Q&As from LAKE ROTORUA MODELLING RESULTS PRESENTATION Monday 9 December 2013

What is the problem with the long-term use of alum dosing? What are the risks around alum dosing?	There is an environmental risk associated with using alum dosing. We don't know whether there may be a cumulative impact on the bottom sediments and biota. The worst case scenario is we make the lake acidic and that will cause fish kills. At this stage our monitoring is showing no adverse effects on the lake ecology.
Is alum dosing in Lake Rotoehu showing the same trends as Lake Rotorua?	Yes we are seeing the same trends in Lake Rotoehu with alum dosing in terms of improvements in water quality. Water quality has improved in Rotoehu and this is due to a combination of land-use and land management change, weed harvesting and alum dosing.
Previously we have been told that algae in Lake Rotorua are nitrogen limited or co-limited with phosphorus. Do the modelling results change this view and are algae in the lake now phosphorus limited?	Specific tests are done periodically to examine whether algae are nitrogen or phosphorus limited. Alum dosing has resulted in very low concentrations of dissolved phosphorus in the lake. It is likely that algae in Lake Rotorua are now phosphorus limited for large parts of the year. But there are also likely to be times of the year when algae in the lake are nitrogen limited (when inorganic concentrations are very low). A co-limiting strategy where both nitrogen and phosphorus are managed will provide the best outcome for the lake.
Can we put more emphasis on phosphorus reduction than nitrogen reduction to reach the target?	Phosphorus comes from both human activities and natural geological sources. For Lake Rotorua a large proportion of the phosphorus comes from the geological component and it is difficult to treat this source at the land level.

	Alum dosing of inflows treats both sources of phosphorus (i.e., from human and geological sources). However, in the long-term, if it were possible to strongly constrain phosphorus from human sources, the nutrient pool available in the bottom sediments (i.e., that leads to internal loading) would be significantly reduced, thus having an effect similar to the current effects of alum treatment.
Can we replace alum dosing with oxygenating the deep waters to stop de-stratification and algal events?	De-stratification machines have been installed into Lake Rotoehu and are undergoing trials to see whether this intervention can be transferred to Lake Rotorua. It is likely that we would need at last 50 of these de-stratification machines installed in Lake Rotorua to make aeration effective.
What are the impacts of sedimentation? Could we dredge the lake?	Around the lake edge the accumulation of sediment is minimal because of the wind exposure. In deeper areas of the lake, sediment accumulates at up to 1 cm per year and more than 1 metre has accumulated since the Tarawera eruption. Dredging of the lake would be a huge cost, at around $100 million to dredge 30 cm in depth over an area of 30 km^2. This would need to be an on-going intervention as sediment would continue to accumulate.
Will TLI of 4.2 continue to be met with alum dosing?	The modelling suggests that if we kept alum dosing at the present amount then we would continue to meet the TLI. The current situation is tenuous, as external loads have continued to increase, whilst there is a risk of adverse ecological impacts from alum and if it was stopped for some reason then there would be a rapid decline in water quality in Lake Rotorua.
What tests have been done on groundwater and deep aquifers?	A lot of our information is derived from what comes out of the aquifers at Hamurana and Awahou. A combination of piezometers, groundwater aging and modelling has been used to understand the groundwater catchment and the age of the groundwater.

	What comes out of the aquifers provides a good indication of what is happening on the landscape. Measuring and monitoring groundwater is extremely difficult and hugely costly. A critical zone is between the root zone and the shallow groundwater aquifer. If nitrate gets below the root zone it will likely get into the aquifer and ultimately into the lake- very little is lost below the root zone.
What work has been done to measure attenuation in Waiteti and Ngongotaha Streams	There has been little work in this area recently. Attenuation will likely be more important in Ngongotaha Stream than in Hamurana or Awahou streams where there is little stream distance between the spring and where the water enters the lake.
What effect does the geothermal inflows have on the lake	The geothermal inflows to Lake Rotorua are rich in nutrients but small in volume. They are a minor source of nutrients to the lake. However, because geothermal streams are concentrated sources of nutrients there are opportunities to reduce nutrients from this source. For example, a pilot plant treatment has been set up to remove nitrogen from Tikitere using zeolite.
There seems to be a lot of uncertainties in the science and the only thing we can say for sure is that the lake has met its TLI.	The application of science to the Rotorua lakes is about targeting areas of greatest uncertainty so that there can be more confidence in the way that management actions are undertaken for the lake. The lake modelling is providing the best science we have to try and address this uncertainty by integration of the catchment and lake, and the physical, chemical and biological environment.
Lake Okataina water quality is said to be an “anomaly” and there are not farms in the catchment to attribute nutrient loss.	Lake Okataina is surrounded by bush. What we have ascertained is the understory is severely devegetated by feral animals such as wallabies and pigs etc. A 3-year PhD study has commenced to investigate and measure the relationship of vegetation with water quality in this lakea.