61stth LakesWater Quality Society Annual Report: 2022

It is my pleasure to present my third annual report for the LakesWater Quality Society.

Review of 2022

Significant actions and contributions from the Society during 2022 have included the following:

- Input into the Science Review for Lake Rotorua. This is required each 5 years as part of the Plan Change 10 process.
- Contributing to the Dama Wallaby Regional Coordination Group and the ongoing management of wallabies in the greater lakes' catchment areas.
- The organisation of our 2022 Symposium (which is considered in more detail further on in this report)
- Proposal to the Rotorua Te Arawa Lakes Strategy Group regarding the need for a science and technical review to refocus the science and restoration programme.
- Self-learning programme for the Executive Committee to enhance the understanding of lake issues and cause and effect relationships.
- Developing an index of the LWQS Symposium Proceedings to facilitate easier access to the wealth of information contained in the Society's symposium proceedings.
- Preparation of an advice document from the Lakes Chair regarding key issues for the Lakes and future research recommendations.

Another aspect to 2022 has been to continue monitoring of the considerable work being undertaken by the BoP Regional Council, Te Arawa Lakes Trust and the Rotorua Lakes District Council related to the lakes' restoration programmes. The Society has been represented at a number of the Rotorua, Te Arawa Lakes Strategy Group meetings and contributed to the ongoing development of the overall lakes restoration programme.

LWQS Position

At the LWQS AGM in 2021, I presented on what we called a Strategic reset in response to:

- a change in the expectation of our communities for more care for the environment,
- the need to take a more integrated view to environmental, cultural, social, economic issues and development,
- changes to the National Policy Statement – Freshwater (NPS-FW) being introduced by the Government.

The key elements of the strategic reset consisted of:

- Encouraging proactive engagement in the NPS-FW with a focus on managing future risks.
- Advocating for a robust science programme which includes future risks and catchment dynamics.
- Incorporating mātauranga māori in our programmes and activities.
- Safeguarding the 8-lake system of the Lake Tarawera complex.
- Pest Management

- Catchment development (urban, forestry and diversified agriculture) and their impacts on lake water quality.
- Develop a score card to ensure transparency on the progress to meeting agreed targets to 2032 and beyond.

We also presented a scope setting document to clarify what the Society wants to achieve and how it wishes to interact with the community (Figure 1).

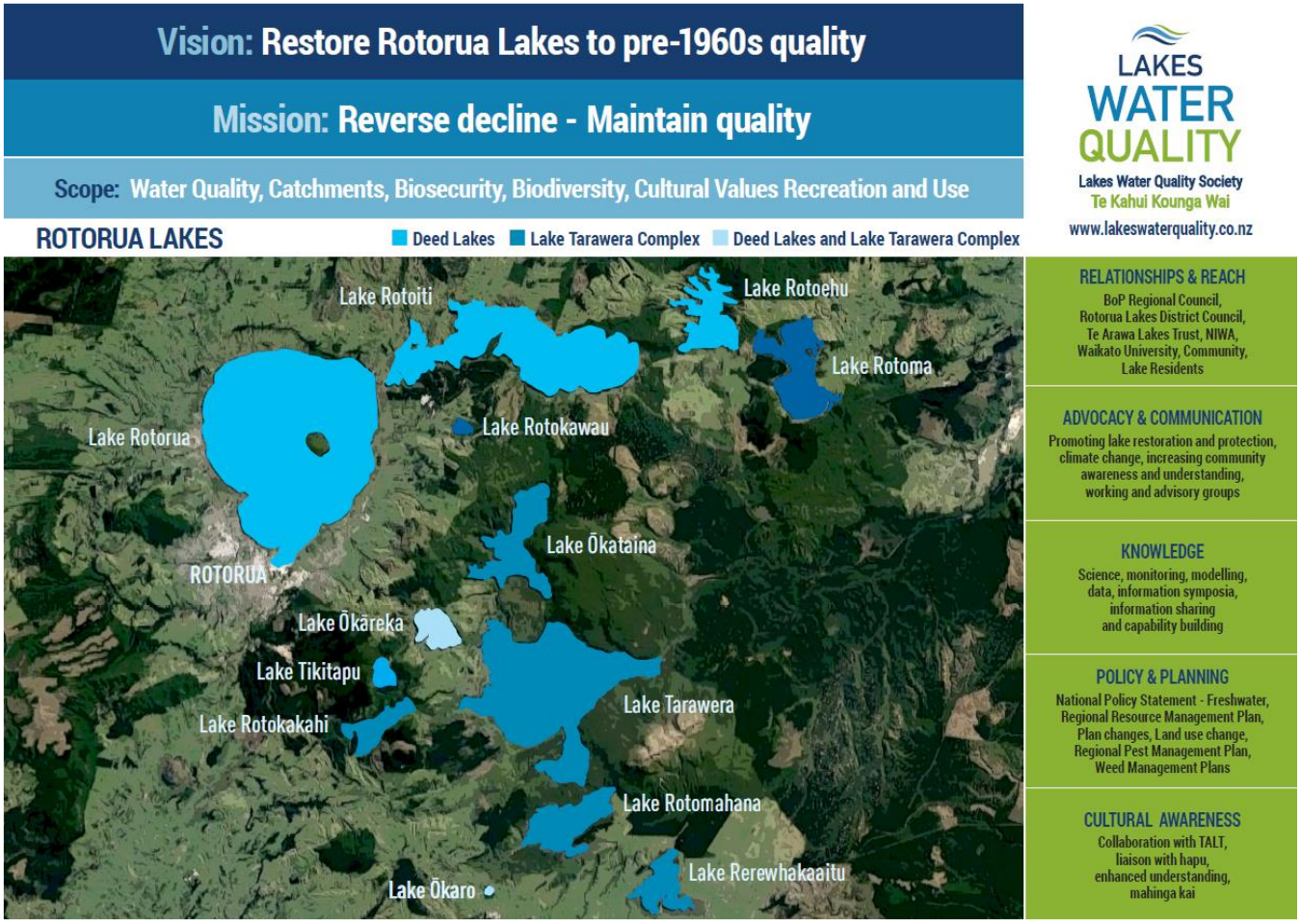

Figure 1. Scope setting for LWQS

Our focus for 2023 will continue with these strategic directions. Though we also have a strong interest to get our message out more into the community and to encourage more community engagement with the critical issues of lake restoration. There has been a tendency for our members, friends, and local constituency to be adsorbed into secular issues which at times may have got in the way of the fundamental need to value our water resources for a wide range of reasons and take a broader perspective on the actions needed.

Symposium 2022

During November 2022, we were finally able to hold our Symposium "Get on the Boat – Lake Restoration – Changes, Challenges and Maintaining Momentum". We were overwhelmed with the response both in terms of the willingness of our presenters to give so freely of their time and knowledge and the level of attendance by symposium delegates. Over the two days, we had over 125 people attend and 36 presentations – which covered topics related to the state of New Zealand's freshwaters, legislative and policy changes, enhancing biodiversity, meeting our restoration targets,

climate change, impacts of land use change to forestry, and integrated catchment management and policy implementation.

Some to the key take home messages from the Symposium were:

- Research needs to continue to develop integrated land and water models to better predict what activities on land affect which water values and the effect of climate change, urban development pressures, and intensification of land use.
- Essential Water reforms have significantly elevated recognition of freshwaters and the link between these resources and protecting the health and wellbeing of the wider environment through Te Mana O Te Wai – where the emphasis is now on protecting the mauri of the freshwater and encouraging participation of tangata whenua.
- To achieve the nitrogen load reduction for Lake Rotorua of 320 tonnes of nitrogen by 2032 (755 tN to a sustainable load of 435 tN) – there is still a long way to go and of course to achieve the target TLI of 4.2 for Lake Rotorua there is still considerable uncertainty about cause and effect – acknowledging that the Rotorua Lakes are some of the most researched water bodies both nationally and internationally.
- The impact of invasive pests (both plant and animal) poses considerable risk to the long term restoration of the Lakes and ongoing work on control, eradication and prevention are critical going forward.
- To meet future demands of tighter environmental regulation, the need to supply food and protein, protect water quality and reduce the impacts of climate change the primary sectors needs to change and look at a more diversified product portfolio but to do this there needs to be increased investment in market channels and supply chain infrastructure.

There were many more highlights – but these will be covered in the Symposium Proceedings which is currently being compiled. We are hoping that this will be competed soon.

Lake Health

Each year we look forward to the latest results from the lake water quality monitoring and biodiversity indicators provided by the Rotorua Te Arawa Lakes Strategy Group. The latest results are provided below.

Lake statistics (water quality attributes)

Rotorua Te Arawa Lakes Health Summary 2021/2022

Bay of Plenty Regional Council, Rotorua Lakes Council and Te Arawa Trust.
Working as one to protect out lakes with funding assistance from Ministry for the Environment

Lake Statistics (Water Quality Attributes)

Lake	Trophic Level Index		National Policy Statement for Freshwater Management (NPS-FM) Lakes Attributes				10 Year Trends				Contact Recreational Attributes		
	TLI 2021/22 (TLI Target)	TLI 3 Year Avg	2021/22 Total Nitrogen Median	2021/22 Total Phosphorus Median	2021/22 Chl-*a* Median	2021/22 Chl-*a* Max	Total Nitrogen	Total Phosphorus	Chl-*a*	Water Clarity	Blue-green health warning	Cyano-bacteria Biovolumes 2019-22	Swimming water quality – faecal[1]
Ōkāreka	3.2 (3.0)	3.1	B	A	B	A					N/A	N/A	Good
Okaro	5.0 (5.0)	4.6	D	C	D	D					Yes	D	Good
Ōkataina	2.5 (2.6)	2.6	A	A	A	A					N/A	N/A	N/A
Rerewhakaaitu	3.1 (3.6)	3.3	B	A	A	A					N/A	N/A	Good
Rotoehu	4.4 (3.9)	4.3	B	C	C	B					Yes	D	Excellent
Rotoiti	3.8 (3.5)	3.7	B/B	C/C	C/C	A/A					Yes	B	Excellent
Rotokakahi*	*3.6 (3.1)*	*3.5*	*B*	*B*	*B*	*A*					N/A	N/A	N/A
Rotomā	2.5 (2.3)	2.4	A	A	A	A					N/A	N/A	Good
Rotomahana	3.7 (3.9)	3.6	B	C	B	A					N/A	N/A	N/A
Rotorua	4.4 (4.2)	4.3	B/B	C/C	C/C	B/B					Yes	A	Poor
Tarawera	2.7 (2.6)	2.7	A	A	A	A					No+	N/A	Excellent
Tikitapu	2.7 (2.7)	2.9	B	A	A	A					N/A	N/A	Fair

Very Likely Improving; Likely Improving; Indeterminate/Uncertain; Likely Worsening; Very Likely Worsening

*Italicised figures are based on Te Wairoa Stream monitoring and a three-parameter TLI (no Secchi disk).
[1] NPS-FM Human contact attribute based on 95 percentile E.coli during the bathing season.
+ Lake Tarawera is not routinely monitored, however ad-hoc samples collected in response to public concern, has resulted in health warnings in past seasons.

What is The Trophic Level Index?

The Trophic Level Index is a number used to indicate the health of lakes in New Zealand. As a general rule of thumb the higher the number, the worse the water quality in the lake.

The number is calculated using four separate water quality measurements – total nitrogen, total phosphorous, water clarity, and chlorophyll-*a*.

National Policy Statement for Freshwater Attributes

To protect ecosystem and human health, attributes are measured to help determine the extent to which specific values are provided for. There is a range of different physical, chemical, microbiological and ecological attributes, and one attribute may apply to more than one value.

Attributes are graded A-D (E), with the National Bottom Lines set for some attributes. 'A' indicated ecosystems are healthy and resilient, or low risk to human health; to 'D' aquatic communities are in a persistent degraded state, or risk to human health from contact recreation is high.

Contact Recreation

Bathing and contact recreation sites are monitored during Summer throughout the Rotorua Lakes, to inform the public when and where it is safe to interact with the water. Not all lakes, or all bathing sites can be monitored, so popular and culturally significant sites are prioritised. Sites can be graded from Poor to Excellent based on attribute statistics in the National Policy Statement for Freshwater (NPS-FM).

Cyanobactreria are monitored in lakes with a history of algal bloom activity. Health warnings are issued by Toi Te Ora based on the volume of potentially harmful cells in the water, and sites are graded according to the NPS-FM.

A	Excellent
B	Good
C	Fair/Moderate
D	Poor

ROTORUA TE ARAWA LAKES PROGRAMME

Lake statistics (Ecological attributes)

Rotorua Te Arawa Lakes Health Summary 2021/2022

Bay of Plenty Regional Council, Rotorua Lakes Council and Te Arawa Trust.
Working as one to protect out lakes with funding assistance from Ministry for the Environment

Lake Statistics (Ecological Attributes)

Lake	Lake Submerged Plant Index[1]				Kōura				Kākahi	Catfish	
	LakeSPI	LakeSPI Native Index	LakeSPI Invasive Index	Invasive Submerged Plants Present	Abundance	Mean CPUE	Trend	Reason for Change	Abundance	Abundance	Trend
Ōkāreka	High	B	C	d	Moderate[3]	5.8		N/A	Present[5]	Absent[5]	N/A
Okaro	High	C	C	c	Absent[3]	0	N/A	N/A	Absent[5]	Absent[5]	N/A
Ōkataina	High	B	C	d	Abundant[4]	15.4		N/A	Present[5]	Absent[5]	N/A
Rerewhakaaitu	Moderate	C	C	b, d	Present[4]	0.9		N/A	Present[5]	Absent[5]	N/A
Rotoehu	Moderate	C	C	a, c, e	Present[2]	1.3		Declining water quality	Moderate[5]	Absent[5]	N/A
Rotoiti	Poor	C	C	a, b, c, d, e	Moderate[1]	6.5		Catfish predation	Abundant[1]	Abundant[1]	
Rotokakahi*	Moderate	C	C	c	Moderate[4]	7.5		N/A	Abundant[5]	Absent[5]	N/A
Rotomā	High	B	C	d	Abundant[1]	22.6		N/A	Abundant[5]	Absent[5]	N/A
Rotomahana	High	B	C	a, b	Absent[4]	0	N/A	N/A	Absent[5]	Absent[5]	N/A
Rotorua	Moderate	C	C	b, c, d	Moderate[1]	9.5		Catfish predation	Abundant[1]	Common[1]	
Tarawera	Moderate	C	C	a, b, c, d, f	Abundant[1]	24.7		Unknown	Abundant[5]	Absent[5]	N/A
Tikitapu	High	B	C	d	Moderate[4]	2.7		White Tail Disease	Absent[5]	Absent[5]	N/A

Trend Key: Improving; Stable; Worsening

[1] *based on LakeSPI survey data collected between 2016 and 2022.*
Invasive Submerged Plants: a) Ceratophyllum; b) Egeria; c) Elodea; d) Lagarosiphon; e) *Potamogeton crispus*; f) *Ranunculus trichophyllus*
[1] Seasonal monitoring; [2] Spring and Summer monitoring; [3] 5-10 yearly monitoring; [4] Baseline survey only; [5] Observational data only
* Anecdotal evidence suggests that hornwort has established in Lake Rotorua, although it has not been picked up in LakeSPI surveys.

Lake Submerged Plant Index (Lake SPI)

The LakeSPI programme monitors macrophytes (aquatic plants) which are used to classify the ecological condition of lakes. The ecological status of a lake can be characterised by the composition of native and invasive plants.

'LakeSPI' index is a synthesis of components from both the native condition and invasive impact condition of a lake, and provides an overall indication of lake condition. The higher the score the better the condition.

Kōura and Kākahi Monitoring

Kōura and Kākahi monitoring is carried out by Dr Ian Kusabs of Kusabs and Associates Ltd. Kōura monitoring is undertaken on all the Rotorua Te Arawa Lakes.

Regular kākahi monitoring surveys are undertaken in Lakes Rotorua and Rotoiti to monitor the long-term effects of lake restoration initiatives on kākahi populations in the shallow littoral zone of these lakes.

Catfish Monitoring

Catfish were first detected in Lake Rotoiti in March 2016 and in Lake Rotorua in December 2018. Surveys have been undertaken to detect their presence in the other lakes. So far they are limited to Lakes Rotorua and Rotoiti.

LakeSPI / Cultural / Catfish	
A	Excellent/Abundant/Absent
B	High/Moderate/Present
C	Moderate/Present/Common
D	Poor/Absent/Abundant

ROTORUA TE ARAWA LAKES PROGRAMME

Figure 2. Overview of lake water quality and biodiversity parameters for the 2021 – 2022 year.

Looking through these results, we see that one lake (Lake Rotomā) has declined in TLI when comparing the three-year average values between the 2021/2022 and 2020/21 years. However, over the same time periods 7 Lakes showed a small decline in the yearly average TLI values (comparing the actual reported values between 2020/21 and 2021/22 (Lake Ckāreka, Okaro, Rotoehu, Rotoiti, Rotokakahi, Rotomā, and Rotomahana). Based on the 3-year average TLI values, most Lakes were indicating an improvement in TLI. Though of concern is the likelihood of increasing phosphorus over a 10-year period in many lakes (as indicated by the red coloured cells in the top graphic under 10-year trends- Total Phosphorus – very likely worsening). This same trend in phosphorus was reported last year as well.

The Submerged Plant Index (SPI) data across many of the Lakes showed improvement – which tends to indicate that invasive plants are reducing in cover of the lake beds and native plants are increasing. This is very positive and in part is likely due to the weed spray programmes being implemented and the management of hornwart in a number of lakes. We are looking forward to seeing this trend continue. It is pleasing to see the SPI for Lake Tikitapu has moved from moderate to high – indicating an improvement in the reduction of invasive pest weeds for this lake.

Lake Tarawera Complex

The ongoing effort into the Lake Tarawera Restoration Plan and actions for both the inner and outer catchments has also been an area of interest to the Society during 2022. The challenge here being able to develop management strategies that consider the effects of 7 contributing lakes when only 2 of these lakes (L. Ōkāreka and Okaro) are part of the current "Deed" and restoration programme. There is significant scope for the LWQS to be involved in influencing actions that will determine the long-term water quality of the Lake Tarawera complex, especially as the NPS-FW process continues to develop during 2023 and into 2024. We would encourage the stakeholders in the Lake Tarawera catchment to become familiar with and engage in the public processes for setting water quality objectives for this system as part of the NPS-FW implementation.

Biodiversity and biosecurity

The management of pests both within the lakes and in the catchments has remained a focus for the Society during 2022. The Regional Council is currently rolling out a programme of work to contain the spread of wallabies beyond a recognised containment area and are investing significantly in this area with support from the Ministry of Primary Industries. LWQS is represented on the Dama Wallaby Regional Coordination Group which met four times during 2022. This is a critical project to monitor as despite considerable effort going into the wallaby containment programme, there is still a significant risk that the wallaby population is continuing to spread. The programme has included the installation of two major fences, one on SH 33 north of the bridge at Okere Falls and the another south along SH 5 from Whakarewarewa.

Catfish in Lakes Rotoiti and Rotorua remain a significant concern to the Society though numbers appear to have stabilised (around 13,000 fish caught over the last year – which is a reduction on the previous year). Furthermore, there is also a strong indication that this pest fish is contributing to a decline in kōura numbers – particularly in areas of Lake Rotoiti. Work is being undertaken on the feasibility of introducing sterile male fish into the lake which would outcompete fertile male fish over time and potentially markedly reduce the population of catfish. We look forward to seeing how this work progresses. The Te Arawa Lakes Trust Catfish killa programme continues and netting is increasing in intensity. You can check on what is going on in this area by visiting the Catfish Catch Report – Community Dashboard at the Bay of Plenty Regional Council web site (see the details below).

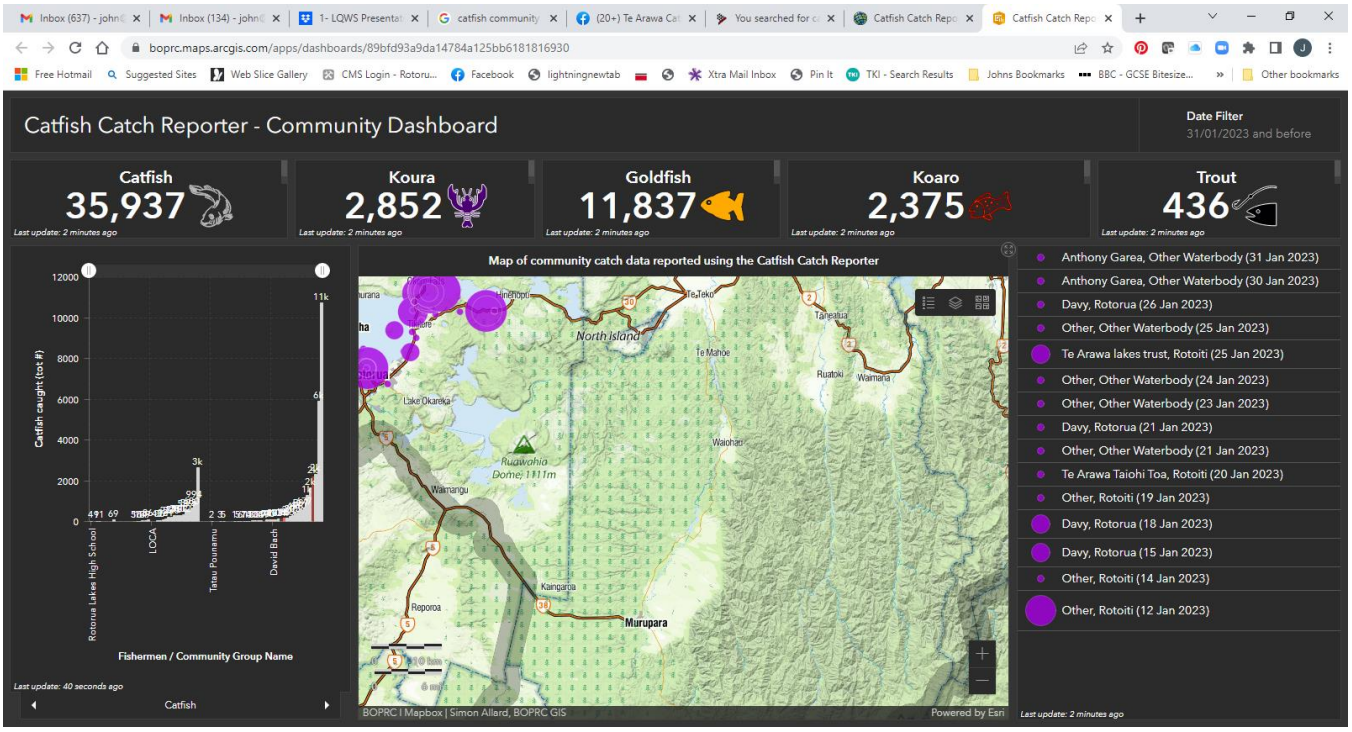

Figure 3. Reporting of catfish catches by the community.
https://boprc.maps.arcgis.com/apps/dashboards/89bfd93a9da14784a125bb6181816930

Over the period 2015 – 2020, the LakesWater Quality Society worked with the BOPRC to include in the Regional Pest Management Plan rules for all boat users to check, clean, drain, dry and then certify that their boats are free from freshwater pest fish and weeds before entering the Rotorua Lakes. The monitoring of compliance with these new rules has now been going for two years. We will be interested to see how these compliance checks are progressing.

When it comes to lakeweeds, LWQS is pleased to see that more effort is going into controlling these pest plants in a number of the lakes through growing investment by LINZ. Though there was an obvious issue with the 5% rule in enclosed bays (i.e., only 5% of the area of enclosed bays can be sprayed at one time). I understand that this is being now being changed, to allow greater areas to be sprayed particularly in sensitive high use areas such as Okawa Bay in Lake Rotoiti where the rule caused concern and limited the effectiveness of weed control programme.

Research and Capability Building

During 2022 we invested considering time and effort to enhance the capability of the Committee through a self-learning process championed by Stuart Corson. This consisted of a series of presentations from key science providers. These presentations provided excellent summaries of key issues affecting the lakes and assisted the committee in identifying key issues that may need to be addressed by the Society over the next 5 years.

As part of this process, the Society also engaged Waikato University, through Assoc Prof Deniz Ozkundakci to undertake two projects: (i) the indexing of the LWQS Symposium Proceedings and, (ii) an advice document on emerging threats for the Rotorua Te Arawa Lakes. This second project will assist to developing an appropriate focus for future advocacy work by the Society. These projects are nearing completion and members will be advised further on both soon.

The Year Ahead

The Society

Overall, 2022 has brought the Society several challenges, the postponement of our Symposium being one of the more significant. Furthermore, as iwi take on more responsibility for the management of the lakes in a range of different ways, this is influencing how our group continues to input into the overall Lake management process. At the heart of the role of LWQS is our advocacy, on behalf of the whole community. Furthermore, this advocacy is based on best quality science to drive the most pragmatic solutions to maintaining high water quality and ecosystem health in all the Rotorua lakes – irrespective of who is managing the process. So, with this in mind, the Society has a key enduring role to ensure that these goals are achieved.

The Society is also interested in the future of Rotorua Te Arawa Lakes Strategy Group (RTALSG). Over the last 10 plus years the Strategy Group has been responsible for administering the funds for lake restoration and coordinating these efforts. But as we move into the next phase of the restoration programme there is potentially an increased role for LWQS by being more directly involved with this group. LWQS participation would ensure that there is effective community voice at the table and more independent ongoing scrutiny of the overall programme. Such scrutiny and transparency will add markedly to the process of the Strategy Group meeting its goals and that actions are embedded for the long-term protection, management and use of the Lakes. The Society presented to the RTALSG in April 2020 on:

1. The Terms of Reference of the Rotorua Te Arawa Lakes Strategy Group are formally reviewed to consider regulation changes (such as Three Waters, the implementation of Te Mana o te Wai, and revisions to the Land and Water plan due to the NPS-FW).
2. A technical and scientific review is undertaken for the whole Rotorua Te Arawa Lakes programme and to consider the pathway ahead for the next 10 years for all the Rotorua Te Arawa lakes.

The minutes of the April meeting of the RTALSG indicate that a review is to be undertaken and that Te Arawa Lakes Trust is to lead this and that there is an expectation that the LWQS would contribute to this process. To date there has been no further invites to LWQS to participate in this process. We are looking forward to seeing this process and having the opportunity to be involved in it.

Having to meet these challenges, has at times put more pressure on your Executive Committee to adjust. However, the committee has remained committed to the overall cause and worked its way through these challenges as they have arisen. I personally, would like to thank the Executive Committee for their input and support for the activities of the Society throughout 2022. Furthermore, I would like to thank Stuart Corson for his input into the self-learning process and the series of lectures that were arranged for the committee. I would like to extend a special thank you to Marcel – who on many occasions has been my right-hand man and assisted me markedly with the Symposium, keeping track of our finances and acting as a sounding board.

Also thank you to all our members. Your interest and support for the work of the Society is appreciated. It is with you, and with your support, that we have a strong voice in a range of circles which in turn ensures that we have some influence!

I would also like to acknowledge all the support we get from the range of relationships we have with different organisations: Te Arawa Lakes Trust, BoP Regional Council, Rotorua Lakes Council, Local Community Boards, local ratepayers, and community associations, NIWA, University of Waikato and the local community. More than ever, to make progress on issues like water quality, it takes a team effort, and I can only encourage the team to remain vigilant and active and continue to act as a strong voice for the Lakes.

John Gifford
Chair, LWQS