

IN THE MATTER of the Resource Management Act
1991

AND

IN THE MATTER OF discharge and land use resource
consents for the operation and
maintenance of the Wairoa
wastewater treatment plant and
sewer pump station overflows

BY **Wairoa District Council**

Applicant

**STATEMENT OF EVIDENCE OF PHILIP JOHN LAKE ON BEHALF OF
WAIROA DISTRICT COUNCIL**

16 November 2020

INTRODUCTION

1. My name is **Philip John Lake**.
2. I am an environmental scientist at Lowe Environmental Impact Limited ("**LEI**").
3. My evidence is given in relation to the application for resource consents for the Wairoa Wastewater Treatment Plant ("**WWWTP**") by Wairoa District Council ("**WDC**").

QUALIFICATIONS AND EXPERIENCE

4. I have the following qualifications relevant to the evidence I shall give:
 - (a) Bachelor of Science majoring in chemistry; and
 - (b) Bachelor of Science (Honours) majoring in geochemistry.
5. I have 30 years' experience in a wide range of industrial and environmental science organisations, including the following roles relevant to the evidence I shall give:
 - (a) 9 years as an environmental scientist with Sinclair Knight Merz (now Jacobs);
 - (b) 1 year as a laboratory technician analysing water samples for a wide range of parameters;
 - (c) 3 months as an operator of Levin's WWTP and the Horowhenua District's drinking water treatment plants;
 - (d) 6 years as a Council RMA Compliance Officer; and
 - (e) 7 years as an environmental scientist with LEI.
6. These roles have included the following relevant experience:
 - (a) Monitoring programme development, sample collection, and assessments of monitoring results with relevance to effects on the environment;
 - (b) Preparation of resource consent applications including assessments of effects for discharges to water, land, and air;
 - (c) Meatworks and industrial wastewater treatment plant reviews;
 - (d) Reviews of the compliance, design, treatment performance, and operation of a number of small community wastewater treatment and discharge systems including Bulls, Halcombe, Sanson, Foxton, Foxton Beach, Levin, and Waitarere Beach WWTP's;
 - (e) Co-ordination of investigations, assessments of options, and development of consent applications for discharges from the Foxton WWTP; and

- (f) Co-author of a paper on oxidation pond design and performance with Derrick Railton (Fluent Solutions) who presented it to the Water New Zealand 2016 Annual Conference in October 2016¹.
7. I am a member of the New Zealand Institute of Chemistry.

CODE OF CONDUCT

8. I confirm that I have read the 'Code of Conduct' for expert witnesses contained in the Environment Court Practice Note 2014. My evidence has been prepared in compliance with that Code. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

BACKGROUND AND ROLE

9. I have been intrinsically involved throughout the development of the proposals and consent applications for Wairoa's wastewater discharges and so I am very familiar with the broad range of environmental and various other considerations relevant to the consent applications. I have completed or assisted with a large portion of the WWTP investigations and consent application preparation.
10. Prior to or while preparing my evidence I have:
- (a) Visited the WWTP, pump stations, main outfall location, lower Wairoa River shoreline, and Whakamahi Lagoon and Beach areas;
 - (b) Collated and assessed WDC's wastewater monitoring data for flows and quality;
 - (c) Obtained river flow and quality data from HBRC's hydrology team and used it to assist with assessments of the existing river environment, effects of the discharges on the river, development of hydrodynamic modelling scenarios and wastewater discharge regimes, and calculations of future discharge effects;
 - (d) Collated reports and data including the WWTP System Data and Compliance², Conceptual Design³, BPO⁴, and AEE reports;
 - (e) Reviewed and assisted with responding to s92 requests; and

¹ Railton, DE, and Lake P (2016): Don't Poo Poo that Simple Pond System. Presented at NZ Water Conference 2016.

² Lowe Environmental Impact (2017:A2I1) WWTP System Data and Compliance Summary

³ Lowe Environmental Impact (2018:C1.0) Conceptual Design for Wairoa Wastewater Treatment and Discharge

⁴ Lowe Environmental Impact (2018:B4) Wairoa Wastewater Treatment and Discharge Best Practicable Option

- (f) Reviewed the reporting planner's s42A report and supporting documentation.

SCOPE OF EVIDENCE

- 11. My evidence addresses the following matters:
 - (a) The Wastewater – Flows, Treatment, Quality;
 - (b) River Flows;
 - (c) Development of Discharge Regimes, Conceptual Design, and Assessment of Effects;
 - (d) Need for Storage for River Vs Land Discharges;
 - (e) Response to Issues Raised by Submitters; and
 - (f) Response to Council Reports.

THE WASTEWATER – FLOWS, TREATMENT, QUALITY

Wastewater Quality Limits for Discharge (Prior to Installing the UV System)

- 12. As shown on the spreadsheet of monitoring data that was supplied in response to HBRC's s92 requests (**Common Bundle of Attachments**), WDC's monthly effluent quality data covers almost 20 years (longer for some parameters). WDC's wastewater flow data indicates that Infiltration and Ingress (I&I) was not a significant issue in 1998 but it clearly has been since 2010. Ignoring seasonal variations and spikes, as concurred by Mr Dempsey, the wastewater quality prior to 2010 is not much different from that of more recent years, which is why I concluded that future reductions in I&I do not need to be considered when assessing future treatment performance, discharge effects and setting discharge quality limits.
- 13. It seems clear that changes in the WWTP's influent dilution from I&I impacts have been balanced by changes in the WWTP's treatment performance. As dilution rates have increased in line with increased I&I inflows, treatment performance has declined to the same extent and produced similar discharge quality regardless of the average flows. The notable increases in I&I dilution have not improved the discharge quality. Treatment has not been able to take advantage of the diluted inflows to produce a better quality discharge. I expect treatment performance (in terms of percentage reductions in concentrations) will improve when less dilute raw wastewater becomes the norm again, but the resulting discharge **quality** will not be much different from the last 10 or 20 years.
- 14. Consequently, I am of the opinion that it is reasonable to use the existing effluent quality dataset as the basis for expectations of future performance and setting limits on its quality even after I&I reduces. I note that Mr Dempsey agrees with

this approach despite his earlier reservations. I agree with Mr Dempsey's approach to setting limits and recommend that his proposed limits be adopted in consent condition 14 on a fixed (not rolling) 12-month basis based on monthly grab samples.

Filtration and UV Treatment

15. WDC have been working on the preliminary design of the filtration and UV system but need certainty of its consent requirements before investing further time and funds. WDC also need to design for likely future flows (which should be lower than recent years' flows as I&I reduces) and to know whether to cater for all flows or allow some high-flow bypass. As indicated by Mr Heath, WDC need 18 months from granting of consent to design, build, and commission such a system. Regardless, WDC will use its best endeavours to install the UV system at its earliest opportunity.
16. WDC's proposed UV system includes a sand filter which has been included in the design to address cultural values that require human wastes to have contact with and pass through Papatuanuku. I agree that it is more usual for such systems to use synthetic filtration materials, but WDC have chosen to address cultural values rather than simply implement standard engineering solutions.
17. Mr Dempsey also commented about UV system needing to be designed to cater for bypassing of flows above a set design flow rate. While this is typically how such systems are engineered, WDC has been asked by the community to ensure that **all** flows pass through the UV system. This is feasible, with the trade-off that the UV treatment performance will be reduced at the highest flows, even with additional UV lamps turning on as flows increase. The highest discharge flows will only occur when the river is flowing above 3 x median, which is when the river is flooding and is already much more heavily contaminated than what is being received from the treated wastewater discharge. I understand that the interested parties have accepted this trade-off because their primary goal of treating all flows would have been achieved and discharges during flood events are less concerning than during lower river flows.

Wastewater Quality Limits for Discharge (After Installing the UV System)

18. Once the proposed filtration and UV systems have been installed, it is clear that the concentrations of total suspended solids and pathogens will be dramatically reduced. I agree that the AEE's indicative future quality for other parameters, such as ammonia, were probably overly optimistic and accept Mr Dempsey's views on this.
19. I think there is no need for more detailed assessments of likely changes in quality after UV is installed so that new limits can be imposed before granting consents. From an RMA effects point of view, I consider that if the discharge quality within the limits set for the period prior to installing UV is found to be acceptable for discharging to the river (and it seems that HBRC accept that it is), then there is no

reason to lower those limits after installing UV simply because it is more capable of achieving lower limits i.e. the effects of the current discharge are less than minor as indicated by **Dr Shaw Mead**. I believe it is better to simply rely on the routine effluent monitoring data that will be obtained after the UV system has been installed to inform WDC's future reviews of further treatment and discharge regime options as proposed in the consent conditions.

20. In relation to the UV performance standards for high wastewater flows, I believe the consent conditions should only have minimum UV Transmissivity and perhaps pathogen reduction rate requirements set for discharges below 3,000 m³/d which will occur when the river flows are less than median.

WAIROA RIVER FLOWS

21. HBRC automatically measure and record river levels and flows at their river monitoring sites at Marumaru, Waikaretaheke, and Waiau at Ardkeen. River levels are also recorded at their Railway Bridge and Wairoa SH2 bridge sites, but these sites cannot measure flow rates because of the overriding tidal influences that prevent any correlation between flows and river levels.
22. In order to obtain river flow data for the Wairoa River after all its major tributaries have joined, HBRC's hydrologists provided me with their calculation method which sums the measured river flows at Marumaru and Ardkeen and then adds a calculated factor to account for runoff from the rest of the lower catchment area.
23. They also advised me that the median flow for the Lower Wairoa River was considered to be 60.3 m³/s at that time, based on 1980-2014 flow data. The median for the Marumaru site was 31 m³/s.
24. As discussed below in my evidence, 60 m³/s was used as the median river flow throughout the conceptual design, hydrodynamic modelling, consent application AEE, and consent conditions. I am not aware of any instances where a median river flow of 31 m³/s was used as the basis for the discharge regime or assessments of effects which Ms Diack has raised at para 116 of the s42A report.
25. The original AEE version and all subsequent versions of the consent conditions clearly gave 60 m³/s as the median river flow and the calculation method which were based on HBRC's hydrological advice. Ms Diack has advised that HBRC's hydrologists now consider that the median flow for the Lower Wairoa River is 79.18 m³/s and that the calculation method should be deleted from the relevant consent definition.
26. This increase in value of the median river flow means that all of the discharge regimes will in fact change at higher river flows than described in the consent application documents. This should not greatly affect WDC's ability to meet the discharge criteria and will probably have minimal effect on the numbers of days per annum that discharges occur for each river flow bin. This is because the

numbers of days above and below median will tend to remain similar despite any changes in value of the long-term median river flow.

27. I accept 79 m³/s (which I have rounded to the nearest whole number) for use as the consents' definition for the median flow for the Lower Wairoa River. I also accept the proposed addition of condition 55(e) to provide for the ability to review the consent conditions in order to reflect any future adjustments to the river's median flow value. However, only the Marumaru, Waikaretaheke, and Ardkeen sites provide live flow data to HBRC's website. There is no publicly accessible method for obtaining live calculated Lower Wairoa flow rates that I am aware of. Consequently, WDC needs either a calculation method or a direct daily feed of river flow data for the Lower Wairoa River so that discharge volumes can be adjusted each day to reflect that day's river flow. In this regard, I think that either HBRC should provide that calculation method as part of the consent or HBRC must set up a system for providing a daily river flow estimate to WDC's WWWT control system.

DEVELOPMENT OF DISCHARGE REGIMES, CONCEPTUAL DESIGN, AND ASSESSMENT OF EFFECTS

28. The Conceptual Design⁵ report provides a comprehensive description of how the proposed discharge regimes were developed to link discharge volumes to river flow rates. The hydrological modelling by eCoast was based on these discharge regimes and the nominated river flow rates where discharge volumes changed. As noted above, the median river flow rate used for the Conceptual Design and hydrological modelling was 60 m³/s based on HBRC's advice of flows for the Lower Wairoa River.
29. HBRC's suggested changes could indicate they have accepted the proposed discharge regime. However, there appears to be a misunderstanding of the nature of the changes and their effects compared with the existing discharge regime. The proposed regime is **more** restrictive than the current discharge limit below 3 x median river flows to better protect the river's water quality and ecology from the effects of higher discharge volumes. The proposed regime is **less** restrictive in terms of volume and timing than the current discharge limits **only** when the river is in flood, which is when the discharges will have no or negligible effects and wastewater flows typically increase dramatically. The discharge won't **increase** from historic discharges. In fact it will **decrease** at and below median flows, particularly as storage and irrigation are developed. This situation is also discussed in the evidence of Mr Lowe and Dr Mead.
30. I have **attached (Annex A)** graphs of river flows versus the historic discharges and the proposed discharges when limited for river flows. These show that the historic frequency of large discharge volumes during lower river flow conditions

⁵ Lowe Environmental Impact (2018:C1.0) Conceptual Design for Wairoa Wastewater Treatment and Discharge.

will no longer occur. This will reduce the scale of any adverse effects on the river's water quality. These graphs also show that smaller discharge volumes will occur more often during all river flow conditions.

31. WDC have introduced continuous discharges with unrestricted volumes for times when river flows are above 3 x median flows which was the **only** circumstance considered acceptable by WDC and from feedback received during consultation.
32. During pre-hearing and related discussions with submitters, WDC changed the proposed discharge limit in Condition 7 from 5,000 m³/day to 3,000 m³/day for river flows below median in response to concerns about discharges below median river flows. This limit will be challenging to meet, particularly without more storage (and irrigation) and significant I&I reductions but it reflects WDC's effort to further restrict discharges at lower river flows to address submitters' concerns and protect the river's water quality and public health. This is a big improvement on the historic (current) situation where discharges up to 5,400 m³ can and do occur regardless of how low the river flows happen to be.
33. WDC will continue to record daily discharge volumes and will daily record river flow rates. Both daily flow records are necessary for WDC to determine how much treated wastewater can be discharged each day and to demonstrate compliance with the proposed discharge regimes.
34. I understand the intent of the addition to Condition 7 delaying commencement of discharges by an hour during January to March is to avoid the public noticing the plume or contacting it during summer evening recreation, but this may cause difficulties with discharging the required volume during the reduced out-going tide window while remaining within the available storage volume at the WWWT. However, I note that the related discharge volume limit is 3,000 m³ which should be readily able to be discharged within the shortened timeframe. I accept this suggested change to the discharge conditions.

NEED FOR STORAGE FOR RIVER VS LAND DISCHARGES

35. Storage is vital and necessary for achieving the proposed discharge regimes both to the river and for implementing appropriate land discharge systems. This is discussed also in the evidence of Mr Lowe.
36. Some of the storage can be accommodated at the WWWT site, but, due to the size of storage required and the practicalities of proximity to irrigation areas, most of the storage volumes will most likely be accommodated on farmland near or within the land discharge areas.
37. In order to manage discharges to the river, storage is less important during summer low river flow conditions if irrigation is available. Storage may simply need to carry any surplus wastewater over from low river flows to times when river flows have risen above its median. If irrigation, when it is eventually developed, is able to take most of the summer inflows most of the time, storage is

then only needed during autumn to spring months. If river discharges are heavily restricted below 3 x median flows, then storage will need to be much larger and discharges during times of 3 x median flows will be correspondingly very much larger unless the wastewater is being held over for irrigation.

Philip John Lake

16 November 2020

Annex A: Discharge vs Flow Relationship Graphs



