential to negatively impact on individuals and communities.

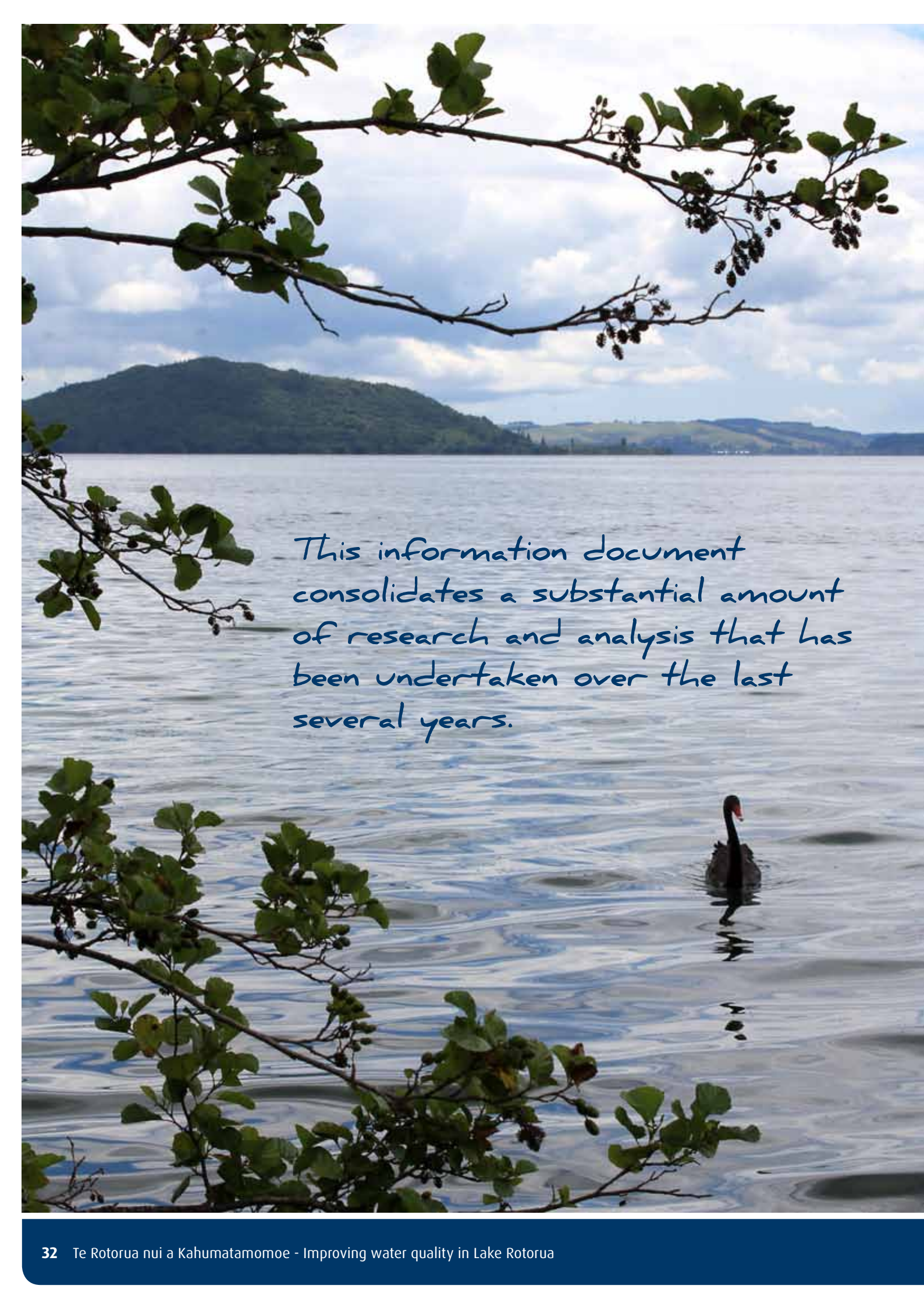
These factors make moving forward challenging, and have frustrated progress to date.

Recent decision-making has provided some certainty on the way forward. Regional Council has set a clear path to achieve the goals set by the community for Lake Rotorua.

It is now time to act, set clear targets and ensure all opportunities can be taken advantage of as they arise in the catchment.

The Regional Council has agreed to use a suite of evaluation criteria when assessing any specific activities that have been designed to reduce the nutrient load to Lake Rotorua. These are:

Cost-effectiveness	The amount of nutrient removal relative to cost is maximised
Certainty	A high degree of certainty that the predicted nutrient reduction will be realised
Timely	Nutrient reduction is achieved in an acceptable timeframe, noting this may cost more
Equitable/fair	Costs and benefits across the local, regional and national communities of interest are recognised and distributed accordingly
Sustainable	Nutrient reduction gains are sustainable in the long term
Delivery	Structure of the intervention is appropriate for the administration of any programme



This information document consolidates a substantial amount of research and analysis that has been undertaken over the last several years.

Supporting information

This information document consolidates a substantial amount of research and analysis that has been undertaken during the past several years. This includes work on how to reduce nutrient loss in catchments throughout the country, the economics of changing farm practices and detailed modelling on nutrients in the Lake Rotorua catchment.

If you are interested in finding out more on the information presented in this information document, a series of information sheets have been developed to provide a greater level of detail on issues such as the science behind water quality monitoring, land management changes and land use changes.

The technical reports that support this document are also available if you are interested in the research and analysis that underpins the approaches presented.

Both the information sheets and supporting technical reports are available to download at www.boprc.govt.nz

Key links

- National Policy Statement for Freshwater Management 2011 (Ministry for the Environment)
- Bay of Plenty Regional Water and Land Plan (Bay of Plenty Regional Council)
- Proposed Bay of Plenty Regional Policy Statement 2010 (Bay of Plenty Regional Council)
- Strategy for the Lakes of the Rotorua district (Te Arawa Lakes Trust, Rotorua District Council, Bay of Plenty Regional Council)
- Lake Rotorua and Rotoiti Action Plan 2009 (Te Arawa Lakes Trust, Rotorua District Council, Bay of Plenty Regional Council)
- Bay of Connections Regional Economic Growth Strategy (Bay of Connections)
- Bay of Plenty Forestry and Wood Processing Strategy (Bay of Connections)
- Rotorua Sustainable Economic Growth Strategy (Rotorua District Council)

*'In order to achieve what's required,
it is likely that significant changes will
need to be made.'*



Appendices

Appendix 1 - Continue on with what's being done approach

PROPOSAL

Continue with the current work programmes, making progress where possible and taking advantage of opportunities as they arise.

EXPLANATION

There is already a large package of works dedicated to improving water quality in Lake Rotorua. The Funding Deed with the Central Government has set a clear goal to reduce nitrogen by 170 tN/yr through land management and land use change within the catchment. An annual work programme for this has been approved and is based on funding of \$9.5 million through to 2017.

The Funding Deed also provides for the implementation of other significant actions for Lake Rotorua and its catchment. These actions will collectively help to reduce the nitrogen (and phosphorus) loads in the lake, ultimately improving water quality.

EXAMPLE

The land use and land management change intervention in the Funding Deed is the most significant action associated with reducing nitrogen.

The approach to date for achieving land use and land management change has been a mix of funding activities on individual properties and considering nutrient reduction agreements. However, progress in achieving changes across the Rotorua catchment has been very slow. Only five agreements are in place so far, securing a total of four tonnes of nitrogen.

Nitrogen reductions from land use change within the catchment have been planned for 2012 and will be delivered by the Regional Council's Land Management Group. The goal for 2012 has been identified as securing a minimum of five tonnes of nitrogen. Staff intend to do this by:

- Improving landowner awareness (for example, through targeted workshops and group liaison); and
- Engaging directly with landowners (for example, through the Nutrient Reduction Fund⁶ and one-to-one approaches to landowners).

Other opportunities to reduce nitrogen losses from the Rotorua catchment are also being investigated. For example, there is an estimated 900 hectares of mature gorse in the Lake Rotorua catchment which is thought to be leaching up to 43 tN/yr⁷. Regional Council is currently looking at what the most efficient, effective, fair and practicable ways of managing this gorse might be.

Bay of Plenty Regional Council now operates two alum dosing plants in the Utuhina and Puarenga Streams contributing to Lake Rotorua.

These dosing plants are designed to reduce phosphorus reaching the lake and any residual alum will be available for binding of phosphorus in the lake.

Recent reports (February 2012) suggest that the alum dosing programme is having a beneficial effect on the lake water quality. Monitoring of this programme will be on-going. This will confirm the long-term benefits of the dosing programme. It is important to note that different seasonal effects can contribute to positive results.

What could this approach mean for you?

The current package of work imposes little change on farmers' current practices. If you are a landowner interested in reducing nitrogen losses on your property, you will be able to work with the Regional Council and agree on the best ways of doing so.

⁶ The Nutrient Reduction Fund is a fund available for landowners to take action on their farms to improve land and reduce nutrients.

⁷ Male, C et al (2010) Quantification of nitrogen leaching from Gorse in the Lake Rotorua catchment.

Future decisions on the work programme (such as through the Regional Policy Statement, and implementing the National Policy Statement for Freshwater Management) are likely to see new policies developed. These new policies may result in requiring or promoting changes to the use of land and its management.

The current package of work on lakes that may impact on landowners includes:

- Updating the Strategy for the Lakes of the Rotorua District;
- Setting specific policies for water quality outcomes through the Proposed Regional Policy Statement;
- Identifying water quality objectives in the Regional Water and Land Plan; and
- Putting rules in place to limit and reduce the nutrients entering the lakes.

Costs and who might pay for this

Under the Funding Deed, \$9.5 million has been budgeted for our current work programme. It is difficult to determine whether \$9.5 million is enough to achieve a total reduction of 170 tN/yr.

The five agreements that have been negotiated during the past three years in the Lake Rotorua catchment have cost an average of \$180/kg of nitrogen. This means that it costs \$180 for every kilogram of nitrogen removed from the system.

These costs are dependent entirely on individual agreements and the circumstances of the individual farms. However, the agreements to date do suggest the total cost of achieving 170 tN/yr could escalate well beyond the \$9.5 million budget.

A note on costs

An indication of the costs involved in implementing each of the approaches has been provided. It is important to note that these costs have been assessed in different ways, using different methods. They are not directly comparable between approaches and are provided just to help the reader understand the implications of each approach.

It is also important to note that no assumptions or assessments have been made about who will actually pay these costs.

Reaching the target

Given that this approach is not currently on track to achieve the goal of 170 tN/yr outlined in the Funding Deed, it is unlikely that it will achieve 320 tonnes by 2022. However, continued progress will be made and nitrogen loads will continue to be decreased.

How could this be achieved?

Any changes to land use or land management practices would be achieved through assistance from the Regional Council. This approach can only work with the voluntary co-operation of landowners.

Benefits

- Allows change by those who want to change.
- A collaborative approach with landowners means greater willingness to comply.
- Consistency in administration as it continues with implementation of the Funding Deed.
- Community is familiar with the goal of achieving 170 tN/yr in 10 years.
- Allows for flexibility in responding to new science, as well as new technology and information.

Impacts

- Very slow uptake so far which means it is unlikely to achieve 170 tN/yr.
- Won't reach the overall reduction target.
- May require a change to the target.

Appendix 2 - Look for other alternatives approach

PROPOSAL

Retain existing land uses in the Lake Rotorua catchment and look to other alternatives for removing nitrogen from the lake system.

EXPLANATION

Changing land management practices or the way land is used is likely to be the most cost-effective ways of reducing nitrogen load into Lake Rotorua. However, these approaches will result in significant changes across the catchment, particularly where a high use land activity such as dairy farming is converted to a lower use activity such as forestry or lifestyle.

There could be other ways to remove nitrogen from the system, although these may require large-scale construction and engineering works. For example, one option that has been explored is building wetlands throughout the catchment. There are likely to be other solutions, but all will be costly.

EXAMPLE

A range of different types of wetlands have been analysed for their ability to remove nutrients from the water of Lake Rotorua. These include restoring natural wetlands, constructed wetlands, seepage wetlands and floating wetlands.

Wetlands have the ability to remove approximately 300kg N/ha to 700 kg N/ha each year. There is a limited amount of suitable space for constructing wetlands or restoring wetlands – approximately 200 hectares have been identified in the Rotorua catchment. Floating wetlands, however, could be located in numerous areas throughout the lake and have the potential to reduce large amounts of nitrogen.

What could this approach mean for you?

This approach is about trying to minimise changes required of landowners. It would be achieved by looking at new and innovative ways of reducing nitrogen losses throughout the catchment.

Costs and who might pay for this

Costs to fund innovative and new ways of reducing nitrogen are hard to assess, however they are likely to fall on ratepayers and tax payers.

Wetland costs

The costs involved in creating or regenerating wetlands can be extremely high, depending on the type of wetland being rehabilitated or constructed.

Total establishment costs have been estimated at \$130,000 to \$270,000 per hectare for constructed wetlands and restoring natural wetlands. For floating wetlands total establishment costs have been estimated to be as high as \$2.1 million to \$4.5 million per hectare, although these estimates have only been based on the construction of a single wetland.

Using the *net present value of costs of wetland creation and restoration over 50 years, the cost per kilogram of nitrogen with this approach is approximately \$20 - \$60/kg for restoring natural wetlands and \$79/kg to - \$400/kg for constructing wetlands.*

Reaching the target

While it is unlikely that enough wetland could be built to remove the target 300 tonnes of nitrogen, it is possible that wetlands could be combined with other actions to reach the water quality target.

Potential areas of wetlands in the catchment for treating nitrogen

	Total area available in catchment (ha)	Nitrogen removal (kg/ha)	Potential nitrogen reduction (tonnes)
Constructed wetlands	220	368	81
Natural wetland restoration	14	289	4
Seepage wetland restoration	7	323	2
TOTAL			87
Floating wetlands		714	

How could this be achieved?

Lots of people have blue sky ideas and inventions for achieving better water quality without having to impact on current landowner activity. Innovation is normally achieved through incentives and without regulatory intervention, such as through innovation hubs, research and development funds and partnerships.

This approach would encourage economic development and the growth of a new economy focused on an industry such as tourism. Grants and assistance packages could be set up for low nitrogen businesses such as ecotourism or the development of wetlands.

Benefits

- Ensures pastoral land in the Rotorua catchment can be retained.
- Minimises impacts on individuals as well as local and regional jobs.
- Allows for flexibility in choices made.

Impacts

- Potentially the most expensive option.
- May take time to find the best suite of approaches to deliver the target reduction.
- Unlikely to meet the desired timeframes.
- Uncertain how sustainable the approach will be over the long-term.
- Will require significant on-going maintenance costs.
- Does not target the source of the problem.

Other ideas that have been raised as potential options to investigate:

- Treat nutrients once they are already in the lake – for example, a common practice in the United States of America is to dose alum into lakes to bind nutrients so they are not available in the system
- Purchase pastoral farms and replace with a network of world-class eco-tourist adventures and destinations around the lake (trekking, bike trails, hikes, horse trails, camping).
- Increase forestry in the catchment and expand the industry to incorporate manufacturing, processing and marketing, with a focus on wood products and fibre products.
- Invest in research that focuses on innovation and new technologies, such as productive grasses that might be able to thrive in a low nitrogen environment or alternative high value products or crops that have a reduced impact on lake water quality.

Image Credits:

Pages 1, 2, 12, 27, 30 Bay of Plenty Regional Council

Pages 6, 8, 10, 15, 16, 18, 20, 22, 32, 34 Simple Designs

Page 28 © Lloyd Homer GNS Science



Bay of Plenty Regional Council
5 Quay Street
PO Box 364
Whakatāne 3158
NEW ZEALAND

Website: www.boprc.govt.nz

Phone: 0800 884 880
Fax: 0800 884 882