

BEFORE THE BAY OF PLENTY REGIONAL COUNCIL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of Lake Rotorua Nutrient Management - Proposed Plan Change 10 to the Bay of Plenty Regional Water and Land Plan under clause 8B of Schedule 1 to the Act

BETWEEN **ROTORUA LAKES COUNCIL**

Submitter

AND **BAY OF PLENTY REGIONAL COUNCIL**

Plan Change 10 Proponent

**STATEMENT OF EVIDENCE OF SIMON DOUGLAS BANKS
(Wastewater infrastructure)**

Dated 22 February 2017

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QUALIFICATIONS AND EXPERIENCE

1. My full name is Simon Douglas Banks. I currently hold the position of Workgroup Manager - Planning and Development at Opus International Consultants Limited (Opus), a multi-disciplinary consultancy at which I have been employed over the last 4 years.
2. I have a Bachelor of Arts (BA) and Postgraduate Diploma in Arts Subjects (PGDipArts) majoring in geography, and a Master of Planning (MPlan) from the University of Otago. I am currently an Intermediate Member of the New Zealand Planning Institute. I have 10 years' experience in various planning positions in New Zealand and the United Kingdom.
3. The focus of my current role is to seek resource consents for infrastructure projects on behalf of local authorities. This includes management of specialist technical input, preparing assessments of effects on the environment, and assessing compliance with statutory plans and policies.
4. I am involved in consenting projects across the Bay of Plenty region, and am familiar with the planning framework under the Regional Water and Land Plan (RWLP), and with Proposed Plan Change 10 (PC10).
5. Currently, I am engaged by Rotorua Lakes Council ('RLC') to lead the resource consent and designation process for the proposed Rotoiti/Rotoma Wastewater Treatment Plant (WWTP), and I have been briefed by RLC staff on the preferred option for the upgrade to the Rotorua WWTP. As a result, I am broadly familiar with nutrient management issues in the Rotorua Lakes catchment related to wastewater treatment and disposal.
6. Although this is a Bay of Plenty Regional Council (BOPRC) hearing, I note that I have read the Expert Witness Code of Conduct set out in the Environment Court's Practice Note 2014 and I agree to comply with it. I confirm that the issues addressed in this statement of evidence are within my area of expertise, except where I state I am relying on the specified evidence of another person. I have not omitted to consider

material facts known to me that might alter or detract from my expressed opinion.

7. The technical information relating to the Rotorua WWTP referred to in my evidence is based on two sources:
 - (a) A letter by Alison Lowe (Senior Environmental Scientist - RLC) to me titled "Re: Urban sector nitrogen requirements" dated 20 February 2017. A copy of this letter is included at Appendix 1 to my evidence.
 - (b) A letter prepared by Kevan Brian (Technical Director - Mott MacDonald Australia Pty Ltd) to Ms Lowe titled "Rotorua Wastewater Treatment Plant - Treatment Technology Option: Expert Statement" dated 17 February 2017. A copy of this letter is included at Appendix 2 to my evidence.

SCOPE OF EVIDENCE

8. RLC has submitted in support of BOPRC's proposed use of a rules-based approach to reduce discharges of nitrogen to Lake Rotorua. However, RLC has also identified a number of concerns with PC10 as currently written, which it considers restrict the ability of Rotorua communities to provide for their social, cultural and economic well-being.
9. My evidence, in conjunction with the evidence of Mr Eccles, addresses the specific matters raised in points 11-21 of the submission by RLC, which sought the inclusion of appropriate objective(s), policies and relevant methods in PC10 to recognise and provide for growth in the Rotorua district, particularly in relation to the Rotorua WWTP and the discharge of nitrogen to Lake Rotorua.
10. Having reviewed the available evidence, the issue at the centre of RLC's concerns regarding PC10 is, in my opinion, that it implies a fixed mass limit of 30 t/N/yr for the Rotorua WWTP. Even with the best practicable technology, the amount of nitrogen discharged from the WWTP will likely exceed this limit in the near future as the city grows. In its notified form, PC10 lacks the ability to address this issue without compromising the sustainable nitrogen load to Lake Rotorua of 435 t/N/yr.

11. The fixed mass limit of 30 t/N/yr for the Rotorua WWTP will restrict growth and does not account for the transfer of nutrients from rural to urban associated with land use change. Ideally, a future resource consent regime for the Rotorua WWTP discharge would include a combination of flexible mass and concentration limits to allow for urban growth without compromising the sustainable load to Lake Rotorua of 435 t/N/yr.
12. To address this, my evidence will focus on three key matters within PC10 which I consider affect the Rotorua WWTP, namely:
 - (a) Giving effect to the Bay of Plenty Regional Policy Statement (RPS);
 - (b) Consequential changes to the RWLP; and
 - (c) Specific provisions for municipal wastewater discharge.
13. Before addressing these matters, I consider it useful to outline some brief background information to the Rotorua WWTP and planned upgrades.

BACKGROUND

14. Currently the Rotorua WWTP accepts loads from within the Rotorua urban area, and from the communities at Ōkāreka, Tikitapu and Rotoiti (all of which lie outside the Lake Rotorua groundwater catchment to which PC10 applies).
15. In the future, there will be additional loads to the WWTP arising from growth. This includes expansion of the Rotorua urban area, growth in the tourism industry (e.g. hotel and motel developments), growth of industrial and trade discharges, infill development or intensification within the existing urban area, and reticulation of communities not currently connected to the WWTP (e.g. Mamaku and Tarawera).
16. The existing Rotorua WWTP discharges around 37 t/N/yr to the land treatment system (LTS) in the Whakarewarewa Forest and achieves the consented 30 t/N/yr limit on the load to Lake Rotorua. The discharge of

treated wastewater from the Rotorua WWTP accounts for less than 5% of the nitrogen load into Lake Rotorua.

17. The current discharge permit authorising the Rotorua WWTP to discharge treated wastewater to land and then to Lake Rotorua expires in September 2021. RLC has committed to ceasing land treatment in Whakarewarewa Forest by December 2019 as the result of a Memorandum of Understanding negotiated between RLC and the owners of the Forest.
18. A new discharge site, along with a major upgrade of the Rotorua WWTP to increase capacity and allow for full treatment prior to discharge, is currently under consideration. An overview of the preferred option for the upgrade is contained in Mr Brian's letter included at Appendix 2 to my evidence.
19. The preferred option for the upgrade of the Rotorua WWTP is designed to discharge around 26 t/N/yr (based on current sewage loads) in the absence of on-site sludge processing. The preferred option includes the discharge of treated wastewater to earth contact beds on the Sanatorium Reserve near the WWTP. The treated wastewater water would flow through the beds, cascade into a channel and flow overland before entering Lake Rotorua at Puarenga Bay.
20. Mr Brian's letter confirms that the preferred option for the upgrade is close to the limit of technology ('LOT'), which represents the best performance that can be achieved by any treatment process. If resource consent is obtained for the preferred option, it will represent the lowest consented limit for any municipal wastewater discharge in New Zealand.

GIVING EFFECT TO THE REGIONAL POLICY STATEMENT

21. Uncertainty around the broad scope of PC10 also affects the way it relates to the relevant policies of the RPS. The RWLP, which PC10 seeks to amend, is required to give effect to the RPS under section 67(3)(c) of the Act. PC10 itself is only required to give effect to those provisions of the RPS that fall within its scope.

22. The recommended amended Introduction to PC10 states that this plan change gives effect to Policies WL 3B, WL 5B, and WL 6B of the RPS, listing them in full as part of the Introduction. However, in reviewing the objectives, policies, and methods proposed, it appears to me that the primary focus of PC10 is on several specific clauses of the RPS policies which relate to nitrogen limits for Lake Rotorua.
23. My understanding is confirmed at Section 4.3, paragraph 29 of the s42A report, which lists the following RPS objective and policies as providing the basis for PC10:
 - (a) Objective 28; and
 - (b) Policies WL 3B, WL 5B, and WL 6B.
24. This more specific basis for PC10 conflicts with the Introduction as currently written, which claims to give effect to Policies WL 3B, WL 5B, and WL 6B of the RPS in their entirety. In my opinion, further refinement of the Introduction to PC10 to more accurately describe which RPS policies it gives effect to (or partial effect to) would reduce the uncertainty around the scope of PC10 as currently worded, and thus its application to the Rotorua WWTP.
25. PC10 and the s42A report also fail to recognise that giving effect to the identified policies is also reliant on management of non-rural nutrient sources, as urban land uses also contribute nitrogen to Lake Rotorua - typically via the WWTP.
26. Accurately describing which RPS policies are given effect to (or given partial effect to), as outlined in the s42A report, will clarify the scope of PC10 and highlight that PC10 is just one of several interventions and policy tools required to manage nutrients in Lake Rotorua.

CONSEQUENTIAL CHANGES TO THE REGIONAL WATER AND LAND PLAN

27. The consequential changes to the RWLP proposed as part of PC10 affect the activity status of the preferred option to upgrade the Rotorua WWTP, assuming that the future application seeks a higher mass limit than the current 30 t/N/yr cap.

28. Prior to PC10, an increased discharge of nitrogen or phosphorus arising from the upgrade of the Rotorua WWTP would be treated as a Restricted Discretionary Activity under Rule 11F (subject to meeting the relevant criteria) of the RWLP.
29. However, the consequential changes to the RWLP proposed by PC10 remove the word "Rotorua" from the Rule 11F text, thereby excluding the Rotorua WWTP from consideration. This is not addressed in the s42A report, which states that discharge rules are out of scope of PC10. It may therefore be an unintended consequence of the current drafting of PC10 that requires attention.
30. The consequential changes mean that an application to increase the discharge of nitrogen or phosphorus from the Rotorua WWTP as part of the consent renewal and upgrade process would have to be considered as a full discretionary activity under the "catch-all" Rule 37 of the RWLP.
31. In my opinion exclusion of the Rotorua WWTP consent renewal from consideration as a restricted discretionary activity is contrary to the recommended Policy LR P17 set out in the s42a Report, and does not reflect the value of RLC's ongoing significant investment in wastewater infrastructure, its essential importance to Rotorua's urban community and the benefit reticulation ultimately has on lake water quality.
32. In my view, this issue would be best addressed through the inclusion of specific provisions in PC10 to provide for the ongoing operation of the Rotorua WWTP. This matter is discussed in more detail in Mr Eccles' evidence.

SPECIFIC PROVISIONS FOR THE ROTORUA WWTP

33. By allocating the sustainable nitrogen load to Lake Rotorua of 435 t/N/yr across the sectors, PC10 implies that the mass limit of 30 t/N/yr for the Rotorua WWTP under the existing discharge permit is fixed for the foreseeable future. This is despite the general lack of specific provisions in PC10 pertaining to the WWTP.
34. Although RLC has acknowledged that the focus of PC10 is on rural land use, the implied fixed mass limit for the Rotorua WWTP under PC10 fails to account for the need to accommodate increased wastewater

flows as a result of growth. PC10 must also recognise the relationship between urban and rural land and provide for the transfer of nitrogen allocations from rural land to the WWTP if it is developed for urban use.

35. It is not the intention of RLC's submission on PC10 to increase the consented load from the Rotorua WWTP through this plan change process, as suggested in the s42A report. However, by the same measure it is critical that the ability to do so through a subsequent consent process is not precluded by the framework established under PC10.
36. To respond to these issues, RLC's submission sought the inclusion of specific provisions to recognise the importance of wastewater treatment and disposal to the economic and social wellbeing of the community. These provisions should provide flexibility for the nitrogen discharge from the Rotorua WWTP to increase to accommodate growth, without compromising the 435 t/N/yr sustainable load to Lake Rotorua.
37. The inclusion of specific provisions relating to the Rotorua WWTP would, in my opinion, address the concerns raised above in relation to the consequential amendments. It would also give RLC certainty regarding the proposed upgrade and application to renew the resource consent, while acknowledging that the plan change process cannot be used to set limits for the Rotorua WWTP.
38. The inclusion of specific provisions relating to the Rotorua WWTP would, in my opinion, be within scope of PC10 and would not affect its fundamental policy direction.
39. Suggested wording for specific provisions to address Rotorua WWTP matters is discussed in, and appended to, the evidence of Mr Eccles.

PRECEDENT FOR THE INCLUSION OF SPECIFIC PROVISIONS

40. There is a recent precedent for the inclusion of specific provisions relating to infrastructure in Regional Plans, with the Region-wide Water Quantity - Proposed Plan Change 9 to the RWLP (PC9) including specific provisions relating to municipal water supplies.

41. PC9 explicitly recognises the social, cultural and economic benefits of municipal water supplies, including the economic investment associated with them, and introduces a controlled activity rule for the renewal of existing municipal consents (WQ O8, WQ P21, and WQ R6 of the RWLP).
42. In my view, there is no reason why a similar approach could not be applied to municipal wastewater treatment infrastructure in PC10. This would recognise the importance of the Rotorua WWTP to the community, and its significance as an essential component of nutrient management for Lake Rotorua.
43. Outside of the Bay of Plenty region, and as Mr Fuller notes in his evidence, Waikato Regional Council (WRC) has also sought to address the impact of nutrients on the Waikato and Waipa Rivers through Plan Change One (PC1) to the Waikato Regional Plan (WRP).
44. In relation to municipal discharges, PC1 seeks reductions but also acknowledges that there will be diminishing return on some improvements, particularly as design gets closer to the LOT. Upgrades can only go so far and minor improvements in reducing contaminants can come at unrealistic costs. Therefore, a Best Practicable Option (BPO) approach is recommended in PC1.
45. Upgrading a WWTP to the best possible specifications to minimise contaminants entering the environment is encouraged. However, it is acknowledged there will come a point where over capitalising of this infrastructure delivers only incremental gains to the discharge and associated water quality.
46. If that additional capital is available it could, in my view, be better spent on strategic investment in alternative farming practices, public education, planting, wetlands, gorse reduction, stormwater discharge and treatment upgrades etc.
47. Previously, Variation 5 - Lake Taupo catchment to the then Proposed WRP (now operative) introduced a framework for the reduction of nitrogen discharged in the Lake Taupo catchment. Originally, Variation 5 sought to restrict new on-site wastewater discharges or new

subdivisions that increase wastewater discharges. This would have prevented subdivision and residential development in the catchment, with significant social and economic costs to the community.

48. These policies were amended prior to adoption, removing the restriction and instead recognising that there is an opportunity to obtain a net reduction in nitrogen from subdivided land serviced by municipal wastewater systems.
49. The approach taken by WRC in relation to nutrient management is discussed in more detail in the evidence of Mr Fuller.

CONCLUSION

50. I have reviewed the further amendments to PC10 recommended by Mr Eccles in his evidence that deal with wastewater infrastructure and confirm that I agree with those recommendations.

Simon Banks

22 February 2017

Appendix 1

20 February 2017

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Hi Simon

Re: Urban sector nitrogen requirements

Please find attached summary of the key points of the draft approach for integrating the urban sector nitrogen requirements, in the nitrogen requirement for the Rotorua wastewater treatment plant discharge, into the Plan Change 10 nutrient accounting system.

This has been developed as a joint Rotorua Lakes Council and Bay of Plenty Regional Council approach. While it is almost complete, there are some details yet to be finalised and the approach is yet to be endorsed by both Councils and the Te Arawa Lakes Programme.

Kind regards



Alison Lowe
Senior Environmental Scientist
Rotorua Lakes Council

Allowing for the urban discharge in the Plan Change 10 nutrient accounting system - summary of draft principles and approach

RLC and BOPRC agree in principle on an approach that integrates the WWTP nitrogen discharge limit with the proposed catchment nitrogen accounting. It will allow for population and visitor growth in Rotorua in a way that will not compromise the 435 TN sustainable target.

The approach primarily sets out how nutrients will be accounted for in the proposed nitrogen accounting system Plan Change 10, as rural land within the Rotorua catchment changes to urban use. It also covers accounting for nutrients at time of subdivision in areas without wastewater reticulation, as well as other future discharges to sewer.

The proposed approach has been developed and tested in a joint effort by staff both Councils and has the support from staff in both Councils. The next steps are finalising and agreeing on the remaining finer details, seeking endorsement by the Te Arawa Lakes Strategy Group, identifying how it could be implemented (Councils regulations and requirements), and developing an implementation plan.

Key points in the nitrogen accounting approach

- It is proposed that sufficient nitrogen is required at time of subdivision to accommodate in addition to other losses, the housing density applicable for that zone (excluding roads etc.), across the total land area used for house-lots, regardless of the proposed size of the house-lots (i.e. zoning drives housing density rather than nitrogen availability).
- The N requirements at time of subdivision relative to Overseer 6.2.0 are shown in Table 1. It is anticipated that BOPRC would prepare a guide outlining how to use this table.
- For accounting purposes additional residual loads resulting from new connections to the WWTP since 2001-2004 remain on the land of origin but are also recognised in the WWTP consent limit.
- In reticulated area, 10% of 14 kg/HUE would be added to the WWTP mass discharge limit at time of subdivision, based on the maximum housing density allowable on the total house-lot area (excluding roads etc.) for the applicable zone. This will ensure sufficient nitrogen on the land in that zone at time of subdivision to allow for the capacity of the land to accommodate housing.
- Accounting for the capacity for housing in the reticulation area as the city expands provides the capacity for infill.
- Based on the N requirements outlined in Table 1, and assuming 35% of the land is not available for house-lots (18% as roads and 17 % as other at the background loss rate), the average N required for land zoned RD1, RD4 and RD5 has been estimated at 25.7, 16.1, 12.2 (Table 2).

- Additional nitrogen arising from outside the Rotorua catchment is not added to the WWTP discharge limit without Programme agreement. These connections may need to be offset from within the Rotorua rural area.

WWTP discharge

During the 2001-2004 benchmarking period the WWTP discharge was consented to discharge 30 t/yr, and the measured discharge was 33.7 t/yr. While RLC is hesitant to accept a benchmark lower than the load that was being discharged during the benchmarking period, we acknowledge that starting at 33.7 t would require 3.7 t reduction elsewhere in the catchment in order to achieve the 435t catchment target.

Assuming a starting point of 30 t in 2001-2004, the projected WWTP mass discharge limit based on the proposed approach is shown as the blue line in Figure 1 and is based on no increase in the load of nitrogen to the lake from the catchment. It will allow for a WWTP discharge of around 4.3 mg/l which is considered as high quality in terms of a nitrogen discharge, and is a tight yet operable target concentration following the proposed WWTP upgrade.

Figure 1. The projected WWTP mass discharge limit (blue line) and the load if the WWTP were to discharge at 5.5 4.3 and 3.45 mg/l.

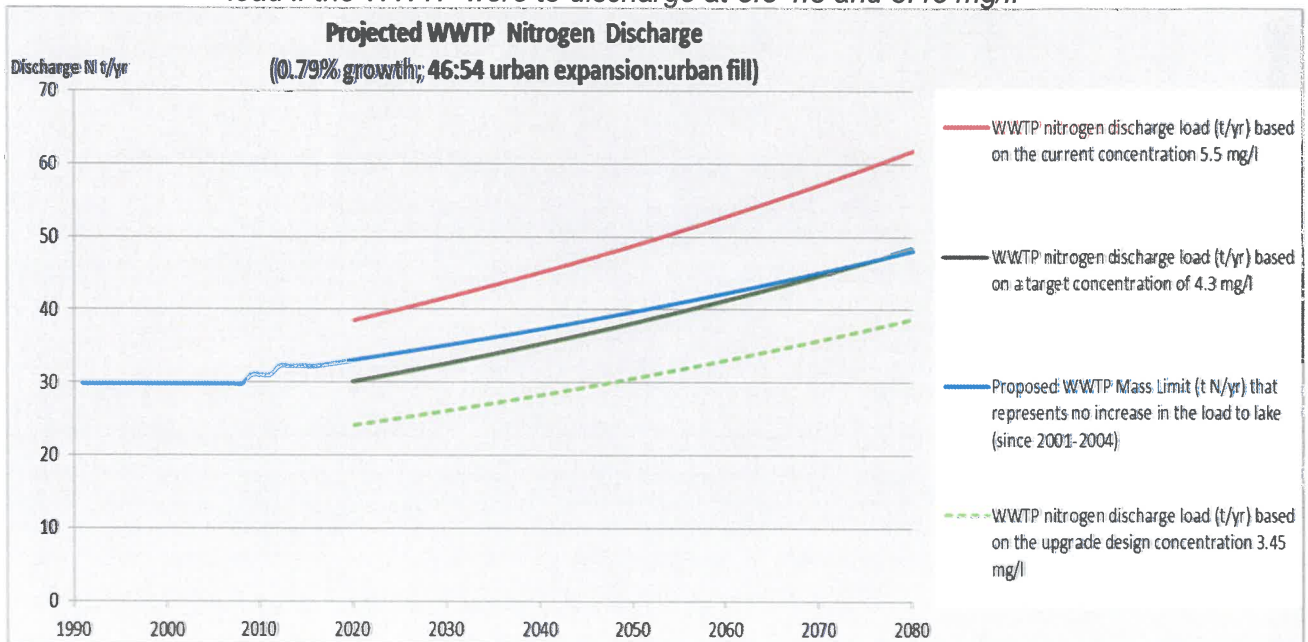


Table 1. Draft nitrogen requirements when subdividing (relative to Overseer 6.2.0)

	Land use and Activity	Residential zones where no grazing is allowed
N required for non-house-lot land losses	Sealed roads and other impermeable surfaces not available for house lots	Area of land at 0.5 kg N/ha/yr
	Restricted or specified land use and reserves not available for house lots	Area of land with at applicable N loss rate
N required for house-lot land losses	Impermeable surfaces allocation (350 m ² /potential house)	Area of land at 0.5 kg N/ha/yr
	Restricted or specified use land available for house lots	Area of land at covenanted loss rate
	Garden losses	Cultivated garden allocation at 138% of the house block reference file (108 kg N/ha/yr)
	Background losses	Remaining land at 23.3% of pastoral drystock reference file (5.9 kg N/ha/yr)
N required for sewage losses		Sewage allocation per potential house (based on zone capacity)
N required for other		other losses
Total N required for subdivision		Sum of above

Table 2. Draft nitrogen estimate by zone (relative to Overseer 6.2.0)

	Residential low-density	Residential lifestyle lakeside	Residential lifestyle
Zone	RD1	RD4	RD5
Average lot size (minimum m2)	450	1000	2000
Garden area allocation per potential house (m2)	22.5	50	100
Impermeable surface allocation per potential house (m2)	350	350	350
<u>Loss rates</u>			
Land not available for house lots (kg/ha)	5.9	5.9	5.9
Roads and impermeable surfaces (kg/ha)	0.5	0.5	0.5
Garden losses (kg/ha)	108.0	108.0	108.0
Background (kg/ha)	5.9	5.9	5.9
Allocation for sewage losses (kg/ potential house)	1.4	1.4	1.4
<u>Non-house-lot land (% of total area)</u>			
Roads	18%	18%	18%
Other	17%	17%	17%
Estimated N for non-house-lot land losses (kg/ha)	1.1	1.1	1.1
<u>House-lot land (% of total area)</u>			
Potential number of houses per ha of land available for house-lots	14.4	6.5	3.3
Impermeable surfaces @350 m2/house	50.56%	22.75%	11.38%
Garden	3.25%	3.25%	3.25%
Remaining area	11.19%	39.00%	50.38%
Estimated N for house-lot land losses (kg/ha)	4.4	5.9	6.5
N required for sewage (kg/ha)	20.2	9.1	4.6
Estimated N requirement over total area including roads and reserves (kg/ha)	25.7	16.1	12.2

Appendix 2

Alison Lowe, Senior Environmental Scientist
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Rotorua Wastewater Treatment Plant - Treatment Technology Option: Expert Statement

17 February 2017

Dear Alison,

Further to your e-mail dated 14 February 2017, please find below my statement on the preferred treatment technology option proposed at Rotorua wastewater treatment plant (WWTP), to support Rotorua Lakes Council's forthcoming Plan Change 10 submission.

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1 Introduction

My name is Kevan Grant Brian. I hold a bachelor of Technology Degree in Environmental Engineering from Massey University, Palmerston North. I have undertaken post graduate studies in environmental engineering through Massey University, Palmerston North.

I am a chartered Engineer and a member of the Institution of Chemical Engineers (UK). I am currently a technical director at Mott MacDonald PTY Limited with responsibility for wastewater treatment plant design, commissioning and process optimisation.

I have worked in the field of process/environmental engineering and wastewater treatment for the last 19 years and during this time I have been directly involved in numerous wastewater engineering projects in Australia and New Zealand.

I have worked with The Rotorua Lakes Council on issues related to their wastewater treatment plant since 2004. I have worked with Council on the development of the proposed Membrane Bio Reactor (MBR) and initially developed the concept of MBR as a means for Council to meet possible future conditions of consent for the treated wastewater discharge. I was directly involved in developing both the concept and preliminary designs for the proposed MBR.

2 Preferred Treatment Option

The preferred wastewater treatment option for the upgrade works at Rotorua WWTP will adopt Membrane Bio-Reactor (MBR) technology to supplement the existing activated sludge process.

Within this proposed process the wastewater and biomass are exposed to aerobic and anoxic conditions, the organics (BOD, COD) are oxidised and ammonia nitrified to nitrate and nitrate removed as nitrogen gas. These processes are generally referred to as biological nitrogen removal and are the most common processes worldwide for reducing nitrogen levels in wastewater.

The extent of biological nitrogen removal is dependent on influent wastewater composition and the process conditions/configuration; however complete (100%) removal of the influent nitrogen is not possible with any biological process.

3 Limits of Nitrogen Removal

Based on typical wastewater characteristics, the average level of nitrogen removal achievable with an MBR is greater than 85%. The maximum level of total nitrogen (TN) removal achievable in a biological treatment process is dependent on several factors. Typical treated effluent quality from MBR plants is widely understood to achieve < 1mgN/l for ammoniacal nitrogen and < 5mgN/l for total nitrogen (Tchobanoglous, G., *et al.*, 2003).

Nitrogen that cannot be removed biologically and that remains in the treated water is referred to as the limit of technology (LOT). This represents the best performance that can be achieved by any treatment process. It is my opinion, based on the wastewater characteristics at Rotorua, that the limit of technology for nitrogen at this plant is in the order of 1.5-2.0mgN/L.

The proposed MBR plant is designed to meet a standard of 3.5mgN/L and is therefore close to the limit of technology (LOT) for this plant. My understanding is that if resource consent is obtained for the proposed plant at this standard (3.5mgN/L) then it would be the lowest consented limit for any municipal wastewater discharge in New Zealand.

If the Rotorua Wastewater Treatment plant had to meet a lower nitrogen standard than 3.5mgN/L, it is my opinion that a tertiary nitrogen removal process in addition to the MBR would be required. While I have not undertaken a detailed costing of such a process, I estimate that the order of cost for tertiary nitrogen removal would be in the order of \$NZ15-\$20 million. The budget costs for the proposed MBR including contingency and risk sums is NZ 41.9 million (note that this budgeted sum for the MBR is subject to change via the value engineering process and further site investigations).

4 Summary

In summary, a high rate treatment system, such as MBR would be the best process available to remove high levels of nitrogen from the wastewater. I recommended an MBR as the high rate process able to remove high levels of nitrogen removal compared to other treatment processes at a cost that is consistent with Council's budget.

I, the undersigned, can be available prior to and during the hearing process for any queries and clarifications required on this statement, and can be reached at the contact details below.

Yours sincerely,

For Mott MacDonald Australia Pty Ltd.

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References:

Tchobanoglous, G, Burton, F.L and Stensel, H.D. 2003. Wastewater Engineering – Treatment and Reuse. Metcalf & Eddy Inc. Fourth Edition. p858.