# MINUTES

## Water Quality Technical Advisory Group Meeting

Bay of Plenty REGIONAL COUNCIL

Date: 9 August 2010

Present: David Hamilton, Piet Verburg, Warwick Silvester, Chris Palliser, Hera Smith, John McIntosh, Rob Lei Max Gibbs, Andy Bruere, Peter Dine, Andy Woolhouse, Simon Park

Apologies: Eddie Grogan, Paul White, Rob Donald, Kit Rutherford, Trevor Stuthridge, Roku Mihinui, Del Raurino, Clive Howard-Williams

## 1 Rotoehu Monitoring Buoy

1.1 The Rotoehu monitoring buoy is programmed to be installed in the near future, and will be a precursor to the aeration and capping work which is being advised for Rotoehu.

It was identified that the Bay of Plenty Regional Council (Council) should take over the management of these buoys, and confirmed that Council is now looking at planning for the maintenance and operation of the monitoring buoy network.

David outlined that the Rotorua buoy had been in for three years of operation. In Rotoiti there is one near the narrows. It is possible that it could be moved to the eastern basin, but that there is a need to consider its use in monitoring the outcomes of the wall before shifting. Tarawera was partly funded by the Tarawera Ratepayers Association. Lake Rotoehu is the next site, as mentioned above. David mentioned that Rerewhakaaitu was the next possible site, as this is a polymictic lake that requires high frequency monitoring to give better information on the changes associated with stratification/de-stratification.

Estimates so far show that buoys should last about 10 years for budgeting purposes and probably cost about $10,000 per annum total for maintenance. Council staff are working with Environmental Data Services section of Council to programme any takeover of buoy maintenance.

### 1.2 Health Prediction Information

An action point from the last meeting was to determine whether there were any correlations which could lead to the monitoring buoy information being used in conjunction with health warning levels or as a predictor.

This matter has been reviewed by staff, and an email on the subject was circulated to the meeting. In effect, it was agreed that we can use the buoys to give an earlier warning of blue-green blooms. There was some difficulty in correlating buoy readings with cell counts or bio-volume, and staff are looking into the historic data to see if there is a useful relationship. They are also considering reinstalling the manual sampling near Rotorua buoy for a period to assist with the calibration. This will be reported again as matters progress.

**Action: Rob to report progress in due course.**

# 2 Lake Rotoiti

## 2.1 Okere Gates Modelling Work

David demonstrated the application of a 3-D simulation model where a dispersion tracer was put in the Ohau Channel flow. This work was undertaken for the Council engineers for their renewal of resource consent for Okere Control Gates. Four scenarios have been modelled using the hydro-dynamic model.

David is close to completing the report on this work, which will be available on the web in the near future. His results indicate that up to 1% of water in the Western Basin comes from Lake Rotorua under the current regime.

The low-weir option gives the highest lake fluctuations but the lowest Rotorua water input to Rotoiti.

The preferred option gives about 0.3% Rotorua water into the main basin of Rotoiti.

In conclusion David commented that the impact of changing the lake level regime is small, and that other ecological considerations may override any possible water quality implications of a change in water regime on flow around the wall.

Warwick asked whether he had run any model comparisons with the pre-wall water quality/inflow regime.

**Action: David is to run the scenarios for no-wall situation to compare before and after wall.**

Peter Dine questioned whether the flushing solution from the Lakes Water Quality Society/Lake Rotoiti Community Association had been investigated. It was commented that it was unlikely that this solution would solve algae problems in the Okere Arm or down the Kaituna River. No further investigations are planned at this stage, and Andy advised that we are focussing more closely on addressing phosphorus releases in Lake Rotorua to try and resolve algal bloom problems going down the Okere Arm.

## 2.2 Velocity Monitoring Ohau Wall

David reported on the latest vertical distributions of velocity around the Ohau Wall. Three ADCP meters were put in the same locations as previous monitoring during March and April to test for any underflow. He presented a graph showing that this was a period when Rotorua was clearly cooler than Rotoiti, and ideal for testing potential underflow issues.

Piet asked whether there were any possible erosion effects from water velocity on lake sediments. Max commented that velocities inside and around the wall are not enough to lift sediment which had settled.

David also commented that the bio-fish monitoring work was showing some underflow.

There was also a question about possible chemical difference in Rotoiti water quality since the wall had been installed. David commented that conductivity is the best indicator, and some of the graphics showed that there was some difference. He also indicated that Rotoiti water is affected quite markedly by geothermal inputs in the eastern basin.

David will complete the velocity monitoring report in the near future, and it will be available on the web.

**Action: Chris Hendy to present mass balance of solutes in Lake Rotoiti for next Technical Advisory Group (TAG) meeting to evaluate changes in inputs of ions to the lake.**

## 3 Sediment Technical Advisory Group and Sediment Work

3.1 David commented that the Hydrobiologia special issue is about to be released (in about one month), and will be published with all papers online. Discussions with Blue Pacific Minerals indicated that they were already linking in to using the information available.

### 3.2 Hypo Dosing

John made a presentation on the hypolimnetic (hypo) dosing which Council is planning for Lake Rotorua during stratification periods in summer/autumn 2010. John presented some notes on the application methods and application rates for the group.

Effectively, we have the ability to inject alum and soda ash (to buffer pH) into the hypolimnion and take out excess phosphorus released from sediments during any stratification period. The aim of this is to potentially get rid of somewhere between two and six tonnes of phosphorus each summer, targeting it when it is likely to exacerbate blue-green algal growth. This will have an impact on algae flushing through Ohau Channel into the Okere Arm and down the Kaituna River. It is expected that this in some way will address the concerns of downstream water users. It was also discussed that this is a short-term option until the Awahou P-locking plant can be constructed, and the chemical be used in that application.

Some other comments were raised during the meeting:

- David mentioned that he was more comfortable with using Aqual P in a fine powder form to flocculate and settle out any phosphorus in the hypolimnion.
- Max Gibbs made the comment that hypo dosing would knock out P released from the sediments, however Awahou was knocking out P from lake inputs. He was reiterating the point of view from the TAG that we need to continue to focus on phosphorus inputs from the catchment as part of our programme, in parallel with addressing internal nutrient releases.
- David made the point that if we are removing phosphorus in streams such as Awahou, it will settle out in particulate matter in stream bottoms and deltas.
- Warwick Silvester made the point that it may be more effective taking phosphorus out of the hypolimnion as it would be easier for Al to combine with phosphorus.
- Andy outlined the sediment programme was still operating as was not changed or interfered with by the hypo dosing proposal.

**Action: Andy to check out the cost of using Aqual P as an alternative flocculent for hypo dosing.**

David pointed out his main concern with dosing alum is that aluminium is more likely to be freely available and not bound in a matrix as it is within Aqual P. He commented that there had been no issues with eco-tox tests for Aqual P, and that gives confidence in the safety of this product.

John McIntosh commented that soda ash was not only necessary to prevent pH change from a toxicity point of view and aluminium release, but also necessary to assist in forming a floc which will see it combine with phosphorus.

Possible monitoring of koura in pockmarks to test if there is any effect: some communication with researchers such as Ian Kusabs could assist in making this happen. John McIntosh outlined that there is also a downside with Awahou P-locking as opposed to the hypo dosing. He made the comment that trout are permanently resident within the lower sections of the stream and, compared with the Utuhina or Puarenga, there is more potential for trout to accumulate aluminium (cf. bullies in Utuhina Stream).

There are also some issues around Rangiwewehi concerns in undertaking interventions around the streams on that side of the lake. It was also commented that there may be better utilisation of aluminium dosed into the hypolimnion than in streams. The ratio of aluminium reacting with P in the streams is about 20:1, however in the hypolimnion the ratio may be closer to 6:1. That indicates we may be able to get up to six tonnes of phosphorus out of the lake hypolimnion dosing compared with about 2-2.5 tonnes from the Awahou Stream.

Warwick also commented that removing a significant amount of P from this type of release could assist in reducing the hypolimnetic oxygen depletion rate, in the following year.

The programme is to continue to address P input from the catchment and recognise that this is a necessary action to continue.

**Action: Andy to continue Awahou engagement with Rangiwewehi and report back to the TAG.**

Note: This hypo dosing is a short-term intervention at this stage, running somewhere between one and three years.

The point was raised how we would monitor the effects and the efficiency of hypo dosing. David commented that we could monitor pre- and post-P levels from previous student work undertaken last year. John commented that it is quite difficult to get a representative sample. There was comment from a number of people around the need to monitor further afield than Lake Rotorua and possibly down the Okere Arm and into the Kaituna River. Some of this monitoring would naturally be part of the existing natural environmental monitoring network; however, some more specific monitoring would be required to determine success.

**Action: John McIntosh to commence designing monitoring programme that will determine success in locking P in the hypolimniom and extent of Al dispersion in the environment.**

It was also recognised that various environmental factors will influence the incidence of algal blooms within the lake, and it may be difficult to indentify the precise reason for changes in algal populations over subsequent years.

It was identified that some monitoring, particularly around koura and the lakebed, was necessary as part of the programme.

## 3.3 Aeration Work/De-stratification

Andy introduced the de-stratification proposal which had been presented to the last TAG meeting. The proposal was to investigate de-stratification further as a method for dealing with sediment nutrient releases from Lake Rotorua. The first step is to undertake modelling work for Lakes Rotoehu and Rotorua to see whether it is likely to address the sediment nutrient releases, then to achieve funding for implementing at least one significant-sized machine in Lake Rotoehu. The timing of this would be applying for resource consent over the remainder of the year, and planning for installation of a machine before the Spring of 2011. David undertook a presentation on de-stratification.

**Action: Andy to circulate presentation to TAG.**

Some points that were made were:

- Any under-design of the machinery may aid in the mixing of nutrients and exacerbate the problem.
- Proper design, including things like bubble size, is important, and David commented that Hans has experience with this with wastewater treatment plant design.
- David will work with Hans on modelling to optimise the machinery, and try and minimise power requirements.

David commented that de-stratification works primarily in three ways:

- The main aim is de-stratification mixing and circulation to keep the hypolimnion aerated, thereby reducing the opportunity for anoxia that allows nutrient release.
- Increased mixing can reduce some of the less-desirable algae species, and this was demonstrated in one of the slides shown in the presentation
- Aeration of the bottom sediments over a period of time will actually encourage the break down of organic matter, which also assists in reducing the opportunity for bottom sediments to go anoxic.

It was commented that there could be a link from the monitoring buoy placed in Lake Rotoehu to operate the aeration equipment.

**Action: David to model performance on Lakes Rotoehu and Rotorua.**

**Action: Andy to work with David and Hans to establish sizing and cost of equipment for Lake Rotoehu.**

David also presented estimates of bathymetric survey work for Lake Rotoehu. This is a matter which has been raised at the last TAG meeting. Bathymetric information is available for Rotoehu, but this would enhance this information further.

**Action: David and Andy to discuss the need and costs of this survey before proceeding.**

## 3.4 Terms of Reference in Product Risk Matrix

Andy reported that no progress had been made on this matter other than selection of the five products to go in the sediment capping trials later in 2010 for Lake Rotorua. These include alum, Phoslock, Aqual P, a lime-alum mix, and possibly one other product.

**Action: Andy to progress TOR and PRM**

## 3.5 Update on Okaro Sediment Work

Max presented a PowerPoint update on the nutrient and chlorophyll within Lake Okaro. The most notable point here was that hypolimnetic phosphorous concentrations over the last six months have been significantly less than for the corresponding period in the previous year. This is associated with the Aqual P dosing which occurred in August 2009, and so far is indicating great success with that application and other interventions on the lake.

**Action: Andy to circulate PowerPoint presentation to TAG members.**

David made the comment that monitoring has shown a shift away from the blue-greens in Lake Okaro to dinoflagellates. There has been no algal bloom on Lake Okaro over the summer of 2009/10, and this is probably the first time that has occurred for at least 20 years. Andy reported that we are eagerly awaiting the TLI results for the previous year, which are reliant on completion of some nutrient analyses.

John reported on the allophane application to the inlet stream in January 2010. So far no analyses are available, but John has a programme of monitoring around the allophane, and possible phosphorous uptake, and will report in due course.

**Note:** it was raised later by John M that we should discuss the impact of the initial alum dose on Okaro, which was 10T at next TAG.

## 3.6 Sediment Trials

(a) Max reported on the current velocity meters. He presented a one-page report showing the location of these meters and key information. Two meters have been installed: one near the 30 x 30 m plot area on a shelving plateau. The issue of the pockmarks in lake was raised, and Max commented that these had been avoided. It was commented that these are up to three metres deep.

Max then stated that the velocity meters were first deployed in Rotorua, will then be shifted to Rotoehu, and then will be re-deployed in Rotorua just prior to the capping trials. These are ADCP meters which measure velocity at one-metre sections up through the water column.

**Action: Max to provide monitoring results when available, and Andy to circulate.**

(b) The products to be utilised in the sediment capping trials are buffered aluminium, Phoslock, Aqual P, allophane and possibly an alum-lime or alum-soda ash mix. John McIntosh is getting the allophane and alum-mix products pelletised at the moment for the initial mesocosm trials. John commented that alum-lime mix was 25% alum and 75% lime or soda ash in a pellet. He also commented that the manufacturers believe they could combine alum and soda ash into a pellet. The exothermal reaction would assist in the processing.

**Action: Max is to test the alum-lime mix and the alum-soda ash mix in the laboratory prior to doing any possible testing within the lake.**

Max also commented that with alum-lime there would be some pH instability, as lime is not a buffer, and potential for some very high pHs to result.

It was commented that the allophane, before being pelletised, would need to pass through a 1 mm sieve to ensure that, on break up, it was a fine material to coat the lakebed.

Max commented that the lab tests undertaken would test the binding of phosphorous and effect on pH to ensure it is safe to use in the lake.

(c) **ViroPhos**

Max presented some notes on his review of ViroPhos as a lake sediment capping agent. In summary, Virotech reclaims waste products. They use aluminium refinery residue, which has a high pH of 11.5, and is classified as toxic or hazardous waste. It is an iron-based product. Max has concerns that an iron-based product will absorb phosphorus or react with phosphorous in the lake sediment, but when sediments become anoxic during stratification it is most likely to release that phosphorous, and so has no advantage for application to our lakes.

**Action: Andy to get material from Virotech and allow Max to test formulation to see whether it permanently locks phosphorous.**

(d) **Mesocosm Trials Prior to Lake Plot Trials**

Max presented a short report on the mesocosm trials. The aim of this work is to test the break up of any products, and at what depth. It is also to test the spread and evenness on the lake bottom. To undertake this work will be a one- or two-day operation testing all the products in a 1.5 m diameter mesocosm located in the general area of the capping trials. It will be in place for a short period of time and all material will be recovered from the lake using the contraption designed by Max at NIWA.

**Action: Andy and Max to finalise trial design and forward to Te Arawa Lakes Trust for approval (in that, specify exact trial location). Also keep consent staff informed as they have advised no resource consent is required for the short-term trial.**

(e) **Plot Trial Design**

The product range to be used is listed prior. It will take place in October/November. The initial objective is to test settlement and dispersion on the lake bottom, and then benthic chambers will be utilised to test performance of products as the environment is taken through aerobic and anoxic cycles. The benthic chamber work will be done in triplicate over a period of a week to look at phosphorus release rates. Max commented that he could undertake micro-profiling of the boundary conditions between sediment and water; and we are to test the burial effects by core testing before and after the trial work.

(f) **Trial Consent**

A draft is prepared and has been presented to the statutory group last week. All products discussed have been in the application except for ViroPhos. At this stage it is included and it can be withdrawn later. There was a comment that iwi consultation should clearly include the Mokoia Island hapū, and also check with Kawerau Jet that they will not interfere with the trial and mesocosm work where they undertake turnarounds on the western side of the island.

**Action: Trial consent to proceed with urgency. Andy to advance this matter.**

**Action: Andy to visit Kawerau Jet and discuss their course.**

## 4 ROTAN and Lake Model Update

4.1 This was a presentation from Simon Park with the target of presenting some results to the 9 September Council meeting.

**Action: Andy to circulate presentation to TAG members.**

The main point so far is that the ROTAN model has now been calibrated to provide nutrient inputs to Lake Rotorua for various land uses on time scale. To determine phosphorus inputs, the CLUES model has been used by Deniz Ozkundakci. The inputs from phosphorus are scaled over a 10-year period. It is expected that phosphorus inputs occur over a shorter timeframe than nitrogen, as it is not generally carried through down the soil and ground profile and into the groundwater as is the case for nitrogen. This information is then fed in from the two land-use models to the lake DC model, and the time scale around other interventions is modelled to determine performance of all interventions. The initial presentation to Council will look at four key scenarios ranging

from zero land-use change, or existing, through to up to 350 tonnes of nitrogen removed from the catchment.

Chris stated that he advised taking the model back to stakeholders, and giving them an opportunity to determine scenarios to test. He advised this had been done in other situations, including some work in Australia, and had resulted in very good buy-in from land owners and stakeholders, which had a positive impact on the success of the subsequent project.

For the presentation of information, David suggested that some standard error bars could be put on the decade data points. This would assist in giving some interpretation as to the likely errors around this work.

The information which may need to be presented to Council would include TLI, chlorophyll, and, in particular, percentage of blue-green algae, total nitrogen, total phosphorus, visual clarity, and hypolimnetic oxygen demand. David commented that the lake DC model would be giving results for the years 1990, 2040, 2070 and 2099.

### 4.1.1 **Phosphorus Mitigation Project**

Simon gave a short update on the phosphorous mitigation project and is included in the presentation that will be circulated from 4.1 above. He outlined that some technical advice was being received from AgResearch's Richard McDowell on the effectiveness of structures versus management changes to address phosphorous loss from land use. Our target at this stage is to address phosphorus loss mainly by structures in some key catchments; however, the advice is that some management changes, in terms of Olsen P levels in particular, may have more beneficial results. Andy commented that this project initially is about engagement with the farming community and getting some buy-in to undertake the project, and he expects that some of those management changes may gain some traction once this engagement has become more successful.

Warwick raised that the issue of addressing Olsen P created some conflict in the normal expected pathways for phosphorous release from land use. Olsen P is generally a soluble source of phosphorous, and it is generally accepted that particulate P is the main source of phosphorous leaving farming-type properties. He also commented that, unlike nitrate, phosphorus is not increasing in stream and groundwater flows, indicating that it is generally from geological sources, and leaching from the underlying geology, rather than coming from land use.

John McIntosh commented that dairy farming began in the Rotorua catchment in 1910 supplying a dairy factory at Ngongotaha. As well as the factory discharging waste to water, cowshed effluent was also allowed to flow to waterways., Up until the 1970s, inputs of phosphorus from dairy farming and poor management practices was probably quite high. Although farming intensity has increased, there has also been an improvement in farm management practices, which has probably countered the increase in dairying intensity with respect to phosphorus loss to the lake. David Hamilton also commented that Stewart Ledgard had been surprised at the high levels of soluble P in some of the land-monitoring that he was undertaking.

The work of Jonathon Abel in his PhD will be looking at sediment trap within streams and within lakeside deltas, and may assist in answering the question as to whether particulate P, which settles in those areas, is locked up or becomes available over time as organic matter decays or is released from sediments.

### 4.2 Phosphorous Modelling Work

Simon outlined the CLUES modelling work which is being undertaken to feed phosphorus inputs to Lake Rotorua from land use to the lake DC model. In this they have assumed no lag time, and allowed 10 years for stream flows to equalise. David commented that this modelling work could be applied to some other catchments, including the ROTAN modelling work. Chris agreed, as long as we know where the groundwater catchment boundaries are and the travel time in the groundwater. This would require some linkage with groundwater experts, such as Paul White, to determine. David was keen on applying this to Rerewhakaaitu.

It was discussed that groundwater work within Rerewhakaaitu should probably include linking with Lake Rotomahana. This is discussed further in 8 below.

## 5 Aeration Work

This was covered in 3.3 above.

## 6 Wave-Action Aeration Machines

David has undertaken some modelling of the application of the wave-action aeration machine, designed by Kelly Hughes, in Lake Okaro. With 40 machines in the lake, it did not prevent destratification, and is unlikely to have a place in the lakes restoration programme.

John made the comment that it may have some application in isolated places, such as small bays, etc, or Okawa Bay.

**Action: Andy and John McIntosh to discuss whether there is an application for this, and to communicate that with Kelly.**

## 7 Tarawera Groundwater Monitoring Work

Andy Woolhouse reported that three sites for groundwater monitoring were now being installed. This included three observation bores and three monitoring bores, and they will all be installed within two weeks. This will give better information as to groundwater levels in key parts of the Tarawera catchment. Janine Barber was not available to report on the programme at this stage.

**Action: Report Tarawera groundwater monitoring progress at the next meeting, and how that fits in with the wider groundwater catchment programme.**

## 8 Science Advice Required for New Action Plans

There was a need for discussion around the level of science advice required for development of new actions plans to ensure that these plans continue to advance, but have a suitable level of science support to makes sure that they are robust and meaningful. David referred to the lake quality assessment and action plan prioritisation matrix developed in 2005. This process ranked a priority scale for lakes not already covered by action plans in the following order:

1. Tikitapu
2. Tarawera
3. Okataina
4. Rotoma
5. Rotokakahi
6. Rotomahana
7. Rerewhakaaitu

Since that time the Lake Rotoma plan has been completed, and Lake Tarawera has had a working party but the action plan is not yet completed. The following discussion outlined general priorities:

## 8.1 Okataina

Lake Okataina was relatively simple to complete, with the only significant inputs within the catchment as the Lodge and Outdoor Centre. Hera Smith commented that we should refer to the Te Arawa Rotorua Lakes Strategy Group Report from Nicky Douglas, which could assist in some commentary on potential sources of nutrients from the reserve areas.

**Action: Andy to circulate this report to the TAG group.**

David and John confirmed that they don't expect any significant misalignment between the groundwater and surface water catchment, and so further detailed groundwater assessment is probably not vital. John commented that there had been a circuit of all the springs and these had been sampled, and contained fairly low nitrogen values.

**Action: John to get sampling results available for the TAG group.**

In conclusion, Okataina action plan could be reasonably completed with existing science knowledge.

## 8.2 Tarawera

The TAG group would like to see the Tarawera action plan completed. It was advised that there would need to be a review of the catchment report undertaken by David, and a review of the lake targets for Tarawera.

**Action: Confirm with Kat Maki science work which needs to be undertaken as detailed above.**

**Action: David and John to review the catchment report and review lake targets for Tarawera.**

## 8.3 Tikitapu

It is commented that sewage reticulation was the main intervention for Lake Tikitapu, and that will be included in the Okareka reticulation system. David commented that stormwater needs addressing, and suggests some sort of zeolite-type treatment or absorbent material placed in stormwater interception trenches prior to water flowing to the lake. It was also suggested stormwater pipes going directly to the lake should be removed.

**Action: Andy to discuss with Rotorua District Council the way forward.**

**Action: Communicate with Kat Maki that there appeared to be suitable science currently available to complete Lake Tikitapu action plan.**

## 8.4 Rotokakahi

David commented that Joe Butterworth had reviewed water quality in his Masters thesis. He advised that it would be useful to review updated water qualities, especially in the view that Rotokakahi, since 2006, had increased from a TLI of 3.4 to 4.0 units by 2009. There was concern the water quality in Rotokakahi was rapidly declining and needed consideration of the possible sources.

**Action: Joe Butterworth to undertake a review of water quality and update information from Masters thesis (this would include nutrients, chlorophyll *a*, and oxygen status), and also compare stream outlet values over the longer time period. David to initiate this work with Joe.**

### 8.5 Rerewhakaaitu and Rotomahana

The farmers at Rerewhakaaitu have engaged with a sustainable farming fund project, and are looking at undertaking actions to minimise their nutrient discharge from farming activities. David explained that Alison Dewes was likely to undertake an MSc and was possibly going to undertake a case study around the farming land use within the Rerewhakaaitu catchment. He commented that she may be able to bring together all the current information on GW monitoring. This would provide preparation for a possible a groundwater modelling project for the catchment, which could assist in an understanding of nutrient flows within the catchment. One of the concerns expressed by Alison to some staff is that, without clear lake targets being reflected in the catchment targets, the project may fall short of desirable long-term results for Lake Rerewhakaaitu. It was discussed that the groundwater catchment and surface water catchment in Rerewhakaaitu are significantly misaligned, and that water flowing into other catchments also needed consideration, in particular, water flowing into Lake Rotomahana; but also concern that water flowing into the Rangitaiki catchment may also need to meet some minimum standards for protection of water quality.

It was considered that there was actually significant groundwater work undertaken by Uwe Morgenstern and Paul White. Within the surface water catchment of Rerewhakaaitu, there is a major difference as to where groundwater goes. Most of the area between Brett Road and Yankee Road flows into Rerewhakaaitu (John McIntosh), then groundwater flows either north west to Rotomahana or east to the Rangitaiki and some to the Waikato.

**Action: Science advice is needed on whether further groundwater monitoring or bores is required to determine catchment boundaries. Andy to pass to Janine Barber for advice.**

**Action: Work needs to be undertaken on land use targets around the lake and, in particular, what part of the catchment that applies to for Rerewhakaaitu (John McIntosh).**

**Action: Refer to Janine Barber re possible groundwater model for Okaro, Rerewhakaaitu and Rotomahana.**

It was agreed that any groundwater modelling work should include Rerewhakaaitu and Rotomahana, as these catchments are intimately linked.

**Note:** Janine has commented after the meeting on the greater Tarawera catchment GW study work "The exploration holes for two of the sites (Lake Tarawera) have been completed and we have intercepted aquifers within these. The rig is presently at the Lake Tarawera outlet. We are down to 40m and have not struck water. The depth for this hole is to 60m, but because of the strata being intercepted I have instructed the driller and GNS to continue to drill to a maximum depth of 100m at this site. The drill site is approximately 80-100m above the Tarawera Falls. The falls discharge from a fractured rock unit. At present we are drilling through compact fine grained sand. It is probable that we would intercept this rock unit below 60m and hopefully into an aquifer", and

"EBOP is continuing to scope for our groundwater research program in the Ōkataina lake catchments. We are now looking toward our next phase of drilling for Tarawera-Rotomahana-Rerewhakaaitu. The proposal at this stage is to drill in the three locations identified (see attached map).

The entire program will be run much along the same lines as the Tarawera drill program.

## 9 Tikitere De-nitrification Work

Andy updated the group on the Tikitere de-nitrification project, stating that the pilot plants were being installed at the moment. Some difficulties with groundwater being close to the surface had been encountered, but these were being overcome by redesign of the de-nitrification beds.

David raised the issue of whether it was possible to use a de-nitrification wall in some high-groundwater locations where higher nitrate concentrations are available.

John noted that this had been attempted at Rerewhakaaitu but, for some reason, the project had not advanced.

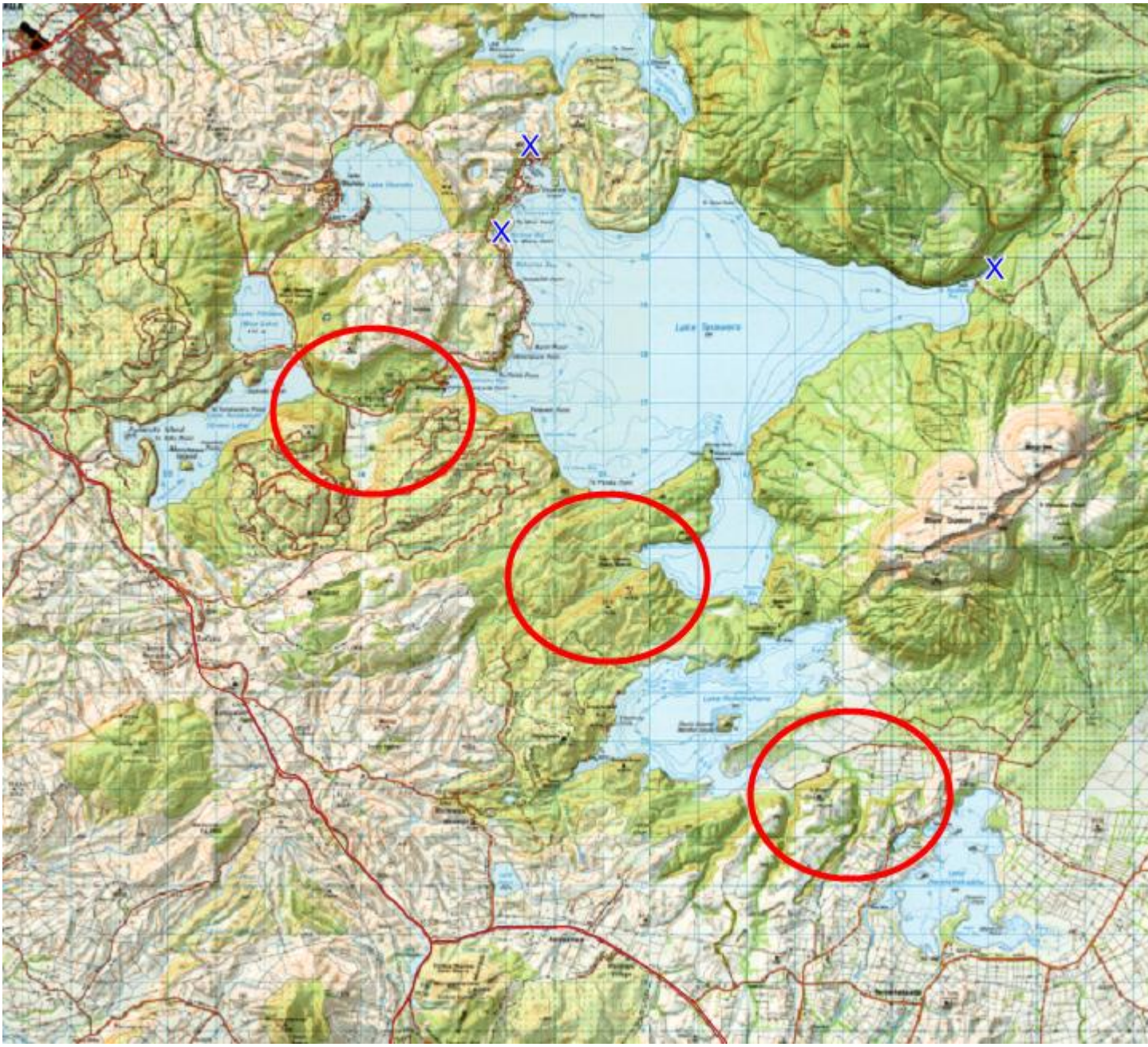
**Action: John agreed to approach the local land owners and see if we could reinitiate the project to install a de-nitrification trench. Some associated support would be needed from the local farmers alongside Council's contribution.**

## 10 Update on Other Projects Being Implemented

Andy presented the group the draft report card series which will be released to the public very soon. This gives a lake-by-lake description of lake health with respect to lakes' TLI, and also updates on various projects including interventions and planning. The group commented that this was a very good summary of lake health and interventions. David commented that it may be useful in future to bring in oxygen levels as an indicator of lake health within the report cards.

**Action: Andy to pass comments on to report card team including possible use of oxygen as an indicator into the future for lake health.**

Meeting closed at 4.30 pm.


Lake Sprowers