RESULTS AND EXPERIENCE IN AUDITING MITIGATIONS SPECIFIED IN A FARM NMP AS PART OF THE CATCHMENT PLAN FOR LAKE REREWHAKAAITU

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Abstract
Lake Rerewhakaaitu, near Rotorua is surrounded predominantly by dairy farms and farm practices are encouraged that protect lake water quality. A series of Sustainable Farming Fund projects, commencing in 2002 have highlighted and indeed advanced the awareness of practical steps that pastoral farmers in the catchment can take to improve lake water quality. The end result is the lake Catchment Plan which is being prepared by the farmers.

On- farm mitigations are a key component of catchment plans. These mitigations need to be audited independently to 'assure the Regional Council and the farmers themselves that actions on mitigations are taking place. An audit procedure was designed by the Service providers' team and agreed to by the farmers and Regional Council. Each farmer agreed to a list of mitigations in 2010 with a completion date set at June 2015. The first audit of these mitigations was completed in 2012, by the auditor visiting each farm and assessing progress.

Progress was determined by what percentage of each mitigation had been achieved in total, partly or not started. Totals for all farms were added up and a catchment % calculated. 49% of the agreed mitigations had been achieved completely, 13% achieved >50%, 8% achieved <50% and 30% were not started.

There were many reasons why mitigations on individual farms had not commenced or been completed. For example, effluent nutrient analysis and measuring effluent irrigation depth was in the 'still to do' box and reductions in P fertilizer were common, but they hadn't shown up in reduced soil Olsen P levels as yet. An excellent season for pasture growth had negated the need to implement new technologies such as Eco-N and substantial capital costs were a constraint for some farmers.

The value of this auditing approach is that farmers can see and in some instances measure progress, neighbours can discuss and combine efforts to monitor mitigations and the Regional Council can be assured that 'down on the farm', progress is being made.

A further audit will be done before this phase of the Rerewhakaaitu project is completed in 2015. New mitigations will be added as the need arises and we are confident that the 49% completion total will increase substantially.

Introduction

Lake Rerewhakaaitu (meaning the lake of "wandering spirits") is one of 12 lakes that come under the umbrella of the Rotorua Te Arawa Lakes. As such, the farmers in the catchment are charged with safeguarding the lake water quality (the Trophic Level Index status of the lake). It is a shallow lake, having an average depth of 7m, an area of 740ha and a catchment of 3,816ha (McIntosh et al 2001). The catchment is predominantly in dairy farms and as such is unique in its land use in New Zealand. The farmed catchment is near to completing its third Sustainable Farming Fund (SFF) project, the first one commencing in 2002 (Parker, 2006) and the second in 2006 (Parker, 2010). In addition to the SFF funding, the Bay of Plenty Regional Council (BOPRC) has supported this project from day one and has provided the funding for this audit.

The farmer's affinity with the lake and lake activities are huge. There has been a good working relationship between the farmers and the Regional Council, and also an excellent relationship with the science providers. Progressively, farmers have introduced Best Management Practices (BMP's); they have received technical and other information from farmer meetings, newsletters and guest speakers and been well informed on industry matters. No one farmer or group of farmers has dominated the projects, so there is confidence in the discussion within the project. These discussions have been robust from time to time. The farmers, Regional Council staff and science advisors have worked through issues and developed nutrient management plans (NMP). These NMPs which will in total become the main part of the catchment plan and involve mitigations on each farm to reduce nutrient loss to waterways and the lake. These are then audited to ensure action is occurring on the ground. .

Method

There are several auditing programmes in the workplace that are used on farms, but none of them met our requirements and they were generally too comprehensive for our catchment needs. The auditing programme and procedure was designed by the project science providers, and then endorsed by the Lake Committee and Regional Council. Each farm was visited by one of the science providers in 2010/2011 and on- farm mitigations were agreed between the farmer and science provider. These mitigations were considered to be implemented over the next few years to June 2015.

The audit took the form of meeting the farmers individually on their properties, discussing and agreeing on mitigation progress and a farm walk/drive. The audit was completed between May and July, 2012. Progress was determined by what percentage of each mitigation had been achieved in total, partly or not started. Reasons for lack of progress were discussed and where applicable, advice was sought. New mitigations were listed and their progress noted for the next farm visit. Totals for all farms were added up and a catchment % calculated. This project is voluntary by the farmers and all but one farmer in the catchment is involved. In fact, such is the interest in the project that several farmers outside the catchment are taking a very hands-on approach to their own mitigations.

For the purposes of the audit, mitigations were considered under a range of categories (Table 1).

Table 1. Mitigation category and examples of each.

Category	Example
Effluent management	Effluent analysis & measure application depth
Nutrient management	Nitrogen & Phosphorus fertiliser inputs, DCD
Riparian management	Fencing waterways, stream plantings
Waste management	Plastic wraps, old trees, dead cows etc
Land management	Track cut-outs, sediment controls
Pasture/cropping management	Baleage/cultivation method

Results

All farmers were very receptive to the audit procedure and the farm visits. As expected, there were a range of interests in carrying out mitigations and some of the mitigations were not possible in the time available. Some farmers had second thoughts on the need for some mitigation and others misinterpreted them. The past season (2011/2012) was exceptional for pasture growth and this negated the need to consider a couple of mitigations.

There were many reasons why individual mitigations had not started, with the most notable one being lack of knowledge measuring the effluent irrigation depth and sampling the effluent for nutrient analysis. Other reasons included change in priority, change in circumstances, capital expenditure and the long term nature of the mitigations.

Overall, 49% of the mitigations have been completed, 13% mostly completed (>50%), 8% partly completed (<50%) and 30% not started (Table 2).

Table 2. Numbers and % completion of mitigations

Number of farms	Total number mitigations	Not Started (0%)	Partly Completed (<50%)	Mostly completed (>50%)	Completed (100%)	Extra Number of mitigations
25	156	30	8	13	49	41

The farmers have received a copy of the audit of their individual farm and a table of all the audit results, but without identifying individual farms. The Regional Council received a summary of all the mitigations for the catchment as a whole.

Discussion

Effluent

A few farms had the application depth measured and effluent sampled for nutrient analysis but generally, most farmers had put this mitigation in the "too hard basket". They didn't know where to start and while most of them said it needed to be done, there were no plans to do it. On one property, the farmer noted that his effluent paddocks looked very poor and it transpired that yard and raceway water fills up the pond so his effluent is mainly water. Also, effluent sampling should be done during the milking season, preferably in the spring. This is a time of year when farmers are busy. It is our opinion that this application depth measurement & sampling should be done by an independent 'contractor' – this would have the advantage that all farms would be measured & sampled the same way, the effluent analysis would be undertaken by the same laboratory, the time of sampling could be concentrated into a short time period and calculations would be on a common method.

If all farms had this mitigation completed, it would put the mitigation completion % close to 60%.

Reducing P fertilizer and Olsen P levels

We have been liberal in our assessment of Olsen P reductions because most farmers only soil sample every second year and changes in Olsen P may take more than 2 years to become evident. In fact, several years of soil analysis will be required to provide a trend. While most farmers are keen to reduce their phosphate fertiliser applications (and hence soil Olsen P), some farmers want to maintain them as an insurance policy.

Most farmers are taking the advice of their fertiliser consultant, based on the OVERSEER® nutrient budget. The timing of this advice varies and this issue was not investigated.

Change of ownership

There have been two changes of farm ownership recently within the catchment and in both cases, the new owners were unaware of the mitigation details. However, from discussions with the new owners, it would seem that management changes will occur and both farmers/sharemilkers were very receptive of the mitigations, but had had no time to implement them.

Farm tracks

Maintenance of farm tracks featured in most of the mitigation practices. In all cases, this was seen as standard maintenance for farms, but the quality varied from excellent to ordinary. To some extent, this variation was due to soil type as those farms on the coarse Tarawera or Matahina gravel are well drained and cuts outs are not so important. Humps & hollows are being practiced more, hopefully as a result our visits and suggestions. This practice was seen as very important for reducing sediment and phosphorus losses from the rolling and easy hill contours of Kaharoa ash, Rotomahana mud and Taupo pumice soils.

Mitigation changes

The use of DCD is a good example of this – the excellent grass growing season of 2011/2012 negated any benefit of applying DCD. Also, (and probably as a result of the visit to Lincoln University last year by several farmers) the science of increasing pasture growth in the Rerewhakaaitu district needs to be confirmed before farmers are likely to use DCD.

Other mitigations have been shelved based on the excellent pasture growth and generally higher pasture cover which decreased the likelihood of surface runoff. We see these as short term decisions, based on this seasons' experience.

Effluent Blocks
In general, most farms are increasing the size of the effluent blocks to match nutrient loadings in line with our recommendations to achieve better nutrient use efficiencies.

New Mitigations
Farmers are purchasing new machinery and equipment to get efficiencies on their farms – these invariably help reduce surface runoff because they are being used when weather conditions are good and effluent is spread on more distant paddocks. Farmers are also improving nutrient management and effluent containment by undertaking new concreting of yards, building up raceways etc. Some farmers are considering more tree plantings and land retirement options on steeper land.

Other comments
Some mitigations are on farms that partly drain to other catchments – while these are recognized by the farmer, improvements in water quality are seen to be advantageous to the region. Surface and ground water drainage is an issue in this catchment – only a portion of the water falling on the catchment is assumed to drain to Lake Rerewhakaaitu (White et al 2003). The remainder goes to Lake Rotomahana and the Rangitaiki River catchment. Some of the groundwater finds its way to Lake Rotomahana and this is being investigated by a well drilling project (Rose et al 2012).

In undertaking this audit, other catchment issues are raised which are not necessarily part of the original project, but nevertheless should be discussed with the farmers and Regional Council. One such issue is to get a grasp of the water quality in the main stream from the headwater springs to the lake.

Micro mitigations are being undertaken and financed by individual farmers. Some of these may be seen as BMP's but others such as sediment traps are a result of this project. Macro mitigations, such as bunds to retain water and slow down runoff from rain events (Clarke et al, 2013) will be on individual farms but funded separately.

It is planned to repeat this audit procedure before the project concludes in 2015 so that farmers and the Regional Council understand what progress has been made to help improve the water quality in the lake.

Conclusions
In our opinion, progress at 49% completion after 1-2 years has been excellent. This should steadily increase as farmers understand the procedure, receive advice from their farm consultants and get help from researchers and service providers. In particular, the effluent irrigation measurements and sampling would be a big help for the farmers. This knowledge should streamline the effluent irrigation efficiency, potentially reduce nutrient use on effluent blocks and increase the farms' bottom line.

The audit process is a key part of the Catchment Plan and the testing of the audit procedure on the first audit round has been successful and well accepted by this farmer group. Fine tuning will make the process more effective in future rounds.

The exercise has shown that farmers can voluntarily develop a farm NMP with on farm mitigations to be done, for these to be audited independently and for the mitigations to be completed successfully.

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