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memorandum

TO	Sven Exeter and Tania Diack	FROM	Oliver Hunt, Nic Love, Neeraj Pratap, Deborah Ryan, Marinus Boon, Daryl Irvine & Hilary Lough
	Hawke's Bay Regional Council	DATE	30 September 2021
RE	Pōrangahau and Te Paerahi Wastewater Discharge Consent Technical Review		

1.0 Introduction

Central Hawke's Bay District Council (CHBDC) operates the wastewater treatment plants (WWTP) for the Pōrangahau and Te Paerahi communities. The Pōrangahau WWTP currently provides treatment and then discharges wastewater directly to the Pōrangahau River. The Te Paerahi WWTP provides treatment and then discharges wastewater to adjacent sand dunes via soakage. The resource consents for these discharges expired on 31 May 2021.

Currently, the Pōrangahau WWTP has a pond treatment system with treated wastewater being discharged via a wetland drain to the Pōrangahau River. The Te Paerahi WWTP has a pond treatment system with treated wastewater being discharged to sand dunes. A new combined long term WWTP and discharge system is being built, and then the existing facilities will be phased out (long term solution).

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 has been relied upon for this review.

2.0 Background

The combined land discharge property is located at 474 Beach Road, Pōrangahau, on the corner of Beach and Hunter Roads and comprises 114.3 ha. The site includes two land parcels, totalling 114.3 ha, bounded to the east by the Pōrangahau River and is situated 1 km from the coast and 4 km from the Pōrangahau River mouth. The site is currently managed as low-intensity sheep and beef finishing, with rotational cropping of chicory, raphno, turnips and oats for stock feed. Pastoral grazing is dominant across the site.

Central Hawke's Bay District Council (CHBDC) is responsible for the management of Pōrangahau and Te Paerahi's wastewater. Treated wastewater from Pōrangahau is currently discharged via a drain entering the Pōrangahau River, permitted by consent DP030233W, with Te Paerahi's wastewater discharged to culturally significant dunes north of the Te Paerahi WWTP, permitted by consent DP030234La. Air discharge consents for the Pōrangahau WWTP and Te Paerahi WWTP are DP030861A and DP030862A respectively. These consents expired on 31 May 2021. Transitional consents for the continuation of the discharges to their respective environments have been lodged with HBRC, whilst consent for the land application regime is investigated, designed, and consented.

3.0 Irrigation and Soils

3.1 Soils

The site has three distinct soil types that impact the irrigation and potential loss of nutrients and pathogens to the environment. Stage 1 and 2 propose irrigating water to Kairaki Sandy Loam (Kyra_15a.2). This soil is a raw soil with a sand texture. It has a very high nitrogen leaching vulnerability, high bypass flow risk, rapid permeability, low runoff risk and a very low (7 mm) profile available water to 60 cm.

In stage 3, 20 ha of Kaiapo silt loam (Flax_69a.1) will be added to the irrigation system. This is a silty clay overlaying a heavy clay. It is likely to be waterlogged in winter, be of low permeability, poorly drained, medium to high runoff potential, high bypass flow, with very low nitrogen leaching vulnerability. There will be limited days during the late autumn to early spring period when soil conditions will be suitable for irrigation. There is a risk of nutrient and pathogen runoff to the two small intermittently flowing streams that flow through this block to the Pōrangahau River. With the addition of wastewater, this Kaiapo silt loam is likely to be more prone to pugging and soil damage. Managing stock and cropping activities for increased soil moisture will be necessary.

The applicant has proposed annual monitoring of the irrigated soils using composite samples in Proposed Condition 60. PDP generally agrees with this approach, however, we suggest that baseline sampling is completed before any irrigation of wastewater. This should consist of one composite sample from each soil block, as described in Condition 60, analysed for the parameters described in Condition 60. We also suggest that the composite samples in the baseline and ongoing annual monitoring are also analysed for the following heavy metals:

- Total Arsenic
- Total Cadmium
- Total Chromium

- Total Copper
- Total Lead
- Total Mercury
- Total Nickel
- Total Zinc

3.2 Proposed Irrigation

The proposed irrigation system is a combination of fixed sprinklers attached to fenceposts and small movable pods. The applicant has proposed that wastewater is applied at a depth of up to 20 mm/event. Wastewater will be applied throughout the year. In addition to the irrigated land, there is expected to be a continued discharge to the Pōrangahau River (for Stage 1 and 2b) and via non-deficit irrigation (wet soils) for all stages except for Stage 3b when land cannot receive wastewater and storage is at capacity.

Stage 0 proposes that the current discharge for both communities continues for up to six years at Te Paerahi to the culturally sensitive sand dunes and nine years to discharge to the Pōrangahau River, from consent granting while the subsequent stages are enacted.

Stage 1 involves the provision of 500 m^3 of storage within the Te Paerahi WWTP and the development of a minimum of 4 ha of irrigation on the Stoddart property, allowing irrigation to sandy soils (IMU 3) under deficit irrigation conditions for approximately 43% of the current Te Paerahi average annual wastewater discharge volume and 57% of the annual volume under a non-deficit wet soils regime. The 500 m^3 of storage is likely to provide less than 7 days of wastewater storage. The 10-year average monthly rainfall and evapotranspiration (PET) data provided in Table 3.5 of the LEI,2021:P:D.10 report shows rainfall exceeds PET from March to September, limiting the number of days in this period where deficit irrigation can be applied. The applicant has proposed applying up to 20 mm of wastewater per event on a sandy soil with a PAW of 7 mm, therefore there would be drainage with each event. They have also stated application rates per event will be limited to a maximum of 25% of the PAW. This is not feasible with moveable pods within LMU 3. The applicant should provide further assessment of an appropriate application depth per event within LMU 3 including an assessment of the change in nutrient leaching at a maximum of 20 mm/event and a maximum of 25% of the PAW.

Stage 1 is proposing that the annual volume of wastewater is applied using a non-deficit wet soils regime approximately 57% of the time (Te Paerahi flows only) and at Stage 3 this will reduce to 0 to 36%. When storage is not sufficient, irrigation that exceeds the soil moisture deficit will be used, which is expected to result in the increased drainage of nutrients and microbial contaminants.

Stage 2 involves the development of an additional 6 ha of irrigation for sandy soils (IMU 3), allowing for a minimum of 10 ha of irrigation at Stage 2. This stage includes both Pōrangahau and Te Paerahi flows, but allows for between 0% to 39% of all flows to continue to the Pōrangahau River (when storage is not possible and soil conditions are too wet).

Stage 3 involves the development of an additional 10 ha of irrigation for sandy soils (IMU 3) and incorporation of 20 ha of silty/clay soils (IMU 1), allowing for a minimum of 40 ha of irrigation at Stage 3. A new combined WWTP and storage pond is to be built at the land application site to receive Pōrangahau and Te Paerahi flows with a capacity of (up to) 35,000 m^3. This storage allows for irrigation of between 66% and 100% of the future (2057) average annual wastewater discharge volume to the dry soils system (deficit irrigation) and between 0% to 36% to be applied under a non-deficit wet soil regime.

The additional 20 ha of irrigation area in Stage 3 will be on a soil (IMU 1) that is prone to waterlogging, has low permeability, and high runoff potential and therefore there will be significant periods when deficit

irrigation is not possible within IMU 1. The Overseer modelling shows no wastewater applied to these soils in June and July and low rates in May and August in Stage 3a/3b. There is considered to be a high risk of surface runoff to the Pōrangahau River, via the streams even with a 20 m set back from the farm waterways when wastewater is applied, due to the risk of surface ponding if 20 mm of wastewater discharged is applied to the Kaiapo silt loam as a result of the low permeability of this soil type. This area is identified as a flood risk area; refer to the Natural Hazards Assessment below. The applicant should provide an assessment of the risk of overland flow from the irrigation site and the effect of any potential overland flow on the receiving environment.

We note the recent Government Response to the Findings of the Overseer Peer Review Report which criticised Overseer's lack of surface water/runoff modelling and warns Regional Councils against solely relying on Overseer modelling to determine nutrient loss from farming activities. There are additional limitations with Overseer when applied to wastewater irrigation, but we consider it is still a helpful tool for assessments.

3.3 Nitrate leaching and Phosphorous loss

The 'Existing Farming System' memo (LEI, 2021:P:B.13)1, provides an overview of nutrient losses under the existing farming system as modelled in OverseerFM. The memo shows nutrient losses for three modelling stages incorporating wastewater irrigation. A summary of the nitrogen losses is in Table 1 below.

Table 1: Nitrogen Leaching per LMU by Proposed Stage

Stage	LMU 3			LMU 1		
	Irrigated Area (ha)	N Loss from Unirrigated Area (kg N/ha/y)	N Loss from Irrigated Area (kg N/ha/y)	Irrigated Area (ha)	N Loss from Unirrigated Area (kg N/ha/y)	N Loss from Irrigated Area (kg N/ha/y)
1	4	26	90	-	-	-
2a	10	27	144	-	-	-
2b	10	27	78	-	-	-
3a	20	29	105	20	8	13
3b	20	29	91	20	8	13

In Stage 2a the nitrogen leached from the irrigated area is modelled to increase from 27 kg N/ha/yr to 144 kg N/ha/yr, a 530% increase. The site will also have high nitrate leaching in Stage 3. Phosphorous loss on the discharge area in Stage 1 is modelled to increase from 1.5 to 7.2 kg P/ha/yr and peaking in Stage 2a at 9.8 kg P/ha/yr before dropping to 7.3 kg P/ha/yr in Stage 3b.

The Overseer Whole Model Review and the recent Government Response raise concerns over the lack of consideration of surface water and nutrient transport within Overseer. Considering this, the nitrogen and phosphorous losses, particularly on the heavy soils in LMU1, could be underestimated in Overseer, particularly for Stage 3.

The water quality in the Pōrangahau River is already nutrient enriched with respect to nitrogen and phosphorus above the site and under this proposal treated wastewater may travel to shallow groundwater or by overland flow to the Pōrangahau River and/or farm drains entering the Pōrangahau River. Although this proposal is an improvement on the current system where all the wastewater is discharged to the river

or a sensitive sand dune area, a larger area for the irrigation discharge would reduce the nutrient loadings and could reduce the frequency of the non-deficit irrigation.

3.4 Buffer Distances and Available Area

The applicant has stated that the following buffer distances will be implemented:

- 5 m to any property boundary;
- 20 m to any sensitive requirement; and,
- 150 m separation to any dwelling.

Further assessment of buffer distances to the boundary and to any natural wetlands has been requested below. We recommend that the applicant should provide a map of the site with all areas proposed not to be irrigated (due to buffer distance, soil type, land use or any other reason) clearly shown. The map should show the area of each excluded zone and the total available area for irrigation within LMU 1 and LMU 3.

3.5 Standdown Period and Grazing Management

The applicant identifies the risk of stock ingesting pathogens from the irrigated wastewater. It is stated that this will be managed with suitable standdown periods. No further information on the standdown periods has been supplied.

We recommend that the applicant should provide information on the length of the proposed suitable standdown periods and the expected residual pathogen level based on the concentration of pathogens in the irrigated wastewater and the length of the standdown periods.

3.6 Clarifications and Further Information Required

We recommend that the applicant should provide more information on the following aspects of the proposal:

a) The applicant indicates the minimum area used for irrigation for each stage and that they have used this for the Overseer modelling. Does the actual proposed irrigation area differ from this and, if so, how does it affect the nutrient loss?

b) Please provide additional information about how the irrigation is proposed to be managed, specifically regarding application event frequency, application event depth and monitored to minimise drainage resulting in leaching and/or overland flow or surface ponding.

c) Please provide further assessment of an appropriate application depth per event within LMU 3 including an assessment of the change in nutrient leaching at a maximum of 20 mm/event and a maximum of 25% of the PAW.

d) Please provide an assessment of the risk of overland flow from the irrigation site (LMU 1 and LMU 3) and the effect of any potential overland flow on the receiving environment.

e) Please provide information on the length of the proposed suitable standdown periods and the expected residual pathogen level based on the concentration of pathogens in the irrigated wastewater and the length of the standdown periods.

f) Please provide a map of the site where all areas proposed not to be irrigated (due to buffer distance, soil type, land use or any other reason) are clearly shown. The map should show the area of each excluded zone and the total available area for irrigation within LMU 1 and LMU 3.

g) Agreement or comment on the suggested inclusion of baseline soil sampling and heavy metal monitoring.

4.0 Overall Wastewater Management

4.1 Staging

The applicant has proposed four stages for the consent:

0. Continue existing discharges
1. Full irrigation of Te Paerahi WWTP effluent.
2. Partial irrigation of Pōrangahau WWTP effluent
3. Full irrigation of all effluent

These stages have significant time periods with up to 6 years requested to cease the original Te Paerahi discharge and 9 years requested to cease the existing Pōrangahau discharge (noting that the discharge may be reduced earlier due to partial irrigation). Given the small areas of irrigation proposed for Stages 1 and 2 (6 ha and 10 ha respectively) and minimal changes required to provide small amounts of storage within the existing storage plants, it would be helpful to have more information on why such long periods have been proposed to establish irrigation. Even if the initial systems do not minimise nitrogen leaching, they are likely to have positive impacts on cultural values and reduce pathogens reaching the Pōrangahau River.

Similarly, we note Stage 2a proposes only partial irrigation of treated wastewater from Pōrangahau. Full irrigation, even if not designed to minimise leaching, will provide benefits to cultural values and reduce pathogens reaching the Pōrangahau River. Given the extensive area available at the proposed irrigation site, it would be helpful to have more information on why only 10 ha of irrigation is proposed.

We recommend that the applicant should provide further justification for the timeframes proposed for commencement and completion of each stage and evidence why partial irrigation under Stage 2 is preferable to non-deficit irrigation of the highly permeable sandy soils.

It is also not apparent how decisions will be made regarding the options for Stages 2 and 3. The applicant should explain how the decision making regarding storage volumes and deficit/non-deficit irrigation will be made. With the current information provided there does not appear to be an alternative to assessing the worst-case scenario at each stage.

4.2 Catchment Mass Balance

The applicant has provided an assessment of the mass loads from each source at each stage in Table 11.1 in report PD.1. We note that the Stage 1 nitrogen and total phosphorus totals and the Stage 0 phosphorus total appear to have been incorrectly calculated.

The applicant has assessed these nutrient loads based on their impact on the Pōrangahau River catchment. It is reasonable to assume that the majority of the leached nutrients from the discharge property will migrate into the Pōrangahau River via hydraulic connection with shallow groundwater and the direct discharge to the river from the Pōrangahau WWTP will impact the Pōrangahau catchment nutrient loads. However, the groundwater flow direction under the Te Paerahi WWTP discharge site is reported as southeast towards the coast (2021:P:D.60). Based on this assessment the Te Paerahi discharge is not currently contributing to nutrient loads within the Pōrangahau River catchment. When the Te Paerahi discharge is irrigated it will contribute to the Pōrangahau catchment and therefore the total nutrient loads between the existing and proposed scenarios are not directly comparable. A more relevant comparison is provided in Tables 2 and 3.

Based on this assessment, while the overall mass of nutrients from the three sources is generally decreased, the contribution of nitrogen to the Pōrangahau catchment is roughly the same within Stages 1 and 3b but increases under Stages 2 and 3a. Similarly, the contribution of phosphorus to the Pōrangahau catchment is slightly decreased under Stages 1 and 2 but increased under both Stages 3a and 3b. This assessment also does not consider any potential for nutrient contribution due to runoff and overland flow as this is not modelled by Overseer. It appears likely that the proposed irrigation system will have limited positive impact on nutrient loads in the catchment and may contribute to a higher nutrient load within the Pōrangahau catchment.

It is important that potential options to reduce the nutrient loss, such as lower event application depths and increased area as described in Section 3 above, are considered to reduce the impact of wastewater irrigation to the Pōrangahau catchment.

Table 2: Nitrogen Mass Load Comparison

Stage	Pōrangahau Catchment				Coastal Catchment	Combined Catchments
	Pōrangahau WWTP (t N/year)	Te Paerahi WWTP (t N/year)	Discharge Property (t N/year)	**Total (t N/year)**	Te Paerahi WWTP (t N/year)	**Total (t N/year)**
0	0.7	-	2.35	**3.05**	0.37	**3.42**
1	0.49	-	2.55	**3.04**	-	**3.04**
2	-	-	3.49	**3.49**	-	**3.49**
3a	-	-	3.30	**3.30**	-	**3.30**
3b	-	-	3.01	**3.01**	-	**3.01**

Notes:

Table 3: Phosphorus Mass Load Comparison

Stage	Pōrangahau Catchment				Coastal Catchment	Combined Catchments
	Pōrangahau WWTP (t P/year)	Te Paerahi WWTP (t P/year)	Discharge Property (t P/year)	**Total (t P/year)**	Te Paerahi WWTP (t P/year)	**Total (t P/year)**
0	0.10	-	0.07	**0.17**	0.05	**0.22**
1	0.07	-	0.09	**0.16**	-	**0.16**
2	-	-	0.16	**0.16**	-	**0.16**
3a	-	-	0.21	**0.21**	-	**0.21**
3b	-	-	0.20	**0.20**	-	**0.20**

Notes:

4.3 Land Ownership Risk

PDP wishes to highlight the following risks associated with wastewater irrigation on private land. The acceptability of these risks is best determined by HBRC and CHBDC.

- Risk of irrigating wastewater to land that is not owned by CHBDC if there is any change of ownership or breakdown of the relationship in the future which prevents irrigation.
- Risk that irrigation does not occur in a manner that minimises potential environmental effects due to economic decisions made on the operating and productive farm.

4.4 Clarification and Further Information Required

We recommend that the applicant should provide further justification for:

a) The timeframes proposed for the commencement and completion of each stage.

b) Evidence why partial irrigation under Stage 2 is preferable to non-deficit irrigation of the highly permeable sandy soils.

c) Explain how the decision making regarding storage volumes and deficit/non-deficit irrigation will be made.

5.0 Odour and Spray Drift

The discharges to air under this application are from the two existing pond treatment systems, a proposed new combined WWTP and associated discharge systems that will transition to a land-based system for wastewater disposal. Our review focuses on the land based system, but we have provided comments on the discharges from the other sites. The Discharge Property refers to the location for future wastewater irrigation located at 474 Beach Road, Pōrangahau. LEI states that the predominant wind is from the southwest. The applicant has identified odour as a potential effect of air discharges from the existing systems servicing the two communities, and odour and aerosols as potential effects associated with the long term solution. LEI has assessed that the effects on air quality are less than minor for both the short and long term solutions. Figure 4.2 of the AEE shows the location of the Discharge Property and the locations of the two existing community WWTPs.

LEI states that the existing Te Paerahi WWTP is located approximately 500 m north of the Te Paerahi (Pōrangahau Beach) Freedom Camping grounds at the end of Te Paerahi Road. The WWTP consists of a single oxidation pond and discharges via a soakage field into sand dunes north of the pond. There are no solids screening facilities. Aerobic conditions are maintained by natural aeration and one surface aerator. LEI has summarised that for the Te Paerahi plant operators become aware of issues related to treatment problems and are able to remedy the treatment process before there is a risk of offensive or objectionable odours beyond the plant boundaries, but no detail of these procedures is provided with the AEE.

LEI indicates that the nearest dwelling is more than 400 m away and that the normal operations will not result in adverse effects of odour beyond the boundary at that distance. From Google Earth maps the nearest dwelling is around 460 m to the south-southwest, and the golf course is 100 m to the southwest. Winds from the northeast through to the north have the potential to carry odours towards sensitive receptors.

LEI states that the existing Pōrangahau WWTP is located at the end of Jones Street approximately 800 m south-east of the Pōrangahau village centre. The existing Pōrangahau WWTP consists of a single clay-lined stabilisation pond with discharge to the river. Aerobic conditions are maintained by natural aeration processes. There are no solids screening facilities. LEI indicates that the outskirts of the Pōrangahau township are within 500 m of the plant. From Google Earth maps the nearest dwelling is around 300 m to

the north-northwest and the school is around 315 m to the northwest. Therefore, winds from the southeast quadrant have the potential to carry odours to the nearest sensitive land uses.

PDP expects that the two existing WWTPs will have a low potential for odour, provided that aerobic conditions are maintained at the surface. Pond upset conditions from inadequate dissolved oxygen (DO) or pond turnover could occur where settled solids, which are anaerobic, could rise to the surface. These events can release odorous gases from anaerobic biological activity including hydrogen sulphide.

PDP notes that periodic removal of settled solids and pond decommissioning solids handling also has the potential for odours.

Figure 6.6 of the AEE shows the layout of the indicative pond system and WWTP at the Discharge Property. Google Earth imagery shows that there are no dwellings within around a 750 m radius of the pond layout. LEI states that the nearest dwellings to the irrigated property boundary are approximately 270 m north and south of the property, although PDP notes there are residences 100 m to the south and 200 m to the north of areas marked as Land Management Units (LMUs). LEI notes that the townships are upwind of the prevailing winds relative to the Discharge Property. Given the discharge to land will be of treated wastewater with detention in a holding pond, PDP agrees that the odour potential from the irrigation system is low.

PDP agrees that the normal operations of the proposed WWTPs and disposal systems have a low potential for adverse effects on air quality. It is only the abnormal emissions that have the potential for elevated odours and thereby increased potential for odours to be noticeable at sensitive receptor locations. Therefore, PDP considers that contingency procedures for abnormal emissions such as from pond upsets or desludging operations are key to minimising the potential for adverse effects.

PDP has reviewed the proposed conditions in Appendix E of the AEE. PDP notes the following:

- Condition 17 includes monitoring of the DO of the wastewaters.
- Condition 23 includes an operation and maintenance plan that requires details of:
  - The frequency of flushing of the irrigation pipes and the circumstances under which pipe flushing will occur;
  - Measures to ensure the treated wastewater irrigated remains aerobic;
  - A risk assessment plan and contingency plans in the event of system malfunctions or breakdowns;
  - Compliant procedures;
  - Mitigation and contingency measures for controlling odour, aerosols, ponding and run-off in and from the land treatment area; and
  - Procedures for the wind speed shut-down.
- Conditions 30 and 31 relating to managing complaints.
- Condition 39 performance requirement for effects of odour at Te Paerahi
- Condition 54 a 150 m set back from a dwelling or milking shed
- Condition 39 a performance requirement for effects of odour and spray drift at the Discharge Property
- Condition 68 wind direction and strength monitoring be established at the Disposal Site.

PDP agrees that the proposed conditions are appropriate to the nature and scale of the activity.

5.1 Clarifications and Further Information Required

We recommend that the applicant should provide further information on the following aspects:

a) The applicant indicates that WWTP process failures can result in odours but that these can be remedied before there is a risk of offensive or objectionable odours beyond the plant boundaries. What monitoring is done by operators and or what indicators of process failures are used to identify increased potential for odour and what contingency measures are implemented in these events?

b) While we agree that the potential for effects from odour beyond the site boundaries is low for all aspects of the proposal, upset conditions can result in more significant odours. If possible, please provide a wind rose showing wind strength and direction to help inform the assessment of the potential for odours from the various activities to result in exposure and/or adverse effects from odours. At a minimum, please provide a description of the local prevailing wind conditions.

c) Will solids screening be included with the new WWTP and/or how will waste solids/sludge be managed to minimise odour? How will sludge be managed during decommissioning of the existing ponds?

d) Please provide evidence of the suitability of the proposed buffer distances, particularly to boundaries. This assessment should consider that the land between the estuary and the discharge property is publicly owned and easily accessible from the boat launching area at the Beach Road bridge. We also note the World Health Organisation guidelines for Safe Use of Wastewater suggest a buffer of 50 – 100 m may be required from roads and dwellings to protect public health.

6.0 Groundwater

Conceptually, the general regional direction of groundwater flow beneath the discharge site is expected to be towards the southeast towards the Pōrangahau River. Based on three boreholes installed across the proposed discharge field, the strata directly below the site dominantly consists of shallow dune deposits in the northern portion of the site, whereas the southern portion of the site contains clay-rich soils, with sands and gravels being present beneath the soil layer at depths of around 7.5 m bgl. A silty clay layer is evident at depths beyond approximately 9 m bgl at the site. Groundwater levels on site were measured between 2.81 and 3.12 m bgl on 15 July 2021. Additionally, 11 standpipes were installed across the discharge property for the purposes of groundwater level observations. Groundwater levels are variable across the site, with levels in the south-western portion of the site being measured close to ground level (around 0.2 m bgl) and in excess of 2.5 m bgl in other areas of the site.

The Applicant states that UV treatment will be implemented at the new treatment plant to aid in reducing pathogen concentrations, and the expected average discharge concentrations are as follows (as provided in the AEE report):

- Carbonaceous biochemical oxygen demand = 20 g O/m^3
- Total suspended solids = 30 g/m^3
- Total nitrogen = 20 g/m^3
- Total phosphorus = 5 g/m^3
- *E. coli* = 5,000 MPN/100 mL

However, it is noted the expected *E. coli* concentration given in the Lowe Environmental Impact (2021)[1] report is 500 MPN/100 mL. This discrepancy should be confirmed with the Applicant.

Based on the water quality information provided, the greatest risk to groundwater is considered to be the potential for bacterial contaminants to migrate to nearby drinking water supply bores. In stages 1 and 2 the applicant is proposing to use non-deficit irrigation onto soils throughout the years, which is likely to result in increased drainage of both bacterial contaminants and nutrients. However, the resultant expected *E. coli* concentrations are reasonably low (even if the high value from the AEE report is used) due to the proposed UV treatment.

There are several bores situated between the disposal field and the coastline, the majority of which are owned by the Applicant. Based on the information provided by the Applicant, only one bore is not under their ownership (5078) which is screened between 3.5 and 7 m bgl and reportedly used for stock water supply. One of the Applicant's bores (4993) is used for community water supply for Pōrangahau and Te Paerahi Beach settlement. Based on information on the HBRC database, bore 4993 is 12 m deep, screened from 2 to 7 m bgl within gravelly strata and is located around 400 m southwest of the disposal field.

The Applicant has estimated the log removal rate for viruses at the edge of the Pōrangahau River based on the report by ESR (2010)[2] and has adopted a separation distance of 200 m and 3 m thickness of vadose zone and gives a $\log_{10}$ removal rate of 22.7. Based on the water levels provided, the vadose zone thickness assumption appears to be overly generous, and some areas of the site are expected to have water levels within around 0.3 m of ground level. Based on the discharge area map provided, the separation distance between the disposal field and river appears to be more in the order of 50 m. Given that some of the site has groundwater levels in excess of 2 m bgl, it would be more conservative to assume an average vadose thickness of 1 m across the site, which combined with a separation distance of 50 m would give a $\log_{10}$ removal rate of 5.6 based on coastal sands. This rate of removal is likely to provide sufficient removal in conjunction with the expected *E. coli* concentrations in the discharge after UV treatment (assuming 5,000 MPN/100 mL).

It is noted that the above assessment relates to the potential for microbial contaminants to migrate to the Pōrangahau River. The two down-gradient supply bores mentioned above are situated on the opposite side of the river and therefore if contaminants were to migrate across the river, additional die-off would be expected to occur, along with significant dilution within the river itself, although the possibility of contaminants migrating across the river is low. The Applicant has highlighted the potential risk to the public supply bore and as a result, has provided a conceptual groundwater model for the site. The assessment shows consistency between groundwater levels and surface water elevations in the area, indicating that there is likely to be a high degree of connection between the two resources. The assessment also indicates that the Pōrangahau River is likely to act as a flow boundary and that qualitatively the risk to the public supply bore is low, but contamination risks cannot be wholly ruled out, for example high tides may cause flow in the river to become stagnated, which could result in contaminants discharging to ground on the eastern side of the river.

The above assessment is reasonable, and based on the available hydrogeological information, we agree that the Pōrangahau River is likely to act as a flow boundary. Hence the most likely contamination pathway to downgradient bores would be from shallow discharge (or overland flow) from the site into the Pōrangahau River and then migration back into shallow groundwater on the coastal side of the river. As noted above, in this instance significant dilution within the river would be expected to occur.

[1] Lowe Environmental Impact. (2021). Discharge to Land of Pōrangahau and Te Paerahi Wastewater, Assessment of Environmental Effects: Land Application.
[2] ESR. (2010). Guidelines for Separation Distances Based on Virus Transport Between On-site Domestic Wastewater Systems and Wells. Porirua: ESR.

Additionally, it is noted that the applicant should be implementing appropriate treatment at the water supply to ensure the risk to consumers is minimised. Whilst the assessment suggests the risks are low, several lines of defence should always be used to protect drinking water quality and the supply could also be at risk from other factors, so appropriate treatment should occur. While the assessment indicates the risk to bore 4993 is relatively low, this is a theoretical assessment and could change if treatment changes/failures occur, changes in the pathway to the bore occur (for example from leaking wastewater pipes) or if conditions are different than expected. In addition, the bore is expected to be at risk of contamination from other sources, given its shallow depth. It is recommended that the applicant provides information to demonstrate appropriate treatment is being provided to this bore given its shallow depth, in line with their responsibilities as a drinking water supplier, and we recommend that HBRC ask the Applicant to confirm this is occurring.

Additionally, the private stock water bore 5078 is likely not treated, and while the contamination risk is considered low, it cannot be wholly ruled out that water quality changes would not occur in this bore (although we note it is not reported to be used for human consumption based on information provided by the applicant, we recommend this should be confirmed).

The applicant has proposed groundwater monitoring for the discharge to land in the proposed consent conditions 61 and 62. This involves sampling two bores located within the discharge fields at quarterly intervals for the following parameters:

- Temperature
- pH
- Electrical conductivity
- Chloride
- Nitrate-nitrogen
- Ammoniacal-nitrogen
- Nitrite-nitrogen
- Dissolved Reactive Phosphorus
- E. coil
- Sodium

We suggest that total nitrogen and total phosphorus are added to the monitoring regime.

The Applicant does note that an unmapped bore exists on the disposal field property, which is assumed to be owned by the Applicant. The Applicant should confirm the future use of this bore given existing water quality within this bore could degrade as a result of the proposed discharge.

6.1 Clarifications and Further Information Required

It is recommended that the Applicant is asked to confirm:

a) The expected *E. coli* concentrations in the discharge after UV treatment given the two different concentrations provided (500 and 5,000 MPN/100 mL).

b) We also recommend monitoring should begin as soon as the consent is granted rather than waiting for the disposal field to be operational in order to build a database of existing groundwater quality. The applicant should be asked to provide comment on background monitoring.

c) The future use of the unmapped stock water bore on the disposal field property.

7.0 Wetland Ecology

The AEE (11.2.2) indicates that two potential wetland areas within the Discharge Property were identified and delineated in terms of the Landcare Research wetland delineation procedure and the National Environmental Standards for Freshwater (NES-F 2020), and that both areas failed the pasture test and are therefore not considered as natural inland wetlands. It should be noted that the latest procedure for delineation wetlands is the *Ministry for Environment (MfE) Wetland Delineation Protocols* (2020). The two wetland areas referred to form part of one wetland (Wetland 1), as indicated in Figure 6 in the Discharge Property Ecological Report (Beca 2021:P:D.66). The ecological report indicates in section 4.1.1 that Site 1 was assessed as a natural wetland; however, Table 2 (section 4.1.2) in the ecological report indicates that Site 1 failed the pasture test. This is contradicting since for a wetland to be considered a natural wetland in terms of NES-F (2020) it should pass the pasture test. In terms of the NPS-F (2020) improved pasture '*means an area of land where exotic pasture species have been deliberately sown or maintained for the purpose of pasture production, and species composition and growth has been modified and is being managed for livestock grazing'*. No reference is made in the AEE and Discharge Property ecological report (Beca 2021:P:D.66) of the details of the pasture tests for sites 1 and 2 (methodology and results), such as the exotic pasture species present and details of the percentage ground cover as described in the *Interpretation guidance on the wetlands definition in the NPS-FM and Freshwater NES* (Exposure draft 7 April 2021).

In terms of Table 2 (section 4.1.2) wetland hydrology indicators were present in both Site 1 and Site 2; however, there is no reference on how the presence of hydrology was determined. The *Interpretation guidance on the wetlands definition in the NPS-FM and Freshwater NES* (Exposure draft 7 April 2021) stipulates that it is essential to distinguish between areas of improved pasture with temporary or with permanent wetland hydrology. Table 2 (section 4.1.2) also indicates 'Yes' under soils, and the soils have been described in section 4.1.1, but it does not indicate if the soils were hydric in terms of the *Ministry for Environment (MfE) Wetland Delineation Protocols* (2020) and the *Hydric soils – field identification guide/Hydric Soils tool* (Fraser et al, 2018).

In terms of the Freshwater NES (2020), the regulations apply to the discharge of water within, or within a 100 m setback from a natural wetland. However, PDP observe that the ecological report (Beca 2021:P:D.66) only screened/identified wetlands within the site boundaries, although there may be other wetlands within 100 m of the site on neighbouring areas/properties. There is therefore a possibility that the proposed irrigation may be located within 100 m of 'natural' wetlands.

PDP notes that that the ecological study (Beca 2021:P:D.66) screened several potential wetlands (sites 3 to 11) although very limited information is provided on the assessment of these sites. Also, the field investigations were undertaken on 23 June 2021 which is during the winter (outside of the growing season to determine the presence of hydrology) which is also a difficult time to determine the percentage of vegetation cover and the identification of species. Field investigations during this time will therefore have some limitations. PDP also note that the ecological report did not make any reference to these limitations.

PDP agrees with the ecological value assessment (Moderate) of Wetland 1 and that although in a degraded state, the wetland will still provide ecosystem services. PDP further agrees with the assumptions regarding stock exclusion and that exotic species be replaced with indigenous species (Section 6 Beca 2021:P:D.66). An assessment of the wetland condition in terms of the *Handbook for monitoring wetland condition* (Clarkson et al., 2003) would provide more detail on how the potential ecological value of the wetland can be increased including identification of pressures on the wetland. This methodology would also provide information on the magnitude of the identified key ecological effects (section 6.1 in the ecological report) on the wetland and to understand the effects management needed for the wetland. The ecological report

(Beca 2021:P:D.66) refers to the NPS-FM 2020 requirements that both the current ecological and potential value of wetland ecosystems is considered, however no specific reference on how the hydrological regime of the wetland could be affected is made in the Discharge Property Ecological Report. An assessment of wetland condition (Clarkson et al., 2003) will facilitate the identification of pressures on the hydrology of the wetland. It will provide information on the present hydrological state including to understand the likely trajectory of hydrological change due to the proposed discharge. PDP agrees with the recommended effects management recommendations (section 7. 1 Table 9) for the wetland, however there is no reference to how the wetland hydrology may need to be managed.

7.1 Clarifications and Further Information Required

We recommend that the applicant should provide more information on the following aspects of the proposal:

a) No reference is made in the AEE and Discharge Property Ecological Report (Beca 2021:P:D.66) of the details of the pasture test (methodology and results) such as the exotic pasture species present and details of the percentage ground cover as described in the interpretation guidance in the *Interpretation guidance on the wetlands definition in the NPS-FM and Freshwater NES* (Exposure draft 7 April 2021). Could the applicant please provide details of the pasture tests for Sites 1 and 2?
b) In terms of Table 2 (section 4.1.2) wetland hydrology indicators were present in both Site 1 and Site 2. Please provide details on how hydrology was determined.
c) Table 2 (section 4.1.2) indicates 'Yes' under soils and the soils have been described in section 4.1.1. Were the soils assessed if they meet the criteria of hydric soils in terms of the *Hydric soils – field identification guide/Hydric Soils tool* (Fraser et al, 2018)? Please provide details of this assessment.
d) In terms of the NES-F (2020), the regulations apply to the discharge of water within, or within a 100 m setback from a natural wetland. Did the applicant identify wetlands and include plans of any wetland, with surveyed boundaries within 100 m of the subject site? If not, please provide this information.
e) The ecological study (Beca 2021:P:D.66) screened several potential wetlands (sites 3 to 11) although very limited information is provided on the assessment of these sites. Could the applicant provide details about the criteria used for the assessments of these sites?
f) No specific reference was made in the Discharge Property ecological report on how the hydrological regime of the wetland could be affected and how the hydrology of the wetland may need to be managed. Could the applicant provide details on the effects on the wetland hydrology and how the wetland hydrology could be managed?

8.0 Natural Hazards

The applicant has identified three natural hazards which may affect the proposed activity. These hazards are earthquakes, tsunamis, and flooding. We agree with the applicant that these are the atmospheric, earth, or water-related occurrences which apply to the proposed activity.

The applicant has stated that the proposed activities will not have an impact on natural hazards. We agree with the applicant that the proposed activities will not have an impact on natural hazards. The activity will not increase the likelihood of a natural hazard occurring or result in an increase in the severity of the natural hazard.

We agree with the applicant that natural hazards may have an impact on the system.

8.1 Existing Systems

For both existing systems at Te Paerahi and Pōrangahau the application states:

"Should there be an event, such as earthquake, flood or tsunami, then many other infrastructure components in the immediate area will be compromised and the effects of this operation being compromised (and effects) will be largely insignificant."

We agree with the applicant that the effects of an event such as an earthquake or tsunami will have a widespread impact on the surrounding area. The existing Te Paerahi WWTP and discharge field fall within the red zone for tsunami inundation with the serving catchment in the orange zone. The Pōrangahau WWTP is within the tsunami inundation yellow zone. The impact of the tsunami on the surrounding area will compromise infrastructure at the WWTP and the surrounding areas. We agree with the applicant that the effects on the WWTP within this context, would be relatively insignificant.

Both existing WWTP's are in the low-risk flood area. It is not expected that the effects of flooding of will be significant in the proposed timeline of works.

8.2 Proposed Discharge Property

The applicant's summary of effects on natural hazards for the proposed discharge property includes an assessment of flood effects. The applicant states that the lower alluvial plain (parts of IMU 1 and IMU 2) is within the HBRC identified 1:100-year flood plain.

The applicant has stated that should this area be flooded, there are easily applied mitigation measures that will allow the area to be quickly remediated and that there will remain an area in the higher elevated locations of more than 40 ha which can be irrigated. The WWTP and wastewater storage pond are proposed to be above the above the high flood risk area. HBRC may wish to clarify what remediation measures will be taken post flood. The applicant should provide a map clearly showing which areas will be irrigated that are within the low flood risk zone including the area in hectares that could be irrigated outside of the high-risk zone.

During periods of flood, the soil moisture content is generally high and due to preceding wet conditions, the storage pond is expected to be utilised. HBRC may wish to confirm that the area of irrigable land/storage is sufficient if IMU 1 and IMU 2 are flooded and irrigation to these areas cannot occur.

The applicant has identified that a tsunami response to an earthquake poses a risk, although infrequent, to the irrigation property and infrastructure. IMU 2 and the drain channels to the south of the site are most at risk. The site was identified as the best location as no alternative land for wastewater discharges within the proximity of the two existing WWTPs is available. The impact of the tsunami on the surrounding area will compromise infrastructure at the WWTP and the surrounding areas. We agree with the applicant that the effects on the land treatment system, within this context, would be relatively insignificant.

8.3 Clarifications and Further Information Required

We recommend that the application provide the following information:

a) What remediation measures will be taken post-flood to allow the irrigation site to be quickly remediated.

b) Provide a map clearly showing which areas will be irrigated that are within the low flood risk zone including the area in hectares.

c) Comment on the impacts of climate change on flood risk to the site.

9.0 Summary

PDP has completed an initial 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

From our initial review, there is a range of further information that we consider is required to complete the assessment of the application. The information required is listed at the end of each of the sections above.

10.0 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.

This memorandum has been prepared by PDP on the specific instructions of Hawke's Bay Regional Council for the limited purposes described in the memorandum. PDP accepts no liability if the memorandum is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

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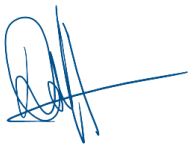

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