MEMO	
ATTENTION	Sven Exeter (Mott MacDonald)
FROM:	Shane Kelly
CC	Tania Diack (Hawkes Bay Regional Council)
DATE:	30 September 2021
REGARDING	Consent to shift discharges from the Pōrangahau and Te Paerahi wastewater treatment plants

COAST & CATCHMENT
ENVIRONMENTAL CONSULTANTS

BACKGROUND AND SCOPE

Central Hawke's Bay District Council (CHBDC) have applied for a consent to implement a staged process for shifting discharges from the Pōrangahau and Te Paerahi wastewater treatment plants (WWTPs) to Pōrangahau River and coastal foredunes Te Paerahi, respectively, to irrigated land disposal on an existing farm. Briefly, the Applicant proposes to:

- Continue current discharges for up to six years for Te Paerahi and nine years for Pōrangahau.
- Begin progressively diverting treated wastewater from Te Paerahi to a land irrigation discharge, 4 years after consent is granted.
- Begin progressively diverting treated wastewater from Pōrangahau to a land irrigation discharge, 6 years after consent is granted. At this stage discharges to Pōrangahau River are expected to almost cease, except for when wet weather limits irrigation and river flows are above median levels.
- Commence the operation of a new, combined treatment plant discharging to land irrigation, provide for associated storage of up to 35,000 m^3, and cease the operation of the Pōrangahau and Te Paerahi WWTPs within 9 years.

CURRENT TREATMENT AND DISCHARGES

The Pōrangahau WWTP services a community of approximately 96 households with an estimated population of 270. Treatment currently provided by the WWTP consists of a baffled oxidation pond, with treated wastewater being discharged via a strainer basket to a gravel filter and farm drain before discharging to Pōrangahau River, about 10 km up from the river mouth. Average annual and daily wastewater volumes are estimated to be 52,560 m^3/year and 144 m^3/day, respectively. No significant trade waste discharges have been identified in the township.

Te Paerahi WWTP currently services a largely holiday population that is estimated to include 117 connected properties, with a highly seasonal residency. The WWTP consists of a single ~0.1 ha clay lined oxidation pond with no incoming flow monitoring or screening. Treatment occurs through anaerobic processes on settled solids, and by the action of bacteria and algae on suspended solids and nutrients in aerobic conditions (supplemented by mechanical surface aeration during peak period). Treated wastewater is pumped to wetland soakage in the sand dunes approximately 150 m back from Pōrangahau Beach. Hydrological modelling suggests groundwater travel times from the wetland to the nearest discharge point along the coast are between 60 days and 340 days, while travel times to the river mouth are estimated to be 35 years to 200 years (Appendix B, Blair 2021a).

PROPOSED FUTURE TREATMENT AND DISPOSAL

The proposed property for the future land disposal consists of a 114.3 ha farm bounding Beach and Hunter Roads, which is currently used for pastoral grazing (ewes and steers) and low intensity rotational cropping. Farm operations currently involve fertilising, but no irrigation infrastructure has been installed. The south-eastern section of the farm has silty and sandy loam soils, with a historic dune system towards the north. These sit above a layer of coarse gravels, underlain by non-permeable clay. The gravel layer is considered to hydrologically link the farm to watercourses running through it, and to Pōrangahau Estuary (Everitt 2021). Wastewater will be treated to achieve mean values in wastewater parameters that are no greater than the existing wastewater systems. Additionally, all flows discharged to the land will be UV treated to manage pathogen concentrations.

PURPOSE OF THIS REVIEW

This review focuses on the assessments of ecological and water quality effects and considers whether: associated values have been adequately described; potential effects have been identified and appropriately assessed; and, whether the conclusions reached about the significance of effects are reasonable. Key documents considered are:

Everitt, L. (2021) Appendix I: Pōrangahau and Te Paerahi wastewater - Water quality assessment. Report prepared for Central Hawkes Bay District Council, P:D.25, Beca Ltd. 67 pp., plus Appendices.

Webb, C. (2021) Appendix K: Pōrangahau Wastewater discharge to land: Coastal ecology assessment. Report prepared for Central Hawke's Bay District Council, P:D.65, Beca Ltd. 9 pp.

Blair, S. (2021) Appendix N: Te Paerahi wastewater treatment plant discharge water quality assessment. Report for Central Hawke's Bay District Council, P:D.60, Beca Ltd. 23 pp., plus Appendices.

Blair, S. (2021) Pōrangahau wastewater treatment plant discharge water quality assessment. Report prepared for Central Hawkes Bay District Council, - P:B.24a, Beca Ltd. 44 pp., plus Appendices.

Eise Venter (Lowe Environmental Impact) (16 June 2021), Memo to Darren de Klerk (Central Hawke's Bay District Council) and Katie Beecroft (Lowe Environmental Impact). Regarding: Surface water sampling feedback (P:B.20). 15 pp.

WATER QUALITY

PORANGAHAU RIVER

The information provided in Blair (2021b) indicates that Pōrangahau River flows fluctuate widely with median flows at the HBRC's Kate's Quarry monitoring site, approximately 5.6 km upstream of WWTP discharge, of around 1.3 m^3/s. The maximum recorded flow was 456 m^3/s, but no-flow situations are common, particularly in summer when flows are regularly less than 0.1 m^3/s. The river is tidally influenced (tidal fluctuations are approximately 0.5 m) and typically saline[1] at the WWTP discharge point, under background, low flow conditions. The tidal influence is strongest in summer when low flow conditions commonly occur.

[1] Salinity is reported as typically being 27 ppt, which is only slightly below typical values for coastal seawater.

The high ecological and societal values of Pōrangahau River are acknowledged, and the river's high ecological values are a key factor in the river and estuary being designated as outstanding water bodies under HBRC's Proposed Plan Change 7 (Blair 2021b; Everitt 2021; Webb 2021). In terms of societal values, the AEE and water quality assessments indicate that shellfish collection occurs near the mouth of the river. Other recreational/cultural activities identified as occurring below the discharge point include boat access and swimming near the Beach Road bridge (which is around 4 km below the existing Pōrangahau WWTP outfall and adjoins the south-eastern corner of the proposed future disposal property), and fishing and whitebaiting around 0.5 km above the bridge. It is also used by kayakers and passive recreation users elsewhere.

However, water quality adjacent to, and upstream of, the WWTP discharge is generally poor. River water quality is monitored at the HBRC's Kate's Quarry monitoring site, and in accordance with existing discharge consent conditions, on outgoing tides at sites 200 m above and below the discharge point. Data presented in the water quality assessment shows that:

1. Ambient river water quality above discharge is nutrient enriched and that water quality worsens slightly downstream between the Kate's Quarry monitoring site and the site 200 m above the WWTP outfall. This is reasonably presumed to be due to diffuse agricultural runoff.
2. Indicator bacteria concentrations (*Escherichia coli* and faecal coliforms) are also elevated upstream of the discharge, but median and 90th percentile values decrease downstream between the Kate's Quarry monitoring site and the site 200 m above the WWTP outfall. Everitt (2021) notes that indicator concentrations only exceed "trigger values"[2] at the 90th percentile of the datasets, and concludes that this infers that spikes in bacterial concentrations are related to high river flow events. However, this appears to be somewhat misleading. While it is correct to say the that 90th percentile values exceed the trigger values, that does not mean values below the 90th percentile do not. My checks of HBRC data downloaded from the LAWA website (31 Jan 2005 to 23 Oct 2019) indicate that around 14% (or around one in seven) samples had *E. coli* concentrations exceeding the trigger at the Kate's Quarry site over the period examined. Everitt (2021) goes on to indicate that data from the site 200 m upstream of the discharge also have elevated *E. coli* values, which put the site into the "D" attribute band of the National Policy Statement for Freshwater Management (2020), and accordingly, that it should be classified as a 'degraded water body'.

The water quality assessment reports (Blair 2021b; Everitt 2021) summarise the results of a previous dilution and mixing study, which found that there was a 1,000 times dilution factor at the point of reasonable mixing, approximately 200 m downstream of the WWTP discharge. Despite that, monitoring results indicate that enterococci, suspended solids, total ammoniacal nitrogen, nitrate + nitrite N, total phosphorus (TP) and dissolved reactive phosphorus (DRP) concentrations are significantly higher at the monitoring site 200 m downstream of the outfall, compared to those at the site 200 m upstream. Non-significant increases in *E. coli* and faecal coliform concentrations between the upstream and downstream sites are also highlighted, along with median faecal coliform concentrations that exceed the Regional Resource Management Plan (RRMP) guideline (200 cfu/100 ml) at the downstream site (the use of the RRMP guideline

[2] Action level concentrations from Ministry for the Environment, Ministry of Health (2003) Microbiological water quality guidelines for marine and freshwater recreational areas. Ministry for the Environment and Ministry of Health, Wellington.

is discussed below). The reports go on to note that a number of parameters, including nutrients (e.g., TN, TP and DRP) and pH are already elevated above the ANZECC chemical and physical stressor trigger values upstream of the discharge point.

Finally, they conclude that predictions from mass balance calculations suggest the discharge causes a moderate increase in nutrient and faecal coliform concentrations during low flow conditions (based on the assumptions used, estimated 200 m downstream faecal coliform concentrations were 317 cfu/100 ml compared with 120 cfu/100 ml 200 m upstream) and a "less than minor" increase during median flows (127 cfu/100 ml downstream compared with 120 cfu/100 ml upstream).

The water quality assessments were supported by appended Opus reports from 2009 (Taylor & Strang 2009) and 2013 (Hamill 2013), which include assessments of:

- discharge dilution (through dye mixing tests);
- tidal mixing analysis;
- sediment quality; and,
- benthic ecology.

TE PAERAHI GROUNDWATER

The existing effects of discharges from the Te Paerahi WWTP on groundwater and the coast have been previously reviewed in a memo by Nic Love (11 May 2021) (Appended), who concluded that based on available data effects on neighbouring groundwater and the coast are expected to be low. I concur with the conclusions and recommendations of that review and have nothing further to add on the matters covered.

SURFACE WATER QUALITY ON THE LAND DISPOSAL SITE

A limited amount of information was provided on surface water quality in water channels on, and surrounding, the land disposal site (memo from Eise Venter (Lowe Environmental Impact) 16 June 2021). Samples were obtained on a single day from two sites in channels within the disposal farm, two estuarine sites close to each of those channels, and from HBRC's Kate's Quarry monitoring site. Highest nitrogen concentrations were obtained from the farm channels, while lowest nitrogen concentrations were obtained from the Kate's Quarry site. Phosphorus concentrations were highest in the southern farm channel, while highest *E. coli* and enterococci concentrations were obtained from the northern farm channel. Overall, the data suggests that water quality in the farm channels was worse than water quality in Pōrangahau River/Estuary, but little more can be drawn from a one-off sampling event (I note that some values are compared to ANZECC guideline values or Horizons One Plan Limits, but the ANZECC values appear incorrect).

STAGED SHIFT TO LAND DISPOSAL

Anticipated changes in discharge loads and water quality during the shift from Stage 0 to Stage 3 are assessed using mass balance (for water quality) and mass load (for contaminant loads to Pōrangahau River) estimates (Section 6 of Everitt 2021). This is a key component of the assessment, which underpins the assessment of coastal ecological effects (Webb 2021). However, I found:

- The assessment very confusing to read. I struggled to understand how the assessment was carried out and to interpret the results.
- I was left unclear about why some parameter values were used. For example:
    - Different discharge volumes were used for the Pōrangahau WWTP between Stages 0 and 1 when, I understand, no change is proposed for that discharge (Stage 0 used values based on monitoring results, while Stage 1 uses modelled values). It appears as though median daily discharge volumes of 93.9 m^3/day (0.001 m^3/s) are used for Stage 0 (bullet point 2 in Section 5.3.1 of Everitt (2021)) and 10,103 m^3/month (0.004 m^3/s) are used for Stage 1 (page 53). The reasons for and implications of this are not adequately explained.
    - Predicted discharge volumes in Table 26 "Pōrangahau WWTP Stage One modelled river discharge" of Everitt (2021) project no Pōrangahau discharges for up to six months per year). The reasons for this are not stated, the source is not fully cited, and nor does it appear to have been included in the Application documents.
- I could not reconcile some of the results presented (a number of results are counter intuitive). For example:
    - Stage 1 reductions in river contaminant concentrations are predicted for the site 200 m downstream of the Pōrangahau WWTP discharge, despite no changes being proposed (or described) for that discharge between Stages 0 and 1.

I am therefore left unsure about reliability and utility of the mass balance and load estimates. Consequently, I recommend that the basis of this assessment be checked, and that a clearer description of its purpose, methods, assumptions, results, and limitations be provided.

HUMAN HEALTH RISK

Information is provided on a range of human activities carried out in the river and on water quality indicators of harmful pathogens, which on occasion, are likely to exceed guideline levels. The activities described, and the nature of the river suggests the potential for people to encounter water containing harmful pathogen levels related to the Pōrangahau discharge is relatively low, but a formal risk assessment has not been carried out to confirm that.

The land disposal site directly adjoins a contact recreation site that currently receives surface water runoff from the disposal site. UV treatment of wastewater prior to irrigation to land is proposed for Stage Three. According to Everitt (2021), this together with filtration, compaction and die-off during the passage through soils, means that no additional adverse loading of bacteria concentrations is expected. While the potential for adverse effects on human health associated with contact recreation or shellfish harvesting from/in receiving waters appears to be low, the conclusion is ambiguous on whether, or not, the land discharge has the potential to pose a human health risk to users of Porangahau River, and if so, how those risks will be mitigated at the discharge sites.

I therefore recommend that unambiguous, technically robust information be sought on the potential health risks to users of Porangahau River, and how those risks will be mitigated. In my opinion, a quantitative microbial risk assessment is the best way of doing that, and they are generally regarded as good practice when considering the effects of wastewater discharges.

GUIDELINE VALUES

The sites used to evaluate water quality are situated along a freshwater to marine gradient, yet measured parameter values are only assessed against freshwater chemical and physical stressors, ecological toxicity, and human health trigger/guideline values. The rationale provided by Everitt (2021) for this approach is:

- *"The Pōrangahau River, at the point of Pōrangahau WWTP discharge, is considered to be predominantly freshwater for majority of the time, particularly at higher river flows.*
- *The paucity of marine water quality standards in New Zealand means the assessment against such guidelines would not draw adequate water quality comparisons across Hawke's Bay and New Zealand.*
- *The point of the Pōrangahau WWTP discharge is not within the HBRC Regional Coastal Environment Plan (RCEP) defined coastal environment and is considered to be within the Pōrangahau Catchment Freshwater Management Unit."*

The amount of salinity data presented in Everitt (2021) is very limited. However, it suggests that river water around the Pōrangahau WWTP discharge tends to be saline. Yet, citing Taylor and Strang (2009) (Appendix A) , the report states "*The river is considered typically freshwater at the point of discharge under background, low flow conditions[4] but transitions to saline (32.5 ppt) downstream*". This statement is clearly inconsistent with the conclusions of Taylor and Strang (2009), who indicate salinity is typically around 27 ppt (pg. 6) and conclude that "*The receiving environment in the Porangahau River for the oxidation pond discharge is essentially saline from tidal inflows with minor dilution by incoming river flows*" (pg. 42).

I agree that there is a paucity of marine guidelines, but the application of freshwater guidelines to saline waters is fraught and can potentially (in my opinion probably) lead to misleading interpretations of water quality data.

Finally, the fact that the river section is not within HBRC's defined coastal environment and is within the Pōrangahau Catchment Freshwater Management Unit is of little technical relevance when considering which guidelines to apply.

Based on the above, I recommend that comparisons of water quality with freshwater guideline values to be treated with a high degree of caution, and that salinity be added to the list of receiving water monitoring parameters.

COASTAL ECOLOGY

Potential ecological effects of the proposed discharges are assessed in two places. An assessment of the ecological effects of the Pōrangahau WWTP is provided by Hamill (2013), which was appended to Blair (2021b) and Everitt (2021). Key findings from that assessment are:

- Sediments below the Pōrangahau WWTP had higher chlorophyll *a*, organic carbon, nitrogen, arsenic, cadmium, lead and zinc concentrations compared to sediment at a downstream control site (which was on the opposite bank to the new land disposal site). However, sediment quality remained in the very good to good range for metals and organic carbon, and in the low to moderate enrichment range for nutrients.
- Sediments at both sites were very muddy (>80% mud).
- No nuisance macroalgae were observed at either site (an indicator of nutrient effects).

- Benthic community composition differed between the two sites, which was largely due to differences in the presence of more freshwater taxa at the site below the WWTP (this is expected given that the sites fell along a transitional zone).

An assessment of the ecological effects of the Discharge Property is provided by Webb (2021), who:

- Conducted a desktop review of available information.
- Undertook a site visit on the 23rd of June 2021, and noted vegetation types, riparian/coastal marine habitats and avifauna present, and took a single eDNA sample of the waters of the Pōrangahau River to "*list out all of the species detected in each sample, within broad taxonomic groups*".
- Prepared a desktop assessment of ecological effects in accordance with Ecological Impact Assessment (EIA) EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems.

Key findings/conclusions from that assessment are summarised below.

- Potential effects of nutrients entering the estuary from the disposal site include algal blooms leading to hypoxia, the degradation of benthic ecosystems, and consequential impacts on the benthic food resources for avifauna.
- Pōrangahau Estuary sediments are uniformly mud, with low nutrient (nitrogen and phosphorus) and organic matter levels, no obvious indications of high nutrient loadings (e.g., nuisance macroalgal blooms or sulphide-rich, muddy sediments). The sediment dwelling infaunal community has moderate species diversity, richness, and evenness and is characterised by *Edwardsia* sp. (anthozoan anemone), *Scolecolepides* sp. (spionid polychaete), crane-fly (Erioptera) larvae, and *Nicon aestuariensis* (nereid polychaete)[3]. Observations of cockles (*Austrovenus stutchburyi*), crabs and sea lettuce (*Ulva* sp.) were noted during the site visit (the results of the eDNA sample were not presented).
- The Pōrangahau Estuary is nationally important for its outstanding fisheries values and has significant cultural values for its mahinga kai sites.
- The estuary is an important feeding and wintering area for migratory waders and contains the largest concentrations of wrybill and banded dotterel in Hawke's Bay.
- The overall ecological value of the Pōrangahau Estuary was assessed as "Very High".
- As nutrient loads are conservatively predicted to remain unchanged, the current baseline ecological condition of the estuary is also unlikely to be changed by the proposal, resulting in "*a negligible magnitude of potential adverse effects*" on benthic invertebrates, foraging resources for coastal avifauna and the risk of algal blooms.

In my opinion, the ecological assessment of Webb (2021) provides only rudimentary descriptions of estuary values and potential effects. I also note the overall conclusions are largely based on the mass balance and mass load estimates of Everitt (2021), about which I have concerns (see above). Having said that, the more detailed assessment and findings of the Porangahau WWTP discharge (Hamill 2013) do suggest that ecological effects are likely to be relatively minor. However, the observation of sea lettuce below the land discharge property, does raise some concern. *Ulva* is known to be highly responsive to nutrient inputs and forms nuisance algae

[3] These findings were largely based on the survey of a single site some distance below the Discharge Property (Smith 2009).

blooms. If consent is granted, I therefore recommend that conditions require monitoring of water quality and the occurrence and extent of nuisance macroalgae blooms in the estuary.

PROPOSED MONITORING

Everitt (2021) recommends that current wastewater and river monitoring continue for stages 0 and 1, and lists the following water quality parameters be measured:

- unfiltered $cBOD_5$;
- total ammoniacal nitrogen;
- nitrate;
- total Kjeldahl nitrogen;
- total phosphorus;
- soluble reactive phosphorus;
- suspended solids;
- pH;
- *E. coli*;
- enterococci;
- faecal coliforms.

I agree with the general approach proposed and that the listed parameters be monitored if consent is granted. However, for clarity I recommend that "Nitrate" be replaced with "Nitrate-N", and the addition of the following water quality parameters and macroalgae monitoring requirements:

- temperature;
- dissolved oxygen;
- salinity;
- conductivity;
- nitrite-N;
- chlorophyll *a;*
- annual surveys to check for the presence of nuisance macroalgae blooms, and if they are present, measure their extent and percent cover.

Temperature, salinity and dissolved oxygen can be cheaply and easily measured using field instruments. They are fundamental parameters that influence the selection of guideline values, or in the case of dissolved oxygen, are an end-point for assessing the effects of oxygen demanding substances. Nitrite-N is required to determine total nitrogen and total inorganic nitrogen concentrations, while chlorophyll *a* is a key indicator of eutrophication. Macroalgae blooms are also a key indicator of eutrophication and their presence can be easily assessed through a rapid survey.

I generally agree with the approach proposed by Everitt (2021) for monitoring the effects of the land discharge in Stages 2 and 3, on Discharge Property watercourses and the estuary. However, more detail would be required and I recommend using the above list of monitoring parameters for surface water and estuary monitoring. Note that, estuary monitoring has not been included in the proposed consent conditions for the land disposal site. In my opinion, the monitoring framework set out in the proposed conditions will require further refinement.

OTHER MATTERS

Table 6.9 of the AEE (which provides a summary of the key discharge parameters on which the assessment of effects is based), indicates that discharge loads of nitrogen and phosphorus to Pōrangahau River and Te Paerahi coast will be reduced to zero in Stages 2 and 3. The basis of that assumption does not seem to be supported by the water quality assessment or the farming system and OverseerFM analysis (Sam Morris (Lowe Environmental Impact) 20 July 2021).

CONCLUSIONS

In general, the level of detail provided is appropriate for the scale and significance of effects that could arise over the period being proposed for discharges from the Pōrangahau and Te Paerahi WWTPs, and in the longer-term, for discharges from land disposal site. However, I recommended that clarifications and additional information be sought on the following matters:

- water quality effects of the proposed staging; and,
- human health risks.

Specifically, I recommend that:

- The basis of the staged mass balance and load estimates assessment (Section 6 of Everitt 2021) be checked, and that a clearer description of its purpose, methods, assumptions, results, and limitations of that assessment be provided.
- That unambiguous, technically robust information be sought on the potential health risks to users of Porangahau River, and how those risks will be mitigated. In my opinion, a quantitative microbial risk assessment is the best way of doing that, and they are generally regarded as good practice when considering the effects of wastewater discharges

I also recommend treating comparisons of water quality results against freshwater guidelines very cautiously, and that if consent is granted, conditions require monitoring to be carried out as generally set out above.

Finally, apparent discrepancies in the various documents, such as the values presented for discharge loads, need to be explained or resolved.

REFERENCES

Blair, S. (2021a) Appendix N: Te Paerahi wastewater treatment plant discharge water quality assessment. Report for Central Hawke's Bay District Council, 2021 P:D.60, Beca Ltd. 23 pp., plus Appendices.

Blair, S. (2021b) Pōrangahau wastewater treatment plant discharge water quality assessment. Report prepared for Central Hawkes Bay District Council, 2021 - P:B.24a, Beca Ltd. 44 pp., plus Appendices.

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Hamill, K. (2013) Porangahau River estuary ecological investigation, April 2012. Report prepared for Central Hawkes Bay District Council, DP030233W, Opus International Consultants Ltd and River lake Ltd., Whakatane. 22 pp.

Nic Love, PDP (11 May 2021), Memo to Tania Diack Hawkes Bay Regional Council, Regarding: Te Paerahi - Wastewater discharge consent review, 4 page(s)

Sam Morris (Lowe Environmental Impact)(20 July 2021), Memo to Darren de Klerk (Central Hawke's Bay District Council), Regarding: P:C.14a – Existing/Future Farming System and OverseerFM Analysis, 24 page(s)

Smith, S. (2009) Estuarine ecology programme: Environmental assessment of Ahuriri and Porangahau Estuaries. Report for Hawke's Bay Regional Council, HBRC Plan Number 4145, EAM, Napier.

Taylor, D., Strang, T. (2009) Appendix A: Porangahau township oxidation pond discharge mixing study. Report prepared for Central Hawkes Bay District Council, Opus International Consultants Limited, Wellington. 43 pp.

Webb, C. (2021) Appendix K: Pōrangahau Wastewater discharge to land: Coastal ecology assessment. Report prepared for Central Hawke's Bay District Council, P:D.65, Beca Ltd. 9 pp.