# MEMO

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| **Attention** | Tania Diack, Hawkes Bay Regional Council |
| **From:** | Dr. Shane Kelly |
| **CC** | Reece O'Leary, Hawkes Bay Regional Council |
| **Date:** | July 4, 2019 |
| **Regarding** | Review of Wairoa WWTP Ecological Assessments |

## 1 Scope of this Review

Hawkes Bay Regional Council have previously commissioned me to review information provided in support of a resource consent application by Wairoa District Council to:

- discharge treated wastewater from the Wairoa Wastewater Treatment Plant (WWTP);
- discharge untreated wastewater from engineered overflows in the wastewater network; and,
- to reposition of the current WWTP outfall.

Conclusions and recommendations from my initial reviews are provided in two previous memos. Those reviews highlighted several matters, and further information was sought (and provided) to obtain a better understanding the potential impacts of the proposed activities. The purpose of this memo is to review that information in relation to effects on Wairoa Estuary.

## 2 Hydrodynamics

Hydrodynamic modelling was used to explore the dilution and dispersal of the discharges to the estuary. The assessment described model inputs and development, but questions remained about the potential for rapid geomorphological changes and/or proposed changes to the position of the wastewater outfall to invalidate predictions. Further information was therefore sought on these matters. The additional information provided[1] indicated that the eastern opening of the river mouth modelled can be considered as a worst-case scenario for those periods when the mouth is open. A visual assessment of the model predictions suggests that under those conditions, and for various scenarios of river flow and discharge volume, discharges will be diluted by about 200 times within around 100-200 m of the outfall.

[1] Wairoa wastewater treatment plant and reticulation network discharge resource consent applications. Applicant's responses to HBRC's requests for further information dated 26 March 2019.

The key contaminant of concern for toxicity effects is likely to be ammonia-N (the effects of oxygen demanding substances is a secondary concern). Final treatment quality data indicated ammonia-N concentrations ranged from 4.0 to 36 mg/l between 2008 and 2016 (Table 5.2 in Hill et al. (2017)). Dilutions of 4.4 to 39.6 times would therefore be required to reduce concentrations to levels below the ANZECC (2000) marine toxicity trigger value for the protection of 95% of species (0.91 mg/l). Model plots suggest that when the river mouth is open, ammonia-N concentrations are likely to fall below the trigger value within 100 m of the outfall.

Figures provided for ammonia-N concentrations in raw influent (Table 5.2 in Hill et al. (2017), coupled with model plots from network overflows (Greer & Mead 2018), and taking into account the dilution of wastewater prior to discharge during storm events (which Greer and Mead (2018) suggest could be up to 98%) indicate that dilution to levels below the toxicity trigger value is likely to occur within a smaller radius around network overflow points.

Periods when the river mouth is closed were not modelled, but the responses to requests for further information acknowledge the potential for adverse effects when this occurs. Few details are provided on the nature of those effects, but it would be reasonable to expect both health and ecological risks to be elevated. Those risks are currently managed through wastewater storage, river mouth clearance, and by issuing public health warnings. In the future, WDC also expect those risks to also be reduced through the application of filtration and UV treatment.

# 3 Benthic habitats and ecology

An ecological assessment was carried out to evaluate the effects of the wastewater discharge on sediment quality and benthic communities Haggitt et al. 2018). The assessment built upon the work of earlier monitoring and assessments, which surveyed three sites around the outfall. Seven additional sites were sampled by Haggitt et al. (2018), with appropriate sampling design and methods being used.

In summary, the sampling results showed:

- Total sediment metal concentrations were relatively low, with the exception of elevated lead concentrations near an overflow inshore from the WWTP outfall. The cause of elevated lead concentrations was not determined, but the potential for it to have originated from dumped material was highlighted in the response to a request for further information. This seemed reasonable, as lead is not a typical wastewater contaminant.
- There were no clear spatial trends in the percentages of silt or organic matter in seabed sediments around the outfall in 2018. This, together with the low metal concentrations, suggests that the discharge was not having a marked effect on sediment quality.
- Infaunal macroinvertebrate diversity was relatively low at the 10 sites sampled in 2018 (17 taxa in total), with the dominant taxa described as being *synonymous with degraded/impacted environments*. Sites closest to the outfall tended to have higher diversity and abundance, but fewer pipi than the more remote sites. This could be due to the discharge or it could reflect natural variation, as differences in community composition were also apparent among groups of remote sites (see Figures 9-11 in Haggitt et al. 2018).

Overall, there is evidence that benthic ecology and habitat quality in the estuary are impacted by catchment activities, but the existing discharge does not appear to be compounding those effects to any substantial degree.

Further information was also sought on whether nuisance macroalgae blooms were present in the lower Wairoa River. Blooms of marine macroalgae such as *Gracilaria* and *Ulva* (sea lettuce) are a key indicator of nutrient effects and commonly occur in nutrient enriched estuaries, where dense beds can cover intertidal sand and mud flats.

The Applicant's response indicated that no periphyton growth was observed during field data collection and noted that *periphyton growth is unlikely to develop in soft-bottomed rivers such as the lower Wairoa River, regardless of dissolved nutrient concentrations*.

And,

*This in combination with the occasionally high water flow rates and poor water quality in terms of light penetration (very turbid), indicate that periphyton blooms are unlikely to occur in the Wairoa estuary.*

I note that the growth of periphyton, which typically occurs in freshwater systems, differs from the nuisance macroalgae blooms that occur in harbours and estuaries (see example in Figure 3-1 below). Nuisance macroalgae blooms tend to grow in intertidal areas and be visually obvious (they can also cause offensive odours). Consequently, they are likely to be noticed by members of the public. Further information on this matter may therefore be provided by submitters.

**Figure 3-1: *Gracilaria* growing on mudflats in Manukau Harbour.**

# 4 Effects of repositioning the outfall

Additional information was sought on the potential effects of repositioning the outfall. The response provided by the Applicant indicated that it would result in the broader distribution of suspended materials in the discharge, but sedimentation patterns will largely be determined by river migration, the position of the entrance, and sand bars in the lower estuary. Based on the modelling information provided, those conclusions seem reasonable.

In relation to benthic ecological effects, the Applicant indicated that effects on pipi are expected to be localized and temporary. The raw pipi data in Appendix B of Haggitt et al. (2018) indicates that relatively dense populations of juvenile pipi are spread throughout intertidal areas in the lower estuary. However, the subtidal area proposed for the new outfall has not been surveyed.

I note that, adult and juvenile pipi can live in separate areas (pipi move by secreting mucus threads that allow them to drift). In Whangateau Harbour, northeastern New Zealand, Hooker (1995) found that:

- pipi recruits occurred in a small mid-intertidal band;
- juveniles occurred below the recruits in the lower intertidal to subtidal zone;
- adults mainly occurred sub-tidally, forming very dense, discrete beds with juveniles missing in central parts of the beds.

It is therefore possible that moving the outfall into the channel will disturb adult pipi beds. In the absence of site-specific information, I therefore recommend that, if consent is granted, the area of disturbance be minimized during construction.

# 5 Kai moana

In response to a request for further information on what and where edible species of kaimoana can be gathered around the river mouth, the Applicant states in 6a of their response:

*In terms of gathering kaimoana around the river mouth, such as shellfish in the sediment and/or on hard substrate, none are gathered due to river water quality being too poor (in terms of high levels of E. coli that would make them inedible). More importantly, it is because there are few there, and they don't grow to maturity……..*

*……This trend appears unrelated to silt content, however it must be stressed that all pipi enumerated were <30 mm in size, therefore are likely to be stressed at all sites where they are encountered….*

*……Local residents and their families who recreationally fish and represent several decades' experience have confirmed that shellfish are not collected anywhere in the estuary because of public health warnings, shellfish population declines, and the small sizes of pipi and mussel spat….*

*…..It should also be noted that all MACA claimants were sent a summary of the proposed package of changes for future consenting and were subsequently sent a copy of the AEE. Their complete absence of feedback suggests that kaimoana and mahinga kai are not valued and perhaps do not exist in the vicinity of the WWTP discharge pipeline or its plume….*

As noted above:

- the ecological assessment indicated that juvenile pipi are relatively abundant and widespread in the estuary;
- the lack of adult pipi at the intertidal sites sampled does not mean adult beds are not present sub-tidally;
- neither does it mean that pipi at those sites are stressed (as the Applicant infers in their response to HBRC's request for further information).

The Applicant did not provide details on which local residents gave details on shellfish harvesting, so I am unsure about the reliability of that information. I also note that there could be many reasons why MACA claimants did not provide feedback on the application. I consider it unwise to assume that the lack of feedback means *kaimoana and mahinga kai are not valued and perhaps do not exist in the vicinity of the WWTP discharge pipeline or its plume*.

In my opinion, effects on kai moana have not been adequately addressed. Further details on shellfish occurrence and harvesting in the estuary may be provided by submitters.

## 6 Proposed discharge monitoring parameters

In my previous memo I provided a number of observations and recommendations on monitoring requirements. Further information was sought from the Applicant on those matters. The Applicant indicated in their response that WDC and HBRC technical experts would collaborate on drafting a benthic monitoring plan during the public notification period. If that process was unsuccessful, they further indicated a revised set of draft conditions would be provided. Consequently, this matter is yet to be resolved.

## 7 Staging

The addition of filtration and UV treatment at the outlet of the facultative pond within 2 years of consent being granted is a positive step that should reduce health risks associated with discharges from the WWTP. Risks from bypass events and other sources of microbial contamination will remain.

In principle, the staging of other WWTP initiatives also appear reasonable. However, the application highlights that key targets in Stages 1 and 2 depend on commitments outside resource consent processes and that Stages 3 and 4 are aspirational. Consequently, there is little certainty that the proposed staging will be implemented.

I also note that the proposed staging relaxes the current requirement of only discharging at night. This is unlikely to have a tangible effect on benthic macrofauna or sediment quality but could have other environmental implications (e.g. increasing health risks).

# 8 Conclusions

The information provided in support of this applications suggests that:

- The key contaminant of concern for toxicity effects is likely to be ammonia-N. Concentrations in the discharge will be rapidly diluted to levels below the ANZECC (2000) trigger value for slightly to moderately disturbed systems when the mouth of the estuary is open.
- Blooms of nuisance marine macroalgae are a key indicator of nutrient effects, but no information was provided on their presence or absence in the estuary. The observations and local knowledge of submitters may provide insights into whether or not they occur.
- The potential for adverse human health and ecological effects is greater when the mouth is closed. Few details have been provided on the likelihood and nature of those effects, but measures including storage, mouth clearance, and public notification are used to reduce their impacts.
- Wairoa Estuary has been degraded by the cumulative effects of multiple catchment activities. The existing discharge from the WWTP does not appear to be compounding those effects on benthic communities or habitats to any substantial degree.
- Moving the outfall into the channel has the potential to physically disturb pipi beds (or other subtidal species), but subtidal habitats and communities in the proposed area have not been surveyed. If consent is granted, I recommend conditions be included that require the disturbance area to be minimized.
- In my opinion, potential impacts on kaimoana have not been adequately addressed. Further context may be provided by submitters.
- An appropriate monitoring plan is still to be developed.

# 9 References

ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment & Conservation Council, and Agriculture and Resource Management Councils of Australia & New Zealand. Canberra, Australia., 316 pgs.

Greer, D., Mead, S. (2018) Wairoa WWTP outfall: 3D hydrodynamic numerical modelling. Client report for Wairoa District Council eCoast Raglan, 50 pgs.

Haggitt, T., Mead, S., Mead, W., O'Neill, S. (2018) Assessment of effects of Wairoa District Council's existing intertidal sewage discharge on benthic sediment characteristics and ecology – Wairoa Estuary. Client report for Wairoa District Council eCoast Raglan, 41 pgs.

Hill, P., Cornelson, J., Lane, A., Tumbure, A., Lake, P. (2017) WWTP system data and compliance summary. Client report prepared for Wairoa District Council Lowe Environmental Impact 36 pgs.

Hooker, S.H. (1995) Life history and demography of the pipi, Paphies australis (Bivalvia: Mesodesmatidae) in northeastern New Zealand. PhD Thesis, University of Auckland, Auckland.