MEMO	
ATTENTION	Sven Exeter (Mott MacDonald)
FROM:	Shane Kelly
CC	Malcolm Miller
DATE:	March 3, 2022
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 between 35 and 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 treated with ultraviolet (UV) light 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.

My review also considers the responses received to S92 requests for further information.

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

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

WWTP discharge point, under background, low flow conditions. The tidal influence is strongest in summer when low flow conditions commonly occur.

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

[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.

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 is discussed below). The reports note that several 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, the reports conclude that predictions from mass balance calculations suggest the discharge causes a moderate increase in nutrient and faecal coliform concentrations during low flow conditions (estimated faecal coliform concentrations 200 m downstream were 317 cfu/100 ml compared with 120 cfu/100 ml 200 m upstream, based on the assumptions used) 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 neighboring 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.

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 underpinned the assessment of coastal ecological effects (Webb 2021). I identified a number of issues with the original assessment (memo of Kelly 30 September 2021) and further information was sought on those matters. An updated report (Everitt 2022, dated 28 January 2022) addressed the matters I raised in my memo, and (re)calculated mass load

estimates for Stages 0, 1, 2a, 2b, and 3. Note that load estimates are based on a simple deterministic model. They allow the mass loads and river concentrations to be estimated, but they do not consider variability in those estimates. Results should therefore be interpreted as indicative. Having said that, deterministic models are a useful and suitable analytical tool for examining the effects of the proposed transition to a land discharge.

With that in mind, the assumptions and estimates from the revised model appear reasonable and I am satisfied they address the matters I previously raised. In summary, together with the additional contextual information provided in the revised report, Everitt (2022) suggests that:

- Water quality at the monitoring site 200 m downstream of the existing Pōrangahau discharge will improve between stages 1 and 3, but total phosphorus and total nitrogen concentrations could still exceed guideline values[3], as those nutrients are already elevated above the relevant criteria upstream of the discharge.
- The proposed shift to land based disposal will lead to a slight decrease in total nutrient loads from the combined WWTPs and land disposal site. I note that loads to Pōrangahau River will increase slightly due to the Te Paerahi discharge being diverted to the land disposal site and population growth.
- That the combined nutrient loads of the Pōrangahau and Te Paerahi WWTPs and the land disposal site only comprise a small proportion of overall catchment loads (around 2 to 2.5%), and that the proposed wastewater redevelopment will further reduce that contribution (albeit negligibly). However, I note that diverting the Te Paerahi discharge to the land disposal site will increase the wastewater contribution to the river catchment loads (albeit negligibly).

Although subsurface soil and groundwater attenuation of nutrients in the land disposal site were not allowed for in the assessment, Everitt (2022) suggests that those processes are likely to lessen adverse effects. The report also highlights that UV disinfection and best practice irrigation management will help minimise local surface water effects. I also note that the diffuse seepage of wastewater from the land disposal site to the river is likely to enhance dilution.

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 had not been carried out to confirm that. Further information was therefore sought on risks to human health.

In response, a quantitative microbial risk assessment was provided by the Applicant. That has been reviewed separately by ESR (Cressey 2022), so health effects are not considered here.

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

[3] ANZECC physical and chemical stressor triggers and MfE Microbiological Assessment Category for Freshwater Grade D.

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 recommended 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)[4]. 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. 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* sp. is known to be highly responsive to nutrient inputs and forms nuisance algae 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.

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

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 (2022) for monitoring the effects of the land discharge in Stages 2 and 3, on Discharge Property watercourses and the estuary. However, more detail should be required (in the form of a monitoring plan), 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, but is recommended by Everitt (2022). I agree with the recommendation, particularly as nutrient loads to the river are not expected to decrease once land disposal is implemented. In my opinion, the monitoring framework set out in the proposed conditions will therefore 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. I generally agree with the proposed condition framework, but for the reasons outlined above, if consent is granted, I recommend the following additions to the Pōrangahau River water quality monitoring parameters:

- 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.

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