

Minutes of the Technical Advisory Group Workshop Meeting held in GHA – Boardroom, 1108 Fenton Street, Rotorua, on 6 August 2019 commencing at 9:30 am

Chair: Andy Bruere

Scribe: Karla Kereopa

Present: Andy Bruere, Chris Eager, Chris McBride, Clive Howard-Williams, Grant Tempero, James Dare, Joseph Butterworth, Justine Randell, Keith Hamill, Kim McGrouther, Max Gibbs, Paul White, Paul Scholes, Troy Baisden, Piet Verburg, Mathew Allan, Gina Mohi and Natalie Miedema.

Apologies: Alison Lowe, Dean Mason, Clive Howard, Nicki Douglas.

Workshop actions:

- 1 RLC paper on Water Conservation Strategy to be circulated at a later date by Alison Lowe
- 2 Troy to remove the quote on the 'Statement on climate change, lakes and water resources' as it is outdated, suggestions to be provided to David
- 3 Troy to circulate both papers to TAG to provide updated feedback and point to some more detailed information
- 4 David to have a chance to revise the paper, and add advice on how different lakes may be affected
- 5 Max to circulate 'Lake Rotoehu circulation patterns' document
- 6 Paul will provide the report on adaptive management for circulation, report endorsed by all but need to have a definition or wording change regarding 'adaptive management' which could possibly be taken to the Rotorua Lakes Strategy group
- 7 Andy to circulate the list of projects currently being undertaken by the University of Waikato
- 8 Andy to circulate TLI information for feedback and workshop to be arranged in the next year
- 9 Troy to circulate document on modelling on Rotoiti with or without the wall (note this has been put on hold until other more urgent modelling projects are completed)
- 10 All who presented to provide copies of their presentations to be uploaded on to website

Welcome and Apologies – *apologies noted above*

Action points from last meeting

- Actions completed (see agenda) 1, 2, 3, 4, 5, 8 and 9.
- Circulated Nano bubble information which is different to Gang Pang material. NIWA also working on this and are starting to collate results.
- In regards to Lake Ōkaro there are 2 main things occurring alum dosing and land management in the catchment, UoW to frame up a modelling proposal from the info already provided by BOPRC. (ACTION Troy).
- Climate change updated statement (2-pager) together with a support document with a lot more detail is not yet finalised. David to complete the detailed report but the 2 pager is ready to go. (ACTION David).

ACTION: RLC paper on Water Conservation Strategy to be circulated at a later date by Alison Lowe

Oxygen levels discussed by Max and Clive (*paper circulated*).

- DO effect of macrophytes.

In Rotoiti about 10% of DO depletion attributable to weed decomposition.

In Ōkāreka about 30% attributed to weed decomposition.

It depends whether the weed drifts into the hypolimnium.

Localised effect in Okawa Bay (Rotoiti).

Presentations/Discussions

1 **Statement on climate change, lakes and water resources (Paper circulated by Chris McBride)**

- There's a multi-author review paper that has been in preparation for some time.
- TAG statement to be ratified/signed off.
- Want the outcome to be some sort of understanding of the issues regarding climate change, audience is the Rotorua Te Arawa Strategy Group (and then the community).

- Matt referred to a recent Global Study on 60 lakes. Troy suggested different lakes will respond differently to CC, need to consider how to assess within the programme. Pass that comment to David for the final detailed paper (ACTION).

ACTIONS:

- Troy to remove the quote it is outdated, suggestions to be provided to David.
- Circulation of both papers to TAG to provide updated feedback and point to some more detailed information.
- David to have a chance to revise the paper, and add advice on how different lakes may be affected.

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Item 2:

(a) Lake Rotoehu Presentation

Presentation given by Max Gibbs

- Max referred to 'Lake Rotoehu circulation patterns document' and will circulate (ACTION).
 - (i) Highest velocity zone in box due to seiche period of about 10 hours.
 - (ii) Currents can distribute alum at much lower dose rates than shock dosing.
 - (iii) What action is needed in the lake side arms, is algae there due to P response or simply the wind blown accumulation?
- What do you do on the side arms? Particularly on the western side of the lake is where the wind seemed to accumulate and in those areas there were massive blooms and it was the same at Otahu bay.
- The blooms in the Bays are unlikely to be effected by the inoculations in the lake.
- Not sure if the blooms are wind-blown but there are pretty thick blooms.
- Could get out there and do some work the next time it stratifies to try to identify source of algae and P.
- In terms of toxicity blooms are at the point where they are a nuisance is it worth harvesting them to reduce the nuisance? Previous experience at harvesting blooms has been unsuccessful, the cyano's can multiply so rapidly.
- Question arises if it's wind-blown then it's not being produced from the sediments so is there a need to treat sediment.
- There are handheld kits that can test the toxins which could be used when undertaking inspections.

(b) Lakes Rotoehu and Rotorua Alum Dosing

Presentation given by Justine Randell

- When dosing has occurred the Rotoehu TP levels have continued to rise (80-90ppb).
- In 2014 Rotoehu came really close to the control limit but from 2015 – 2019 it has risen considerably so that plant was turned off last year as it appeared to be not having any effect, however the TLI has been the highest since dosing stopped and cyano blooms have been worse. This indicates alum dosing was probably doing some P locking but not enough.
- Increased monitoring to weekly intervals to catch P data. Peak P up to 150ppb.

Slides presented by Chris TLI and anoxia/internal loading for Rotoehu

- 3-4 years where the TLI is relatively low in Rotoehu.
- 1 year where there is a big stratification event and the TLI shot up (2014/15).
- Looked at various factors that might be driving change.
- Rotoehu and Rotorua have similar physical dynamics so the level of stratification in Rotorua is probably the same as Rotoehu which explains why there was a problem with Rotoehu TLI so it comes down to adaptive management. This is the plan now to adjust Rotoehu alum dosing to address P in the same way that has been successful in Rotorua.
- Matt comment: Looking into forest harvest over the period in satellite images. Some work in Northland shows harvesting can have a significant effect.
- Regarding Lake Rotoehu we see adaptive management as being a key part of that i.e. do you need to dose alum in particular locations, how do we change that? and then the idea of the lakes transition - so we may be able to shift it back to a clear water lake that is not being dominated by algae - where we might be able to use the harvester - but then we might get a pH shift in the lake which is going to have a bigger proportion of weed growing in the lake and so that's another aspect of adaptive management. So let's see what happens there, we might have to think about managing weed in a different way if we get pH increases which is really going to effect the bottom water pH.

Lake Rotorua alum dosing has also been run at a lower rate for the past 8 months. The storage tank at Puarenga has failed its certification and so the plant was turned off until it can be replaced (Nov 2019). All alum dosing has been out of Uthina, and so the full dose required cannot be delivered (only about 2/3).

BOPRC undertakes additional monitoring (weekly) for P. Levels have risen but come back into the control range in autumn.

Rotorua has not had any algal blooms, where Rotoehu has been plagued with blooms and health warnings right through autumn.

- 3 **Update and water conservation strategy from Alison was postponed as Alison was unable to attend. Bring the report back to next meeting (ACTION Alison)**

Lunch

4 **Item 5**

Work programme update (UoW and BOPRC)

Presentation given by Troy Baisden.

- (a) **Towards a framework underpinning the use of models and data to support RTALSG**
- (i) ***Use of simple budget models, model ensembles, and/or information criterion scores to justify ongoing use of more complex models***
- Post normal science = science that is dealing with problems that are high stakes, high uncertainty, often urgent and usually so big that even values are in dispute.
 - Contrasted with normal science where you can do a bit of applied science and transfer that method into consultancy.
 - Biggest challenge in the Rotorua Lakes Programme is how we deal with Alastair's diagram/conceptual model that pulls everything together.
 - The big question is how can low TLI lakes exist below high TLI lakes?
 - The flow of water through catchment changes?
 - In terms of geothermal inputs there was work done early on in the programme by 'Bio researchers' and GNS but it seems in terms of Tarawera there was a big hole when we got down to the modelling work, so what's the timeframe around getting some of this stuff to happen so we can start talking to people about whether its 5 tonnes of phosphorous coming into Tarawera from geothermal, is it increasing? Or is it changing?
 - The only additional thing in terms of forest harvesting management is what's the actual management practice going on for a forestry company in a given area around a lake? Is best practice as it should be? E.g. how do they manage run off.

- The trees themselves take a lot of water from the atmosphere and so forth so when you take them out the tree release the water in the ground and that water contains a lot of N so for example a lot of streams running along the side, monitoring shows a sudden increase in N in the ground water into the Waikato river.
- The issue of adaptive management was raised and is that really what we are doing? In general do we support 'adaptive management' as a TAG? Is using that term unhelpful? We are aiming to move forward with a management strategy and are happy with everything else except the wording of 'adaptive management'. Suggestion to use the term – 'progressive management?'

ACTIONS:

- 1 **Paul will provide the report on adaptive management for circulation**
- 2 **Report endorsed by all but need to have a definition or wording change regarding 'adaptive management' which could possibly be taken to the Rotorua Lakes Strategy group**

(ii) *Consideration of uncertainty; introduction of tracers and other approaches; and staged community engagement*

- Paul will send report through.
- Accept approach with definition of adaptive management.

(iii) *Toward improved consideration of forests and forest harvesting*

Presentation given by Troy Baisden

- Matt's discussion covered half of this and Troy continued.
- Water budgets, Tarawera catchment is a key example for hydrologic change via afforestation.
- Puruki example of elevation specific interception.
- N losses different than you think. Mature forests planted into improved pasture have high N loss.
- Recovers after harvest due to understory or canopy uptake.
- Need to understand time lags for pasture to pine, OVERSEER does not provide value.

(iv) *Updated N and P budgets for all lakes*

Presentation given by Chris McBride

- Broad overview of method and key results.
- Action plans from various lakes which provided a nutrient budget for various uses.
- Project to try and adopt a standardised approach when calculating the nutrient budgets to have consistency.
- These budgets (large draft report) are available in the drop box.
- Trying to capture a state of knowledge and will hopefully feed into other work (e.g. Paul's report).
- What's the comparison in terms of numbers with reference state prior to human occupation?
- In terms of trying to get the lakes back to their natural state it's a long way past that, it won't happen.
- This may be something that we need to communicate better in terms of the catchments that we actually have some realistic way to manage land use within some catchments, and does that need to go through to our councillors so that they get that picture? At the moment they may be thinking that we can apply mitigations and we're going to bring everything back but we need to communicate the reality. Maybe this needs to be put into categories e.g. one category where you can apply one management strategy in this way and that might work and then in another category you might need a bit more drastic management.
- One of the issues is how to get information from the work that you are all doing to the people that make decisions about pushing buttons on projects. This can be difficult as the programme is complex and has different groups that make the decisions on interventions.
- Next step is for Piet at NIWA to calculate the internal lake loads.

(v) ***UoW programmes***

- Andy to circulate the list of projects, so it can be talked about at our next meeting if we need to talk specifically about those projects (ACTION Andy).
- This is basically a list of all the projects that have emanated from the TAGs, or the Rotorua PC10 Science Review or other things that we have initiated so that everyone is aware that we are working on them.
- There will be a whole bunch of projects that you will be aware of and maybe some you are not aware of e.g. Troy's smart ideas projects.

ACTION: Andy to circulate the list of projects

(b) **Updates of existing model/activity/proposals**

(i) ***Ōkāreka***

Presentation given by Chris McBride

- Ōkāreka report provided.
- There is a catchment model and there is a swap model that is being completed for the catchment.
- Calibration of the model looks pretty reasonable at initial glance – it looks fit for purpose.
- Draft report at this stage there will be more coming.
- That came about just trying to see where we were with land use change in that catchment and trying to get further land use change and in the meantime additional land use change has been negotiated. I think we had a target of converting about 200 ha of pastoral land through some sort of retirement through forestry and got to about +100 ha and somebody did some nutrient loss calculations and concluded that enough had been done. So in the meantime BOPRC have negotiated more land use change to about somewhere near the 200 ha and it was just seeing what kind of potential outcome is there, so it may be that we need to run another scenario just to find out what the final figures are.

(ii) **Tarawera**

Presentation given by Troy Baisden and Chris McBride

Revised data, reconsideration of historic TLI, model objectives

Ongoing development interconnected water and nutrient flows in Lake Tarawera catchments

- Discussion of memo Troy circulated.
- This brings us back to data that has been around the TAG a few times You've seen a lot of this material before and you get a sense that the results that you get for measures like DRP can very much depend on what Lab you measured it – that's not good.
- The second thing was that when there was changes in labs and big changes in the records for lake Tarawera in particular, so why? What is going on here where suddenly we have this leap in total P but that lab assured us that it was following protocols e.g. NIWA continued to get quite low values when there was a re-initiation of inner comparison.
- This is not just about where TLI is headed but where we set TLI.
- Why BOPRC lab data is high in terms of TLIs, certainly the data came out of the same method used at the university, there are a few interferences but the main one is arsenic which pretty much substitutes for P in a lot of reactions.
- Phosphorous average is 1.9, arsenic is 30-50 ppb which is the current water standard but the Rotorua district council are working on that.

- BOPRC have been using that NIWA method for 18 months and have concurrent data sets and it looks to be lining up.
- The adjusted method is sitting in a separate data base at the moment so it's waiting for a discussion between scientists to decide what is the best way to retrospectively adjust - planning to have a workshop to sort this out.
- BOPRC lab is doing both methods then. It's just the adjusted method that hasn't been reported and the adjusted method is not accredited.
- Interesting that for phosphorus it is possible it has plateaued or a slight decrease in recent years (since 2010). Could do a bit more work on this statistically to check if significant.
- The next step is for further assessment for formal significance and decide who's the right person or group to do that and recommend looking at baselines for total nitrogen for supporting the TLIs based on pre 1996 values.
- Should we be recommending that those values get substituted into the TLI reports as soon as possible so that we're not continuing to put TLI values that are probably .5 too high approx. In front of the decision makers, is there any reason not to recommend that? Agreed adjust next year.
- We can suggest and formalise solutions for Tarawera based on what we have and what James has reported and we could finalise it at the workshop.
- For the other lakes we can understand the scope of the problem and get half way there to solutions at the workshop.
- The reality is we relied on an accredited laboratory doing sampling and then somebody looked closer at the data and thought it was a little bit strange and then we thought it was just changing lab methods that was causing change. So it's effectively a problem that is 99% solved so we don't need worry about the TLIs going forward.
- Scientists to complete the memo and then we'll raise this with the Strategy Group that there was a problem. Make sure that we have the laboratory people on side so that we agree with what they're doing and then at that stage can we adjust the Tarawera TLI and bring that out so we can work with the community in terms of the action plan process and we have reporting on the whole analysis and data adjustment in advance of next year's TLI preparation, so then we will review all of the TLIs.
- When was the current TLI for Tarawera set? In about 1993 or 1994.
- We can go back and review what was set and what data we have now. We can see from the presentation the increasing trend in N and there is an increase in phosphorus and it shows that there is something going on in the background here so we can't just assume that the TLIs too low for Tarawera at the moment. We need to look into the N and P trends first to see what is really going on.
- Because of the quality of what we have we may need to communicate with the community primarily around the N and Phosphorus trends for the moment rather than the TLIs.
- Need to consider reviewing all lake target TLIs at a later date.

ACTION: Workshop to be set up ASAP (September 2019)

(iii) Ōkaro

Presentation given by Matt Allen

- Need to know reference conditions land use changes that are required to meet targets.
- Climate change will also impact the long term outcomes.
- For Lake Ōkaro UoW already got a really good Dyresm-Caedym model.
- Also have 1D ecological model can simulate all sorts of things in the water column.
- Also have a GLMAED model based on a similar sort of data set and it is still being developed.
- We've also got the PC Lake model which we now have initial calibration for using software developed in Europe which is an automatic optimisation software which tries to calibrate your model for you using computer power and parallel processing. So basically using different multiple CPUs and running a model on each CPU. We've been trying to test this tool on the server computer and we've got this process running now where we do this differential resolution where the calibration tries to accelerate in the parameter space for parameters that it thinks are a good fit to the model.
- Next phase is biological calibration and we probably want to devise some scenarios that they want to run.
- Expecting to be in the biological calibration and have that finished up in the next few months and then we'll be in a position to run some scenarios.

5 General business and emerging issues:

(a) TLI report (James Dare)

- Council has based some KPIs on the TLIs that we've got. They have set out that there was an aim to meet 2 TLIs over the last rolling 3 year average and that's going to increase over time, management action has been consistent all the way through (refer to memo).
- We need to communicate intuitively about what we know about these lakes to the people who are managing these things so that KPIs are not set on achieving outcomes we have no control on (e.g. TLI can be heavily affected by weather and future climate).
- Rotoehu is a good example to highlight the potential effects on poor TLI (start to increase people's awareness of this):
 - (i) High lake levels → stratification impact.

- (ii) High rainfall → erosion.
- (iii) Forest harvest → erosion/nutrients.
- (iv) Time for land use and GW to take effect.
- Can we review actions we can take based on TLIs? We can evaluate what are the reasons and then if we can identify the reason (e.g. higher lake level, excess effluent levels) then what can we do about that? E.g. The approach to alum dosing on Rotoehu, shift to better location for efficacy.

ACTION: Andy – TLI information to be circulated for feedback

(b) Rotoiti underflow (PDF Report by Max Gibbs)

- This came about as part of the Lakes Symposium 2017.
- Lake water quality asked the questions about Rotoiti can the slow recovery of hypolimnium be attributed to the decay of weed beds that is established around the periphery the lake – short answer is no – wrong question.
- The question should have been why is the recovery of the anoxic hypolimnion so slow? To look at that you need to go back 30 years to 1986.
- Are we approaching the time when the diversion wall is no longer needed? This needs consideration in a future workshop.
- One of the reasons we got a new consent for that wall and justification for that was that we had recovered Rotorua, most would say that is because of the Alum Dosing but we have not renewed that consent yet and if we didn't get that consent that would change things quite drastically and secondly maybe there's an opportunity to be considering if we put some mechanism in the wall or some gates at a particular time as there's no point in pulling it out and realising later that we should have left it there.
- What we've got is a management system that seems to working well for Rotorua. If you put control gates on the end of the wall to allow your full flow under certain circumstances it could go into Rotoiti and you would be benefiting both lakes so small treatment in Rotorua is restoring both lakes and after a period of time it may be that Rotorua was quite capable of doing its own thing and staying in a TLI of 4.2 or amounts as it was in 1970.

ACTION:

- Troy to provide modelling document on Rotoiti with or without the wall (note this has been put on hold until other more urgent modelling projects are completed).
- Everyone to please send through their presentations.

6 Meeting finish: 4.25pm

Presentations:

- (a) Lake Rotoehu presentation given by Max Gibbs
- (b) Lakes Rotoehu and Rotorua Alum Dosing Presentation given by Justine Randell
- (c) Slides presented by Chris TLI and anoxia/internal loading for Rotoehu
- (d) Work programme update (UoW and BOPRC) presentation given by Troy Baisden
- (e) Toward improved consideration of forests and forest harvesting presentation given by Troy Baisden
- (f) Updated N and P budgets for all lakes presentation given by Chris McBride
- (g) Tarawera presentation given by Troy Baisden and Chris McBride
- (h) Ōkāreka presentation given by Chris McBride
- (i) TLI report given by James Dare
- (j) Rotoiti underflow PDF Report by Max Gibbs