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MEMORANDUM

TO Sonia Baker | Greater Wellington Regional Council (GWRC)
FROM Alex James | EOS Ecology

Review of ecological components of GWRC's flood protection operations and maintenance activities in the Wainuiomata River consent application

EOS Job No: GRE01-14074

Dear Sonia,

Please find below my review of the ecological components of GWRC's "Resource Consent Application WGN150094: Flood Protection Operations and Maintenance Activities in the Wainuiomata River". This has involved the review of the actual consent application document prepared by Tonkin & Taylor Ltd, October 2014 (referred to herewith as Tonkin & Taylor, 2014 or the application report) and the report "Effects of flood protection activities on aquatic and riparian ecology in the Wainuiomata River" prepared by David Cameron of MWH, September 2014 (herewith referred to as Cameron, 2014 or the ecological AEE report). I have not covered the proposed mitigation/avoidance/remedies included in these reports, as it is understood these elements will be covered in the Code of Practice, which will be reviewed in a separate memo.

1 DESCRIPTION OF THE EXISTING ENVIRONMENT AND ASSESSMENT OF ECOLOGICAL EFFECTS

"Your opinion on the appropriateness of the updated ecological effects assessment in the Wainuiomata River application report"

"A review of the updated ecology effects assessment in Cameron (2014) for the Wainuiomata River and the validity of the conclusions reached"

1.1 GENERAL COMMENTS

The Wainuiomata River is much less affected by GWRC flood protection activities relative to the other western rivers (Hutt, Waikanae, and Otaki). The area covered by the consent application is an approximately 5 km reach and historically flood protection works have predominantly involved the planting of willows. Gravel extraction is not currently undertaken while limited bed recontouring is undertaken at three relatively discrete locations only as required. Hence the GWRC Flood Protection works are limited in comparison to the other western rivers they operate in. That is not to say a comprehensive AEE is not required and it is of concern that both the ecological AEE report and application report have lesser coverage of ecological matters than the other western rivers applications (which themselves were already lacking in a number of areas regarding ecology).

The Wainuiomata River application report (Tonkin & Taylor, 2014) included some information (e.g., periphyton monitoring data) that was not included in the supporting ecological AEE report (Cameron, 2014). This is of concern as in my experience; the ecological AEE report should give comprehensive coverage of ecological matters with the actual application report then providing a summary of that information, rather than the consent application having to supply additional ecological information because it was not provided in the ecological AEE report.

The area covered by the consent application has been subjected to flood protection activities for many years. Hence it is already

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modified by these activities (e.g., extensive willow plantings). To determine if this “impact” section of the river shows any signs of such impact, it is important to compare ecological information between this section and a “reference” part of the catchment where GWRC Flood Protection do not operate. The reports have no impact-reference comparison within the Wainuiomata River catchment, and there is very limited ecological information presented from within the section of river covered by the consent application. The information on periphyton, water quality, macroinvertebrates was obtained from two GWRC SoE sites, neither of which is in the impacted reach. For fish a list of species recorded in the “impact” section of the Wainuiomata River is provided but there is no explicit comparison of fish faunas between the “impact” and “reference” parts of the catchment. Additionally, no information on the bird species that make use of the riverbed and riparian zone is presented.

In the application report, there is a lack of a simple map showing the area covered by the consent application. While the detailed aerial photographs are useful, a single page overview map is beneficial to quickly show the extent of the waterways where flood protection activities occur. Figure 1-1 from the ecological AEE report does this well and should be included in the application report.

Both reports need to have the citations and references checked and corrected for omissions and inconsistencies.

In general, I agree with the determination of effects for most of the proposed activities based my own general knowledge of gravel bed rivers, however many aspects of aquatic and riparian ecology specific to the application area are not adequately covered. The description of the existing environment is missing some important information that in my view is required to adequately determine effects beyond a generic New Zealand gravel bed river. Such specific information is especially important in this instance as an adaptive management regime driven by a “living” Code of Practice document is the proposed means of avoiding/remediating/mitigating the impacts of the flood protection activities for the next 35 years.

1.2 DESCRIPTION OF THE EXISTING ENVIRONMENT

A comprehensive description of the existing ecological condition of the area covered by the consent application and the catchment in general is crucial to undertaking a rigorous assessment of ecological effects. The description included in the ecological AEE report and application report largely relies on GWRC state of the environment (SoE) data for periphyton and macroinvertebrates (two sites only), some additional macroinvertebrate data collected by MWH downstream of the water treatment plant, and the New Zealand Freshwater Fish Database (NZFFD). In my view there are gaps in the coverage of these ecological components while other relevant ecological components are missing entirely. Because the description of the existing environment in the application report is largely drawn from the ecological AEE report, both documents are covered here. These gaps and other identified issues are outlined below.

Catchment overview/Physical characteristics:

- » The application report states a catchment area of 133 km², while the ecological AEE states a catchment area of only 34 km². I would think the former is correct. This needs to be resolved for consistency.

Periphyton:

- » The application report provides a table of periphyton monitoring results that I would have expected to be in the ecological AEE report.

Aquatic plants:

- » The only coverage of aquatic plants in the ecological AEE report is about a nationally endangered coastal species (pygmy clubrush – *Isolepis basilaris*) that occurs in the vicinity of the Wainuiomata River mouth, which is some 16 km downstream of the reach covered by the consent application.
- » While the Wainuiomata River main stem (including the GWRC managed reach) is unlikely to have any macrophytes, this should be confirmed in the ecological AEE report.

Macroinvertebrates:

- » The macroinvertebrate data presented was limited to pre-existing data based on two GWRC SoE sites (2009–2011) and some additional sampling by MWH from 2013. There is little information provided in the ecology AEE report regarding macroinvertebrates, and there is key information missing that I would expect to be standard for any AEE report. This is detailed

further in the subsequent bullet points.

- » While the presented data provides a broad catchment-scale overview of some invertebrate metrics, it does not provide the required detail; nor is there any invertebrate data from within the reach covered by the consent application. For an application that involves invasive instream activities such as bed recontouring and gravel extraction, more detail on the invertebrate community is required. What are the most common species/taxa in the sections to undergo gravel extraction/bed recontouring? How does the community composition (density/abundance of main species, diversity, evenness, etc.) compare to that found outside of the area (i.e., are the communities within the project area distinct or similar to that found outside of the affected area)? Are there any threatened or at risk invertebrates present according to the listing of Grainger *et al.* (2014)? Which EPT taxa are present in the river? If there is no invertebrate data from within the GWRC managed reach, then at a minimum the Freshwater Ecosystems of New Zealand (FENZ; Leathwick *et al.*, 2010) could have been queried to at least get an idea of the freshwater invertebrates that would most likely be encountered in that section of the Wainuiomata River based on predictive modelling.
- » All the macroinvertebrate data is from shallow habitats. Is there any data available on the invertebrates of deeper habitats?
- » Table 7 (application report) and Table 3-3 (ecological AEE report) present means, thus some kind of measure of variability would be useful (e.g., ranges, standard errors).
- » There is no coverage of the invertebrate fauna that live in the gravel substrate both in the wetted bed and laterally in gravel bars and beaches (hyporheic invertebrates = hyporheos) of the Wainuiomata River. Wherever bed/beach recontouring or gravel extraction occurs, there will be negative effects on the hyporheos. While such effects are largely unavoidable, it is still important to characterise this fauna and acknowledge as much. Sampling of this fauna may have been undertaken as part of some past research project or survey.
- » The ecological AEE report and application report both present GWRC SoE monitoring invertebrate data for the period 2009–2011. I know there is data from these sites for several years earlier than this. Why hasn't the full period for which there is data available been presented? This would be particularly interesting in determining any trends (or lack thereof).

Fish:

- » Information is limited to a summary of NZFFD records, which include sites inside and outside the application area.
- » The tables of NZFFD records (application report: Table 9; ecological AEE report: Table 3-5) give no indication of where each species has been found in relation to the area covered by the consent application. To make effective use of this information, the records should be split into those from in the application area and those outside. A map of site locations would also be useful in the application report. Distribution maps of four fish species in the Wainuiomata River catchment are provided in the ecology AEE report (Figures 3-1 to 3-4). These would be more useful if they showed the area of the catchment included in the consent application, and if this data was used to help determine those species likely to be most impacted by in river works.
- » Tables 3-6 and 3-7 (ecological AEE report) show the results of fish surveys undertaken in the Hutt River by Perrie (2013). While these are useful at indicating the deeper water fauna of the Hutt River and could perhaps give an indication of the effects of gravel extraction in other gravel bed rivers similar to the Hutt River, they are not directly applicable to the Wainuiomata River in describing the existing environment.
- » The tables of fish data also only present presence/absence rather than any abundance (relative abundance, rank abundance, etc.), which means that it is impossible to know what species are more abundant and what the general community composition is like.
- » The presented fish information gives an indication of the species present but not about which species will be affected the most by the more invasive activities such as gravel extraction and bed recontouring. In essence the authors need to cover which of the various fish species we should be most concerned about.
- » It is stated that trout spawn throughout the main stem of the Wainuiomata River, which presumably includes the section covered by the consent, however there is no information on the other species that may spawn in that reach (e.g., bully species).
- » What is the level of customary, recreational, and commercial fishing for eels in the Wainuiomata River? This may affect their abundance and distribution.

Water quality:

- » The water quality data presented were from GWRC SoE sites (2009–2011).
- » It is stated the latest GWRC water and ecology trends report covers the period 2004-2011. Why wasn't the earlier data included in

Table 3-1 (ecological AEE report) or Table 5 (application report)?

- » The application report states the two Wainuiomata GWRC SoE sites are ranked 6th and 26th of the 55 GWRC SoE sites, however the ecological AEE states the rankings are 9th and 33rd. This needs to be resolved.

Gravel bar and beach flora and fauna:

- » Apart from riverbed nesting birds (or the lack thereof) there is no information on the flora and fauna of gravel bars and beaches that may be impacted by gravel extraction and bed recontouring. While the vegetation colonising such environments is more than likely composed of fast growing exotic species and these environments are periodically reset by large bed-moving floods, there is the potential that periods between large floods could see the development of plant communities that may have some native vegetation and provide habitat for native fauna. Disturbance of these plant communities through gravel extraction and bed recontouring could negatively affect any such native flora and fauna. Some basic information on what native flora and fauna are present in such environments is required to determine if there are any negative ecological effects of flood protection activities that disturb gravel beaches.

Riparian vegetation:

- » Neither the application report nor the ecological AEE report (despite having "riparian ecology" in the title) presents any information on riparian vegetation. This needs to be rectified.
- » While some 59% of the flood protection reach of the Wainuiomata River is managed willow, what is the remaining 41%? Are there any significant areas of remnant native vegetation or native plantings?

Birds:

- » The ecological AEE report presents some bird information from the Wainuiomata River mouth, which is some 16 km downstream of the reach covered by the consent application. It is acknowledged that the Wainuiomata River is relatively narrow with minimal gravel beaches, thus it is unlikely to support populations of riverbed nesting bird species (i.e., pied stilt, dotterels). However, I am certain other bird species make use of the riverbed and riparian zone in the area covered by the consent application. I would expect some coverage of birds in this area, however currently no information is provided.

Herpetofauna:

- » This is not covered at all. Are there any skins or geckos known or potentially present in the area covered by the consent application?

1.3 ASSESSMENT OF ECOLOGICAL EFFECTS

To fully assess the effects of a proposed activity on the environment, one first must have a full understanding of the existing environment. Based on Section 1.1 and 1.2 above, it is clear there are key information gaps. However, it must also be noted the section of the Wainuiomata River covered by the consent application has been subjected to various flood protection activities for many years and the most likely activities to be undertaken (i.e., willow planting and maintenance and bed recontouring) are not new to the catchment. It has also been subjected to reduced rates of gravel accumulation due to the presence of water supply dams upstream and like so many rivers has been severed from its floodplain by the construction of stop banks. Hence, in general the river fauna now present is a fauna that is tolerant to such alteration and we will never know how the diversity and abundance of species differs to the pre-impact state. It is also a fauna that is adapted to persisting in a dynamic gravel bed river where floods that redistribute bed gravels are relatively regular. We know for certain that there have been negative ecological impacts from flood protection works (for example the reduction of aquatic habitat complexity) but there may well have been and continue to be undetected impacts, some of which could be avoided/mitigated/minimised by refining flood protection practices.

As the ecological effects in the application report are largely drawn from the ecological AEE report, the comments on these documents are combined. In general I agree with the determination of effects for most of the proposed activities and the following comments cover those areas of the AEE where my opinion differs from that of the application report and/or ecological AEE report, or where relevant information is missing:

- » Application report: Some of the proposed activities are not new to the Wainuiomata River, thus a map showing where the main

existing flood protection features (i.e., willow plantings, rip-rap rock lining, timber groynes, etc.) are would be most useful to gain an appreciation of the location and extent of pre-existing channel modifications.

- » Application report: Section 5.1: Positive Effects. As stated in this section there is no doubt the previous flood protection works have had huge economic and social benefits through the prevention of the flooding of surrounding land. This section could however be expanded to cover positive ecological effects including:
 - The potential for bed recontouring activities to actually increase river habitat variability or at least maintain, that which is already there (which would be an advance on how it was done in the past).
 - The construction of groynes creates structures that have the positive effect of creating deep, slow pool habitats, which are probably not dissimilar to those that naturally would have resulted from fallen trees and associated debris dams when the riparian zone had native vegetation. Likewise, debris fences, debris arrestors, and timber groynes also mimic to some extent natural debris dams, however, these are likely to be regularly cleared of debris thus diminishing any positive effect.
 - Rip-rap boulders at the water's edge and below the surface provide a stable surface for the spawning of some fish species (i.e., bullies) and some aquatic insects that lay eggs on the undersides of larger rocks.
- » Application report (Section 5.3 Discharge of sediment) and Ecological AEE report (Section 5.2 Water Quality)
 - Useful information is presented on the actual measured impacts of gravel extraction and truck crossing on turbidity and TSS in the Hutt River and for riprap placement, truck crossing, and bulldozer thalweg cutting in the Waikanae River on TSS. While it appears that river works do not increase turbidity/TSS to levels any greater than recorded during floods, the important difference is that river works are generally undertaken at low flow periods, such that any suspended sediment relatively rapidly settles out and is deposited on the riverbed in low velocity environments. While suspended sediment as a result of river works is a relatively short term disturbance, deposited fine sediment may cover the gravel bed and fill the interstitial spaces between the rocks where invertebrates and smaller fish live for an extended period of time depending on when the next significant fresh/flood occurs. Thus the effects of works on downstream deposited sediment is at least as important, or arguably more important a factor than suspended sediment and its effects need to be covered in the application report. The Hutt River gravel extraction habitat mapping report (Appendix A of the ecological AEE report) did measure deposited sediment, but only from shallow run habitats, not from pools, backwaters, or side eddies where suspended fine sediment would be more likely to settle under low flow conditions. It is also from the Hutt River not the Wainuiomata.
- » Application report (Section 5.10) & Ecological AEE report (Section 5.9): Vegetative bank protection
 - I agree that for larger rivers, there are no native plant species that allow an effective, reliable, and relatively inexpensive means of soft engineering. It is of concern, however that some 59% of the riverbanks in the application area are now willow lined. I would be useful if the application provided evidence that all these willows (and the required on-going maintenance) are actually needed and a good use of resources. In the past were areas just planted in willows because "that is how you do flood protection" or was there a real need? Is there the potential that based on bed morphology and bank erosion potential that some reaches don't actually require willows and could over time be "retired" and converted to appropriate native planting?
 - The planting of native species seems to be an accepted and well-organised part of flood protection works in the Otaki, Waikanae, and Hutt Rivers; however, the commitment to use native plants behind the front line on willows in the Wainuiomata River is not so evident in the application report. I'm unsure whether this is actually the case, thus it would helpful if the use of native plantings along the Wainuiomata River was clarified in the application report and ecological AEE report.
 - The ecological AEE report states that based on a review of the effects of willows on stream ecosystems, they provide benefits such as provision of shade and shelter, control of water temperature, and control of sediment and nutrient levels. Additionally, it is concluded that on balance vegetative bank edge protection is expected to enhance some forms of fish habitat and the overall effect on native fish and trout populations is likely to be positive. Given the small size of the Wainuiomata River, the willows lining the channel likely do have some of these positive effects (relative to no or low vegetation). However, it should also be noted that *any* significant riparian vegetation of similar density and height would have similarly positive effects, with additional benefits of native species for terrestrial values in particular.

- » Application report (Section 5.12) and Ecological AEE report (Section 5.10): Channel maintenance
 - Despite a page being dedicated to the removal of aquatic vegetation in the ecological AEE report it is unclear whether the activity is required in the Wainuiomata River. Given the flood protection works are limited to the main stem, it is unlikely there will be any macrophytes or macrophyte removal. Additionally, the application report does not even include this activity. Clarification of the likelihood of this activity being undertaken in the Wainuiomata River would be useful to determine if there is a need for a macrophyte survey.
 - The ecological AEE report states that "Where mechanical weed removal is undertaken in perennial streams consideration given to requiring at least one observer, in addition to the digger operator, to check for trapped fish and to facilitate their capture and return to the watercourse." What does "consideration" mean in this instance? I would suggest a dedicated person to rescue fish be a requirement rather than a consideration. This is a matter to be defined in the Code of Practice (see my separate review of that document). However, as stated previously it is actually unclear as to whether macrophyte removal is even part of the works proposed for this river, there is no mention of any tributaries as part of the application area, and the main stem itself is unlikely to have any macrophytes of a density requiring specific removal.
 - I agree that the clearance of flood debris should be limited to only those items that present an immediate risk to flooding so that other logs/debris are left in the channel where they can provide habitat for fish and invertebrates. However, some criteria on what are left and what is removed needs to be in place to prevent the removal of material by over-zealous operators. This is a matter to be defined in the Code of Practice (see my separate review of that document).
- » Application report (Section 5.13.1) and Ecological AEE report (Section 5.10.3): Beach ripping
 - The effect of beach ripping cannot be determined in the absence of information on the flora and fauna of gravel beaches. Are there any native flora or fauna present?
- » Application report (Section 5.13.4) and Ecological AEE report (Section 5.11.2): Bed recontouring
 - There is no mention in the construction effects of the direct mortality of fish and invertebrates that are in the former channel that is either filled in or dewatered. This needs to be resolved.
- » Application report (Section 5.13.5) and Ecological AEE report (Section 5.10.5): Gravel extraction
 - Given only dry gravel extraction from exposed gravel beaches is proposed for the Wainuiomata River the main ecological concerns are related to disturbance of the flora and fauna of these beaches. As it is, the effect of gravel extraction cannot be determined in the absence of information on the flora and fauna of gravel beaches.
- » Application report (Section 5.22) and Ecological AEE report (Section 6): Cumulative Effects
 - It is noted that one landowner downstream of the GWRC's managed reach has consent to undertake limited works in the river adjacent his property while other landowners are seeking such consents to undertake similar works adjacent their properties. I suggest these private consents also be required to follow the procedures and actions outlined in the Code of Practice in order to minimise their impacts on ecology and avoid the cumulative effects being borne by the GWRC consent.

2 FURTHER INFORMATION

"Identification of any further information the EOS should be provided with to complete the assessment of environmental effects for the Wainuiomata River"

This section is divided into two parts: information that is definitely required to complete the assessment of environmental effects, as well as information that could be included in the Environmental Monitoring Plan (and thus collected/obtained later).

2.1 INFORMATION REQUIRED TO COMPLETE AEE

Information gaps and other deficiencies in the information provision are detailed in Section 1. The following is a summary of the key matters requiring resolution, but it will be important to also refer to Section 1 for additional detail:

- » More effective maps should be provided, in particular, the NZFFD records maps (and all maps for that matter) should clearly indicate the sections of river covered by the consent application, the application report should include a map of ecological survey site locations, and a map showing existing flood protection features (i.e., willow plantings, native plantings, rock lining, etc.)

would be highly useful.

- » The description of the existing environment needs to provide an effective comparison of the ecology of the area covered by the consent application (the "impact" section) with the upstream catchment outside the influence of flood protection activities (the "reference" section).
- » The description of the Wainuiomata River benthic macroinvertebrate community needs to be expanded to better describe the typical community of the area covered by the application, especially in habitats that are impacted by bed recontouring and potential gravel extraction.
- » More detailed information on the fish species that we should be most concerned about such as those that are abundant and spawn in the area covered by the consent application, especially in habitats that are impacted by bed recontouring and potential gravel extraction.
- » A description of riparian vegetation in the application area, specifically covering any remnant native vegetation or significant areas of native plantings.
- » A description of the bird species that we should be most concerned about such as those native or endemic species that roost, feed, nest, or rest in the area covered by the consent application.
- » Coverage of herpetofauna that could be present in the consent application area.

2.2 INFORMATION TO OBTAIN LATER VIA THE EMP

- » A description of the flora and fauna that colonises the gravel beaches/bars of the Wainuiomata River in the periods between bed-moving flood events.

3 REFERENCES

- Cameron, D. 2014. Effects of flood protection activities on aquatic and riparian ecology in the Wainuiomata River. MWH. Report prepared for Greater Wellington Regional Council (Flood Protection).
- Grainger, N.; Collier, K.; Hitchmough, R.; Harding, J.; Smith, B.; Sutherland, D. 2014. Conservation status of New Zealand freshwater invertebrates, 2013. New Zealand Threat Classification Series 8. Department of Conservation, Wellington. 28 p.
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- Perrie, A. 2013. The effects of gravel extraction from the wetted channel on the aquatic ecosystem of the Hutt River: a summary of two Environmental Science Department investigations undertaken 2012/13. Greater Wellington Regional Council memo, file no. 1235956-v3. 24 p.
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