



memorandum

TO Sven Exeter and Paul Barrett FROM Oliver Hunt & Hilary Lough
Hawke's Bay Regional Council DATE 22 December 2022
RE Pōrangahau and Te Paerahi Wastewater Discharge Technical Review – Overseer Assessments and Helminths

1.0 Introduction

CHBDC is applying for consents from the Hawke's Bay Regional Council (HBRC) to continue operating their existing discharges from the Pōrangahau and Te Paerahi WWTPs while they transition to a new year-round irrigation system and consent to operate the new irrigation system. Specifically, this includes:

- ∴ *Discharge of contaminants into air:* discharge of aerosols and odour to air associated with the receipt, treatment, storage and discharge of wastewater from the Pōrangahau and Te Paerahi Wastewater Treatment Plants.
- ∴ *Discharge of contaminants onto or into land:* Discharge of treated wastewater from the Te Paerahi WWTP to the existing land disposal area and discharge of treated wastewater from the Pōrangahau and Te Paerahi WWTPs at the proposed irrigation site.
- ∴ *Discharge of contaminants into water:* Discharge of treated wastewater from the Pōrangahau WWTP into the Pōrangahau River.

Pattle Delamore Partners Ltd (PDP) has been engaged by HBRC to provide a technical review of the following aspects of the application, specifically for the new proposed land application system:

- ∴ Details of the proposed land application system
- ∴ Effects on soils
- ∴ Effects on groundwater
- ∴ Effects on air quality (odour and spray drift)
- ∴ Effects on wetlands
- ∴ Risk of natural hazards

The information in the AEE and supporting documentation, together with further information provided by the applicant, has been relied upon for this review.

PDP has prepared this memorandum to review and comment on the additional information and proposed consent conditions provided by the applicant on 6 December 2022 regarding:

- ∴ Overseer Modelling and Nutrient Loading Rates; and,
- ∴ Proposed Helminth Consent Conditions

2.0 Nutrient Loading Rates

The applicant provided Overseer assessments in the initial AEE for leaching from the discharge property at all the proposed stages. This modelling has been used to inform all of the surface water effects assessments to date.

The initial modelling in the AEE included the following loading rates:

- a) Whole of Property Average N load 46 kg N/ha/y
- b) Whole of Property P load 18 kg P/ha/y
- c) Max N Load 135 kg N/ha/year; and
- d) Max P Load 55 kg P/ha/year.

We therefore proposed these rates as the consent condition limits as the increase in nutrient contribution to the Pōrangahau River had been agreed as less than minor.

The applicant had earlier proposed significantly greater nutrient loading rates but had not demonstrated how these would affect the nutrient losses from the discharge property and any actual or potential effects on surface water quality.

Following PDP's proposed limits (refer above), the applicant has provided further modelling considering a loading rate of 100 kg N/ha/y and 150 kg/ha/y as a whole of property average.

It should be noted that in both modelled scenarios the wastewater nitrogen applied to LMU3 is 125 kg N/ha/y. This is important as the LMU3 soils have very high nitrogen leaching vulnerability as they are raw sands. Conversely, the heavy clay soils of LMU1 have very low nitrogen leaching vulnerability. The applicant's modelling demonstrates this clearly with significant increases in nitrogen application to LMU1 resulting in small increases in nitrogen leaching. The focus on preventing nitrogen leaching is therefore on LMU3.

The applicant has proposed the following limits based on their modelling:

- a) Whole of Property Average N load 100 kg N/ha/y
- b) Whole of Property P load 40 kg P/ha/y
- c) Max N Load to LMU3 250 kg N/ha/year; and
- d) Max P Load to LMU3 100 kg P/ha/year.

It is not clear what the justification is for the 250 kg N/ha/y limit for LMU3 as the maximum applied load to LMU3 in the modelling is 163 kg N/ha/y and the maximum applied load under the 100 kg/ha/y farm average is only 126 kg/ha/y. We do not see that sufficient justification has been provided for the limit for LMU3.

Furthermore, in all the scenarios the wastewater nitrogen applied to LMU3 is only 125 kg N/ha/y. If the median effluent limit of 35 mg/L is applied at the consented volume (five year rolling average of 183,000 m³/yr), then this is an average of 6405 kg of only wastewater nitrogen which needs to be applied. This equates to an average of 160 kg N/ha/y from wastewater if the irrigation is even across the 40 ha. It is more likely that the majority of the irrigation will occur in LMU3 due to its free draining soils. The AEE assessment was based on 66% of the wastewater being irrigated to the 20 ha LMU3 which assuming 35 mg/L is a loading of 211 kg N/ha/y to LMU3. It is likely that in winter, when the treatment system is less effective at nitrogen removal due to lower temperatures, that LMU3 will be the primary discharge area as LMU1 is more prone to saturation. Therefore, this median derived loading rate may underestimate the actual loading rate to LMU3 if higher winter concentrations are offset by lower summer concentrations.

For a comparison of the modelling scenarios and the potential effects on the Porangahau River, we have reproduced the simple mass balance assessment completed by Beca in Table 28 of the Surface Water AEE. Note that the contribution of the Te Paerahi WWTP has been removed from the existing scenario as this is known to drain towards the coast and not the Pōrangahau River. See the table below.

The “Potential Consent Conditions – Estimate” scenario is an estimate only. This is based on similar ratios of applied nitrogen to leached nitrogen from the updated Overseer modelling provided. The applicant did not provide detailed modelling of the proposed consent conditions scenario. We have estimated this based on 250 kg/ha/y to LMU3 and 46 kg/ha/y to LMU1 and LMU2.

Table 1: Increased nitrogen loss for new scenarios.

Parameter	Unit	Scenario				Potential Consent Conditions - Estimated
		Existing System	AEE Stage 3a	100 kg/ha/y Modelling	150 kg/ha/y Modelling	
Nitrogen Losses (kg/y)	kg/y	3050	3278	3687	4480	6400
% Increase on Existing	%	-	7%	21%	47%	110%
% Increase on AEE Model	%	-	-	12%	37%	95%

The applicant has not provided any justification for the proposed P loads for the site.

3.0 Contribution to Catchment Loads

To put the above potential increases into perspective, we have compared these with estimated total catchment nitrogen loads.

In the original AEE, the applicant completed a simple calculation of catchment nitrogen loads using the average flowrate and the average concentration from HBRC flow monitoring and quality sampling at the Pōrangahau Saleyard/Quarry site approximately 5 km upstream of the discharge property.

We consider that using averages, which may be significantly skewed by floods or very high nitrogen sample results could potentially overestimate the total nitrogen load in the catchment. PDP has therefore completed for comparison a further assessment of the loads using the water quality sampling data¹ and flow monitoring data² from 2009 to 2021 for the Pōrangahau River at the Saleyard/Quarry site. PDP has undertaken this using the Ratio Method which considers the variability of flow and nitrogen load and can therefore provide a more accurate assessment³. The variability of total nitrogen concentrations with flow is shown below in Figure 1. It is clear that that the concentration varies with flow.

¹ <https://www.lawa.org.nz/download-data/>

² <https://www.hbrc.govt.nz/environment/river-levels/>

³ Snelder, T.H., McDowell, R.W., and Fraser, C.E., 2017. Estimation of Catchment Nutrient Loads in New Zealand Using Monthly Water Quality Monitoring Data. *Journal of the American Water Resources Association (JAWRA)* 53(1): 158– 178. DOI: [10.1111/1752-1688.12492](https://doi.org/10.1111/1752-1688.12492)

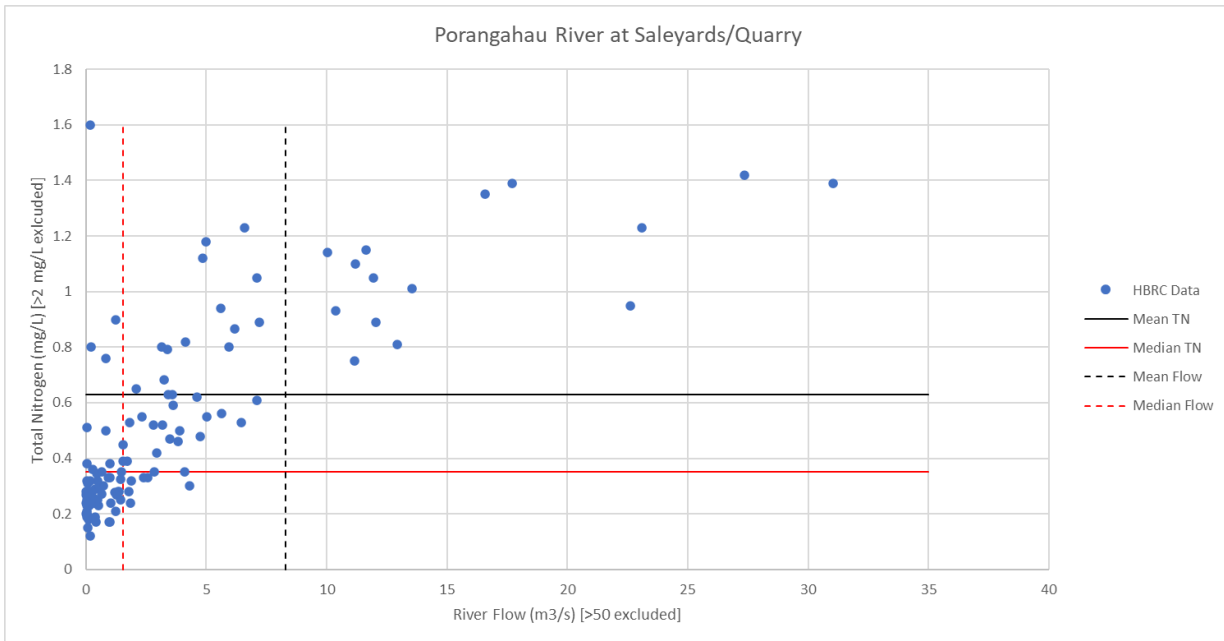


Figure 1: Total Nitrogen concentration by flow in the Pōrangahau River. Note that three outliers have been excluded from the graph only for readability.

The ratio method indicates that the catchment nitrogen load at the measuring point is approximately 58 t/year compared to the 137 t/year assessed by the Applicant. The contribution percentage of each of the potential scenarios may therefore be significantly higher than has previously been indicated as shown in Table 2, although it is acknowledged, in both assessments, that use of the Saleyard/Quarry site does not include further flow or nutrient contributions below that point.

Table 2: Relative contribution to total nitrogen load in the Pōrangahau River Ratio method vs AEE assessment.

Assessment Method	Catchment Total (T N/y)	Percentage of Upstream Catchment Nitrogen Load				Potential Consent Conditions - Estimated
		Existing System	AEE Stage 3a	100 kg/ha/y Modelling	150 kg/ha/y Modelling	
Ratio	58	5.2%	5.6%	6.3%	7.7%	11.0%
AEE	137	2.2%	2.4%	2.7%	3.3%	4.7%

It is apparent that the existing wastewater/farming system is a significant contributor to the catchment nitrogen load. Further increases in nutrient load as a result of the proposed discharge need to be assessed carefully for their impact on the receiving environment. The above table indicates that the latest set of proposed consent conditions could result in a substantial increase.

Based on the further information provided on nutrient loads and in the absence of further information justifying this increase in terms of resulting surface water quality impacts, we have not changed our position on our recommended nutrient limit conditions.

4.0 Helminths

4.1 PDP Proposed Helminth Conditions

In Consent Conditions v8 (dated 11 November 22) PDP proposed the following consent conditions regarding Helminths, on the basis of existing Australian guidelines (Victorian EPA Water Recycling Guidelines (2021)):

69	The consent holder shall ensure that no pigs graze on or are fed by any pasture or fodder crop that has been irrigated by treated wastewater at any time.
70	If cattle are to consume pasture or fodder crops irrigated by treated wastewater the consent holder must ensure one of the following control measures are in place: (a) A 2 year withholding period occurs between wastewater irrigation and consumption. (b) A wastewater treatment process or combination of processes which provides a minimum of 4 log removal for helminths.
71	The consent holder must ensure that no crops intended for human consumption are irrigated with wastewater.

4.2 Applicant Proposed Helminth Conditions

In response, the applicant has accepted conditions 69 and 71 but suggested the below conditions to replace condition 70:

1	The Consent Holder shall from the commissioning of the new WWTP at the Discharge Property: a) take bi-monthly wastewater sludge samples over a year long period and have them analysed for helminth ova for the purposes of developing a baseline dataset; and b) following the completion of (a), take bi-annual wastewater sludge samples for the consent duration to be analysed for helminth ova for the purposes of regular monitoring and WWTP performance.
2	Subject to the completion of Condition X (a), the Consent Holder shall within 6 months, in collaboration with the Hawke's Bay District Health Board (HBDHB) and the Ministry for Primary Industries (MPI), develop two critical limits for helminth ova within wastewater. These limits shall reflect: a) A limit the Consent Holder shall notify and then discuss and develop an agreed approach to managing helminths; and b) In addition to the requirements of a), a higher limit that requires immediate movement control of stock on and off the Discharge Property.
3	For the purposes of managing helminths, the Consent Holder shall; a) require the farm manager to observe stock condition and test for worms as needed or in accordance with veterinary advice.

	<p>b) If worms are suspected, or observed, then stool samples are to be taken from a representative sample of stock. Following return of the worm count results, in collaboration with veterinary advice an appropriate parasite control programme implemented.</p>
<p>23</p>	<p>Add a (v) to Condition 23 that requires:</p> <p>v) A protocol and management requirements for managing sampling and notification of high helminth ova counts, including:</p> <ul style="list-style-type: none"> i. Sampling and analytical processes; ii. Method and process to set a baseline ova counts; iii. Establishment of two status threshold, first being a 'watch status' and second 'movement control status'. iv. Who and how notification occurs; v. Response procedures; and vi. Farm management and responses practices to monitoring helminth ova. <p>Advice Note: (iii), (iv) and (v) may require baseline sampling to have been completed</p>

4.3 PDP Comment on Applicant Conditions

Condition 1 Comments:

PDP agrees that monitoring of sludge for helminth ova is a more appropriate method of monitoring. However, the proposed monitoring regime will only identify within a reasonably short timeframe if helminths at levels of concern/species of concern are present in the first year of monitoring. Helminth ova can rapidly become present in the wastewater if an infected adult enters the community, most likely from overseas in the case of *Taenia saginata*. A fully grown tape worm can shed more than half a million eggs per day. It is likely that if an outbreak did occur the ongoing 6 monthly monitoring may not identify helminth ova presence for some time, if it manages to locate this at all.

We agree that the sampling will be helpful for understanding helminth presence in the sludge, but we are still not convinced that the sampling procedure described provides adequate risk mitigation for helminths. We note that the Victorian EPA Water Recycling Guidelines (2021) do not discuss sampling nor an acceptable concentration for helminth ova in wastewater but rather specify a required log removal. However, we acknowledge the further conditions proposed which are discussed below.

Condition 2 Comments:

Please refer to condition 1 comments on sampling concerns. We do consider it could be helpful to have the parties referred to involved, but we would also recommend that any parties identified in these conditions should be involved prior to consent being granted, to ensure they agree to involvement in limit development and that this condition could be met.

Condition 3 Comments:

As has previously been stated by PDP, *Taenia saginata* is a human tapeworm and does not typically cause any visible symptoms in the cattle it infects. Eggs contained in human faecal matter consumed by cattle are absorbed in the small intestine and make their way to the skeletal and cardiac muscles where they

grow as cysts. This condition is called *Cysticercus bovis* or beef measles and the cysts are not typically detectable until a post-mortem inspection is completed as part of NZ food safety controls.

In isolation, Condition 3 does not appear to provide significant protection against *Taenia saginata*, should this become present in the communities at Pōrangahau or Te Paerahi. The applicant acknowledges that stock may be asymptomatic, but is proposing this condition as part of overall management of helminths.

Condition 23 Comments:

We agree that a detailed plan for managing any potential helminth outbreak should be included in the operation and management plan. However, we have concerns regarding the effectiveness of the current proposals under Conditions 1 and 3 as outlined above.

Overall, the proposed limit setting process and the management plan are likely to assist in managing the potential public health issues related to helminths, however, as above, we recommend that any parties identified in Condition 2 should be involved prior to consent being granted. At present there is a degree of uncertainty in the effectiveness of the conditions. These parties may offer further helpful advice on the finalisation of these conditions. Involvement of additional public health experts may also be helpful to achieve resolution.

5.0 Limitations

This memorandum has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Hawke's Bay Regional Council and others (not directly contracted by PDP for the work), including Lowe Environmental Impact, WSP, Beca and Tonkin and Taylor. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the memorandum. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

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