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25 August 2017

## MEMORANDUM

TO Kirsty van Reenen | Greater Wellington Regional Council  
FROM Alex James | EOS Ecology

### Ecological review of GWRC Flood Protection Western River consent applications and submitter comments

EOS Job No: GRE01-14074

Dear Kirsty,

Please find below my review of the GWRC flood protection resource consent applications and submitter comments as per the scope you provided on 29 June 2017. This includes consideration of:

- » Matters raised in previous reviews, where my comments from previous reviews have not been taken into consideration, or where these matters continue to raise concerns;
- » Comments relating to ecology made by submitters;
- » Matters of an ecological nature raised in the key issues table you provided on 29 June 2017.

To reflect the separate consent applications for each river, I have divided this memo into sections for each river but have also included separate sections for items that cover all applications (e.g., Code of Practice (COP), Environmental Monitoring Plan (EMP), key issues table, general submitter comments).

## 1 HUTT RIVER

The Hutt River assessment of effects (AEE) has been reviewed twice in the past (James, 2015a; James, 2016). Thus here I limit my comments to considering those matters previously raised in the second review (James, 2016) where these have not been satisfactorily rectified and any relevant comments made by submitters relating specifically to ecology in the Hutt River.

### 1.1 MATTERS RAISED IN PREVIOUS REVIEWS

- » **Use of NRWQN macroinvertebrate data:** My previous review recommended "this data be incorporated into the EMP alongside GWRC SOE data to provide some background/context to any future macroinvertebrate sampling undertaken by the EMP. At this stage such analysis could be undertaken once the COP and EMP are operative." Currently there is no macroinvertebrate sampling included as part of the EMP baseline monitoring, hence at present the NRWQN data will never be examined.
- » **More detailed information on bluegill bully:** My previous review stated "Some good information on spawning periods and locations of fish has been provided, but it would be useful to provide more detail on bluegill bully in particular as this species is resident and abundant in habitats most impacted directly by flood protection activities." No additional information on bluegill bully spawning in the Hutt River has been provided. Additionally, if the Site Specific Effect Management scheme described in the COP was to be enacted I would like to see bluegill bully spawning added to the parameters that indicate high sensitivity to disturbance.

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- » **Recreational and commercial fishery:** Several factors may influence fish populations including recreational and commercial fisheries, hence it would be relevant to take these into account when interpreting the results of any fish monitoring undertaken as part of the EMP. Of the fish species present, eels (both longfin and shortfin) are commercially fished under the Quota Management System, while brown trout are caught recreationally under the management of Fish & Game. My previous review indicated more information on recreational and commercial fishing in the application area should be provided and suggested, "The future analysis of fish data as part of the EMP include some coverage of commercial and recreational fishing data from the application area." There is no indication anywhere that this will be taken into account in the analysis of baseline monitoring data. I acknowledge obtaining any detailed information may be difficult but it would still be worthwhile knowing whether commercial eeling is occurring in the area (Ministry for Primary Industries (MPI) should have records) and the fishing pressure on trout (Fish & Game should have some estimates). It is probably impossible to determine the recreational eeling take, as this is undocumented as far as I know.

## 1.2 SUBMITTER COMMENTS

### 1.2.1 WELLINGTON FLYFISHERS CLUB

- » **Page 2, Point a:** The submitter requests the disturbance of the river bed in the Hutt River should be restricted to 500 metres in any one year. I can't comment on whether this is practical for FP to achieve the work they need to do. In my opinion the avoidance/remedy/mitigation requirements for each activity are more important than a bed disturbance length restriction.
- » **Page 2, Point c:** The submitter requests significant instream work should be avoided from 1st April to 30th September to allow for upstream migration of trout to spawn. A six-month long avoidance period purely to avoid upstream migrating trout (given they do not spawn in the Hutt River main stem covered but the application) may be unreasonable, considering the relatively short duration of most instream activities (i.e., days), although if large scale continuous gravel extraction were to occur then it could be worthwhile having some provision around breaks in the activity to allow free passage of trout and other fish. The fish migration advice of Ministry of Primary Industries (2015) indicates the upstream migration of adult brown trout occurs December to May, peaking March to May. In the absence of any information specific to the Hutt River, it would be sensible to avoid the March to May period for significant instream works. This would match up well with the key sensitivity period for trout spawning in the Akatarawa River of 1 May – 31 July shown on Table 12 of the COP.

### 1.2.2 WELLINGTON FISH AND GAME COUNCIL

- » **Page 4, Point 19:** The submitter requests the disturbance of the river bed in the Hutt River should be restricted to 500 metres in any one year. Refer to Section 1.2.1 above (first bullet point).
- » **Page 4, Point 19:** The submitter requests a "precaution on instream work" from 1st April to 30th September (i.e., a six-month period) to avoid migrating trout and spawning grounds. Apart from the lower Akatarawa River, I was under the impression there is no trout spawning in the part of the Hutt River covered by GWRC FP activities; hence I assume this request is mainly to do with protecting the upstream migration of trout from the sea and lower river to spawn. Refer to Section 1.2.1 above (second bullet point).

## 2 OTAKI RIVER

The Otaki River assessment of effects (AEE) has been reviewed twice in the past (James, 2015b; James, 2016). Thus here I limit my comments to considering those matters previously raised in the second review (James, 2016) where these have not been satisfactorily rectified and any relevant comments relating to ecology made by submitters.

### 2.1 MATTERS RAISED IN PREVIOUS REVIEWS

- » **Estuary information:** The queries from the previous review on the validity of 20+ year old vegetation data have not been addressed.
- » **Freshwater mussels:** The previous review noted there was no comment on whether freshwater mussels are present in the tributary waterways of the application area. There is still no information on this.
- » **Trout drift dive data:** The previous review noted the updated maps included trout drift dive reaches, yet there is still no drift dive data included in the latest version, despite the Otaki River being described as a regionally important trout fishery.
- » **Aquatic plants:** The previous review stated "As mentioned in my earlier review (James, 2015b) it would be useful for the COP to include guidance on protecting substantial patches of native macrophytes while implementing measures such that invasive species are not spread." I could not find any provisions in the COP for the protection of native macrophytes.

- » **Recreational and commercial fishery:** Several factors may influence fish populations including recreational and commercial fisheries, hence it would be relevant to take these into account when interpreting the results of any fish monitoring undertaken as part of the EMP. Of the fish species present, eels (both longfin and shortfin) are commercially fished under the Quota Management System, while brown trout are caught recreationally under the management of Fish & Game. My previous review indicated more information on recreational and commercial fishing in the application area should be provided and suggested, "The future analysis of fish data as part of the EMP include some coverage of commercial and recreational fishing data from the application area." There is no indication anywhere that this will be taken into account in the analysis of baseline monitoring data. I acknowledge obtaining any detailed information may be difficult but it would still be worthwhile knowing whether commercial eeling is occurring in the area (Ministry for Primary Industries (MPI) should have records) and the fishing pressure on trout (Fish & Game should have some estimates). It is probably impossible to determine the recreational eeling take, as this is undocumented as far as I know.

## 2.2 SUBMITTER COMMENTS

### 2.2.1 DEPARTMENT OF CONSERVATION

- » **Page 7, Point 20:** The submitter states the application fails to avoid adverse effects on inanga spawning areas identified in the pNRP. This is true, as the Cameron report has not considered the pNRP. It does however have provision in Table 13 of the COP for avoiding inanga spawning, thus the "affected areas" in this table should be updated to reflect the latest information contained in the pNRP. In addition, I have previously recommended that for the Code of Practice (COP) the inanga spawning area restriction should be expanded beyond the identified spawning areas to cover the whole zone of potential spawning habitat; although I note that this has not been updated (see Section 5.1 below, sixth bullet point).
- » **Page 7, Point 21:** The submitter states the application fails to provide information on the effects of the proposed activities on the wetlands and lagoon system in the lower Otaki River estuary. There is some coverage of the effects of river mouth opening on the estuary in the Cameron report, but little on other upstream activities (i.e., gravel extraction) that may influence the estuary.
- » **Page 7, Point 22:** The submitter states the application is lacking information on the cumulative effects of gravel extraction on the river, estuary and Kapiti open coast beach system. I agree this information is lacking and I understand that at the time of writing at least an assessment of gravel extraction effects on coastal processes had been requested.

### 2.2.2 WELLINGTON FISH AND GAME COUNCIL

- » **Page 4, Point 19:** The submitter requests the disturbance of the river bed in the Otaki River should be restricted to 500 metres in any one year, with a maximum of 200 m of continuous disturbance. I can't comment on whether this is practical for FP to achieve the work they need to do. In my opinion the avoidance/remedy/mitigation requirements for each activity are more important than a bed disturbance length restriction.
- » **Page 4, Point 19:** The submitter requests a "precaution on instream work" from 1st April to 30th July (i.e., a four month period) to avoid migrating trout and spawning grounds. I was under the impression trout do not spawn in the section of the main stem of the Otaki River covered by this consent. It is not clear what a "precaution on instream work" actually entails. The fish migration advice of Ministry of Primary Industries (2015) indicates the upstream migration of adult brown trout occurs December to May, peaking March to May. In the absence of any information specific to the Otaki River, it would be sensible to avoid the March to May period for significant instream works.

### 2.2.3 KAPITI FLY FISHING CLUB

- » **Page 5, Point 18:** The submitter requests the disturbance of the river bed in the Otaki River should be restricted to 500 metres in any one year, with a maximum of 200 m of continuous disturbance. Refer to my response to this in Section 2.2.2 above (first bullet point).
- » **Page 5, Point 18:** The submitter requests a "precaution on instream work" from 1st April to 30th July to avoid migrating trout and spawning grounds. Refer to my response to this in Section 2.2.2 above (second bullet point).

### 2.2.4 NGA HAPU O OTAKI

- » **Page 7, Point 20:** The submitter states the actual effects of the activities have not been adequately assessed due to a lack of data from hyporheos habitats or macroinvertebrate data from pool and slow run habitat. My original review (James, 2015b) also noted the lack of any hyporheic information and this has not been rectified to date. FP activities involving the moving of riverbed gravels will disturb hyporheic habitat, hence it would be useful to have some idea of the fauna of such environments. It is true the

Cameron report does not include macroinvertebrate data from pools or slow run habitat in the Otaki River and it is possible some invertebrate taxa not observed at the two GWRC SOE sites could be present in such habitats. This however, is very unlikely to materially affect the conclusions of the AEE with respect to the effects on benthic macroinvertebrates.

- » **Page 7, Point 21:** The submitter quotes a section of the Cameron report which itself relies on a Boffa Miskell fish survey in the lower Otaki River from 2001 and uses this to support their assertion that FP activities in the river “has undoubtedly negatively impacted on fish populations”. In my view this Boffa Miskell study, which only deployed a small number of traps in large river, cannot be used to infer anything about the abundance of fish in the lower Otaki River. I agree with Cameron that there is very limited fish data for the section of the Otaki River covered by the FP consent application and as stated in my previous review (James, 2016) this will need to be rectified by the fish survey requirement of the EMP. Therefore based on such limited information it is difficult to determine if FP activities in the river have negatively impacted fish populations, although the morphology of the lower river will certainly have been altered by decades of river control works and this may well have reduced habitat variability.
- » **Page 8, Point 22:** The submitter states they are aware of recent pre and post works monitoring by Te Āti Awa of gravel extraction and channel widening works by GWRC in the Waikanae River, which demonstrated a significant adverse effect on relative abundances of freshwater fish including inanga and common bully. I have not seen the methodology used or results of this monitoring so are unable to comment on this.

### 3 WAIKANAЕ RIVER

The Waikanae River assessment of effects (AEE) has been reviewed twice in the past (James, 2015c; James, 2016). Thus here I limit my comments to considering those matters previously raised in the second review (James, 2016) where these have not been satisfactorily rectified and any relevant comments relating to ecology made by submitters.

#### 3.1 MATTERS RAISED IN PREVIOUS REVIEWS

- » **Estuary information:** My queries from the previous review on the validity of 20+ year old vegetation data and presence of rare or endangered plant species in the application area have not been addressed.
- » **Recreational and commercial fishery:** Several factors may influence fish populations including recreational and commercial fisheries, hence it would be relevant to take these into account when interpreting the results of any fish monitoring undertaken as part of the EMP. Of the fish species present, eels (both longfin and shortfin) are commercially fished under the Quota Management System, while brown trout are caught recreationally under the management of Fish & Game. My previous review indicated more information on recreational and commercial fishing in the application area should be provided and suggested, “The future analysis of fish data as part of the EMP include some coverage of commercial and recreational fishing data from the application area.” There is no indication anywhere that this will be taken into account in the analysis of baseline monitoring data. I acknowledge obtaining any detailed information may be difficult but it would still be worthwhile knowing whether commercial eeling is occurring in the area (Ministry for Primary Industries (MPI) should have records) and the fishing pressure on trout (Fish & Game should have some estimates). It is probably impossible to determine the recreational eeling take, as this is undocumented as far as I know.

#### 3.2 SUBMITTER COMMENTS

##### 3.2.1 DEPARTMENT OF CONSERVATION

- » **Page 6–7, Points 15–19:** The submitter has concerns about the effects of river mouth opening and gravel extraction on the Waikanae River Scientific Reserve and Kapiti Marine Reserve, which they manage and consider these effects have not been adequately assessed by the applications. I understand that at the time of writing an assessment on the effects of gravel extraction on coastal processes had been requested.

##### 3.2.2 WELLINGTON FISH AND GAME COUNCIL

- » **Page 4, Point 19:** Request the disturbance of the river bed in the Waikanae River should be restricted to 250 metres in any one year with a maximum of 100 m of continuous disturbance. I can’t comment on whether this is practical for FP to achieve the work they need to do. In my opinion the avoidance/remedy/mitigation requirements for each activity are more important than a bed disturbance length restriction.
- » **Page 4, Point 19:** Request a “precaution on instream work” from 1st April to 30th September (i.e., six months) to avoid migrating trout and spawning grounds. It is not clear what a “precaution on instream work” actually entails. The COP appears to be missing

a “general activity constraints calendar” for the Waikanae River, which I assume is an error since there are two identical tables for the Hutt River. Given trout do spawn in the Waikanae River in the section covered by the application I assume this table would list the key sensitivity period for trout spawning in the Wainuiomata River as 1 May – 31 July as they have for the Wainuiomata River and Hutt River (Akatarawa River). The Ministry of Primary Industries (2015) indicates a brown trout spawning period of March to July with a May to June peak but with larvae/fry present until the end of October. In the absence any spawning information specific to the Waikanae River it would be sensible to avoid significant instream works from March to at least the end of August to allow for alevins hatched during the peak spawning period to become free swimming. Given actual trout spawning takes place in the section of the Waikanae River covered by the application and trout spawning would be relatively easy to observe given the size and high water clarity in that river (actual spawning behaviour as well as redds) then there is a potential any works in the wetted channel could require a pre-works check for spawning trout and redds (just as works on dry beaches/gravel shoals requires checks over the river bird nesting period), which is an item that could be added to the COP for the relevant activities. There is no reason this could not be required over the period requested by F&G, at least initially and the period updated as more information of actual spawning times in the Waikanae River is gathered. Such checks would need to be done by appropriately qualified persons experienced in recognising trout redds. If spawning activity is observed then there would need to be a further stand-down period of at least eight weeks following the end of the spawning to allow for the eggs to hatch and the alevins to emerge from the gravels.

### 3.2.3 KAPITI FLY FISHING CLUB

- » **Page 5, Point 18:** Request the disturbance of the river bed in the Waikanae River should be restricted to 250 metres in any one year with a maximum of 100 m of continuous disturbance. Refer to my response to this in Section 3.2.2 above (first bullet point).
- » **Page 5, Point 18:** Request a “precaution on instream work” from 1st April to 30th September to avoid migrating trout and spawning grounds. Refer to my response to this in Section 3.2.2 above (second bullet point).

### 3.2.4 TE ATI AWA KI WHAKARONGOTAI

- » **Page 4, Point 14:** The submitter states they have recently undertaken pre and post works monitoring of gravel extraction and channel widening works by GWRC in the Waikanae River, which demonstrated a significant adverse effect on relative abundances of freshwater fish including inanga and common bully that appeared to be the result of disturbing large volumes of soil along the banks during these works. I have not seen the methodology used or results of this monitoring so are unable to comment on this.

## 4 WAINUIOMATA RIVER

The Wainuiomata River assessment of effects (AEE) has been reviewed twice in the past (James, 2015d; James, 2016). Thus here I limit my comments to considering those matters previously raised in the second review (James, 2016) where these have not been satisfactorily rectified and any relevant comments relating to ecology made by submitters.

### 4.1 MATTERS RAISED IN PREVIOUS REVIEWS

- » **Recreational and commercial fishery:** Several factors may influence fish populations including recreational and commercial fisheries, hence it would be relevant to take these into account when interpreting the results of any fish monitoring undertaken as part of the EMP. Of the fish species present, eels (both longfin and shortfin) are commercially fished under the Quota Management System, while brown trout are caught recreationally under the management of Fish & Game. My previous review indicated more information on recreational and commercial fishing in the application area should be provided and suggested, “The future analysis of fish data as part of the EMP include some coverage of commercial and recreational fishing data from the application area.” There is no indication anywhere that this will be taken into account in the analysis of baseline monitoring data. I acknowledge obtaining any detailed information may be difficult but it would still be worthwhile knowing whether commercial eeling is occurring in the area (Ministry for Primary Industries (MPI) should have records) and the fishing pressure on trout (Fish & Game should have some estimates). It is probably impossible to determine the recreational eeling take, as this is undocumented as far as I know.

### 4.2 SUBMITTER COMMENTS

#### 4.2.1 WELLINGTON FLYFISHERS CLUB

- » **Page 2, Point a:** The submitter requests the disturbance of the river bed in the Wainuiomata River should be restricted to 500 metres in any one year. I can’t comment on whether this is practical for FP to achieve the work they need to do. In my opinion the

avoidance/remedy/mitigation requirements for each activity are more important than a bed disturbance length restriction.

- » **Page 2, Point b:** The submitter requests avoidance of instream works in the Wainuiomata River between 1st April and 30 September (i.e., six months) to allow for trout spawning. Table 15 of the COP indicates the key sensitivity period for trout spawning in the Wainuiomata River is 1 May – 31 July. My comments in Section 3.2.2 above (first bullet point) also apply to the Wainuiomata River.

#### 4.2.2 WELLINGTON FISH AND GAME COUNCIL

- » **Page 4, Point 19:** Request the disturbance of the river bed (wet channel) in the Wainuiomata River should be restricted to 500 metres in any one year. My comments in Section 3.2.2 above (first bullet point) also apply to the Wainuiomata River.
- » **Page 4, Point 19:** Request a “precaution on instream work” from 1st April to 30th September to avoid migrating trout and spawning grounds. Table 15 of the COP indicates the key sensitivity period for trout spawning in the Wainuiomata River is 1 May – 31 July. My comments in Section 3.2.2 above (second bullet point) also apply to the Wainuiomata River.

## 5 CODE OF PRACTICE (COP)

### 5.1 MATTERS RAISED IN PREVIOUS REVIEWS

In early 2015 I reviewed an early draft version of the COP (James, 2015e). Thus here I revisit those review matters as necessary, as well as any relevant comments relating to ecology made by submitters.

- » **Page 16, Section 3.3, Site Specific Effect Management:** The “Event Monitoring” of the earlier COP has been significantly revised to now include a five step process to determine when site specific effects monitoring is required via a matrix of magnitude of disturbance and sensitivity of the work site. My original review concerns regarding determining the magnitude of disturbance using riverbed length and days of river works still stand. Additionally, there is now a habitat sensitivity-ranking scheme that has a series of states that determine relative sensitivity (most, intermediate, least). This scheme is missing several states that I believe are important in assigning habitat sensitivity to disturbance and I recommend the Applicant consult EIANZ (2015) for further guidance:
  - » Only inanga and trout spawning habitat is mentioned. What about spawning habitat of other species, particularly native or endemic fish such as bluegill bully and torrentfish which both have an “at risk – declining” threat classification?
  - » What about the likely presence of at risk or threatened species (e.g., longfin eel, bluegill bully, lamprey, kakahi, etc.)?
  - » With many FP activities there are downstream effects (e.g., fine sediment deposition), which are not accounted for.

It would also be useful if the Applicant could provide some scenarios from say the last five years of river works in the water bodies covered by the consent applications to show how this proposed scheme would have rolled out in practice.

- » **Page 41, Section 7.3.5, Operation & maintenance of machinery:** My original review suggested the requirement of having an appropriate spill kit on site. While the COP includes what must be done in response to a spill, it does not specifically include the requirement for a spill kit to be on site. Additionally, do GWRC FP’s wash bays drain to stormwater or wastewater? If stormwater then any contaminants washed off machinery will ultimately discharge to a water body. I would suggest all wash bays either drain to wastewater or runoff is adequately treated prior to discharge to water bodies.
- » **Page 46, Section 7.3.8, Formation of access from the banks to the riverbed:** I support the action point “avoid vegetation clearance adjacent to Key Native Ecosystems (as identified by GW’s KNE programme)”, but suggest this should be expanded to cover ecologically significant vegetation as identified in District Plans and by DOC.
- » **Page 51-52, Section 7.3.11, Maintenance and protection of ecological values:** suggestions from my earlier review regarding the use of ambiguous language (e.g., “consider”, “should”, and “where practicable”) have not been taken up, nor has the suggestion to add two more actions: “The protection of any identified significant growths of native macrophytes (aquatic plants)” and “The rescue of any fish, koura (freshwater crayfish), or kakahi (freshwater mussel) stranded or removed from a watercourse by flood protection activities”
- » **Page 53, Section 7.3.12, Consideration of opportunities for environmental enhancement:** The comments from my original review regarding this good practice item giving no clear, definitive direction or certainty around implementing environmental enhancement still stand. The reliance on the person responsible for supervising on-site works to identify such opportunities is a key weakness as expert ecological knowledge is required for this task.
- » **Page 76, Section 7.4.3, Rock lining:** I previously suggested the inanga spawning area restriction should be expanded beyond the

identified spawning areas to cover the whole zone of potential spawning habitat. The COP has not been changed to reflect this.

- » **Page 96, Section 7.4.12 Channel shaping: Channel Diversion Cut:** The additional adverse effect and mitigation action regarding stranding and relocation of fish and megainvertebrates suggested in my previous review are not reflected in the current COP.
- » **Page 100–101, Section 7.4.14 Channel shaping: Bed recontouring:** The additional mitigation action regarding stranding and relocation of fish and megainvertebrates suggested in my previous review are not reflected in the current COP.
- » **Page 106, Section 7.4.17 Channel maintenance: Removal of flood debris:** There is no evidence of my review suggestions being considered in the current COP.
- » **Page 116-117, Section 7.4.20 Channel maintenance: Mechanical clearing of minor watercourses:** There is no evidence of my review suggestions being considered in the current COP.
- » **Page 118, Section 7.4.21 Channel maintenance: Mechanical clearing – Opahu Stream (Hutt River):** There is no evidence of my review suggestions being considered in the current COP.
- » **Page 120, Section 7.4.22 Channel maintenance: Mechanical clearing – Chrystalls Lagoon (Otaki River):** There is no evidence of my review suggestions being considered in the current COP.
- » **Page 138–139, Section 7.4.31 River mouth cutting:** There is no evidence of my review suggestions being considered in the current COP.

## 5.2 SUBMITTER COMMENTS

### 5.2.1 DEPARTMENT OF CONSERVATION

- » **Page 6, Point 12:** The submitter states the Applicant should consider amending the COP and Operational Management Plan to meet the requirements of the restoration management planning requirements of the pNRP. I agree with this as appropriate remedy and mitigation (i.e. restoration) should be incorporated into each COP activity.

### 5.2.2 HUTT VALLEY ANGLING CLUB INC.

- » **Page 2:** The submitter indicates the Macroinvertebrate Community Index (MCI) and hyporheic zone should be added as parameters in Table 6 of the COP, with detailed baseline monitoring triggers and responses. MCI was developed to assess the impacts of organic pollution on streams and rivers and is unlikely to be sensitive to the sporadic and localised activities of FP on a catchment scale. Hence I do not support MCI as a parameter for measuring the impacts of FP activities. FP activities involving the moving of riverbed gravels will disturb hyporheic habitat. Given the lack of any hyporheic data from any of the rivers subject to these applications it would be sensible to include hyporheic invertebrate sampling as part of the baseline monitoring and undertake some event specific monitoring over at least the first five years of the consents to gain an appreciation of the impacts on hyporheic invertebrates.
- » **Page 2 & 3:** The submitter would like a statement of effects specifically relating to the hyporheic zone added to Section 7.3.11 (pg. 51) and various other sections of the COP (7.4.10, 7.4.11, 7.4.13, 7.4.14, 7.4.15, 7.4.18, 7.4.19). I agree this should be acknowledged and added to the COP.
- » **Page 2:** The submitter would like an additional action added to Section 7.3.12 of the COP (pg. 53) relating to the creation of additional instream structures to benefit invertebrates and fish. I agree the installation of structures such as logs and boulders should be one of the mitigation requirements of certain FP activities included in the COP (e.g., bed recontouring, channel diversion).

## 5.3 OTHER COMMENTS

- » **Page 16, Section 3.3, Site Specific Effect Management:** I would suggest this site specific effect management could be replaced by a toolbox of remediation or migratory actions integrated into the COP with activity-specific actions that can be tailored to each site and situation (e.g., native riparian planting where native vegetation is disturbed, habitat improvements (installation of woody debris in the channel, reinstatement of mesohabitats in same proportion to those disturbed), etc.). This would ensure appropriate avoidance/remedy/mitigation would occur at the actual sites of adverse effect and in a timely manner.
- » **Page 21–24, Section 3.4.1, Baseline monitoring triggers and responses:** Table 6 outlines a trigger and response for each parameter subject to baseline monitoring in the Environmental Monitoring Plan (EMP). For several of these, a ‘statistical significance’ is required for the “trigger”. It is important to note that Type 1 (false positive) and Type II (false negative) errors in statistical analysis are greatly influenced by sample size, and that statistical significance does not always mean ecological significance and vice versa. I provide comments below on some of the individual parameters:

- » Riverbank undercutting & overhanging vegetation: The trigger is “A statistically significant decline in the length of undercut banks or overhanging vegetation in any management reach.” Wouldn't any changes to this as a result of FP activities be recorded/measured on a site-specific basis and any adverse effects theoretically mitigated via the COP? If no activities have occurred in the management reach then why would any great change in this be expected other than flood-induced changes?
- » Trout abundance: The trigger is “A statistically significant decline in trout abundance, based on a comprehensive analysis of the long term (20 year) data record for brown trout.” How many years of downward trend would be required to indicate a significant decline?
- » Riparian vegetation: The trigger is “A statistically significant change in the ‘high value areas’ defined by survey & mapping.” Wouldn't any changes to this as a result of FP activities recorded/measured on a site-specific basis and any adverse effects theoretically mitigated via the COP?
- » Native fish communities: The trigger is “Any recorded decline in the number of indigenous fish species present in a river management reach or stream system detected between one 3-yearly survey and the next.” Any such “declines” in species richness could easily be to do with the vagaries of sampling in either catching or missing relatively uncommon or hard to catch species. Additionally, if a survey were to happen to catch some species migrating to the upper catchment in one survey but not the next then this would needlessly be triggered. I would have thought fish densities, catch per unit effort, and fish community compositional changes would be better parameters to look at.
- » Inanga spawning habitat: The trigger is “A statistically significant reduction in inanga spawning habitat.” Wouldn't any such reductions to this as a result of FP activities be known and any adverse effects theoretically mitigated via the COP? Additionally, the condition or quality of inanga spawning habitat can vary greatly in time and space so I would suggest any trigger incorporates habitat condition rather than solely habitat area as the proposed trigger would suggest.
- » **Page 41, Section 7.3.5:** there is a broken link to Waikato Regional Council document.
- » **Page 59-60, Table 11 & 12:** Table 12 appears to be a duplicate of Table 11. Additionally, there is no specific table for the Waikanae River.

## 6 ENVIRONMENTAL MONITORING PLAN (EMP)

### 6.1 MATTERS RAISED IN PREVIOUS REVIEWS

In early 2015 I reviewed an early version of the EMP (James, 2015e). Thus here I revisit those review matters as necessary, as well as any relevant comments relating to ecology made by submitters.

- » **Page 8, Section 2.3.1, Deposited Sediment:** As suggested in my original review the “SAM-5 – Resuspendable sediment (shuffle index)” has been added to the deposited sediment methodology. However the “SAM-2 – In-stream visual estimate of % sediment cover” appears to have been dropped. I would highly recommend adding this widely used method back into the proposed deposited sediment-monitoring programme.
- » **Page 8, Section 2.3.3, Trout Abundance:** My original review comments still stand and do not appear to have been addressed.
- » **Page 9–11, Section 2.3.4, Native Fish Communities:** My original review comments regarding the point of monitoring fish in perennial low gradient streams subject to mechanical weed removal still stand.
- » **Page 11, Section 2.3.1, Riparian Vegetation:** My original review comments still stand and do not appear to have been addressed.
- » **Page 12, Section 2.3.4, Pool and Riffle Counts:** My original review comments still stand and do not appear to have been addressed.
- » **Page 12, Section 2.3.6, Inanga Spawning Habitat:** My original review comments regarding identification of likely inanga spawning habitats that have been historically lost through flood protection modifications to riverbanks do not appear to have been addressed.
- » **Page 13, Section 2.3.7, Natural Character Index:** My original review noted my concerns about including NCI in the monitoring programme. The current EMP mentions “GWRC is considering the application of a refinement of this method on management reaches. . . ., as part of it baseline monitoring programme”. It is difficult to comment on this without knowing what this refined method is.



## 6.2 SUBMITTER COMMENTS

### 6.2.1 HUTT VALLEY ANGLING CLUB INC

- » **Page 3:** The submitter indicates the Macroinvertebrate Community Index (MCI) and hyporheic zone should be added as baseline monitoring parameters in Table 2.2 of the EMP. Refer to my comments in Section 5.2.2 above (first bullet point) which also apply here.
- » **Page 3:** The submitter wishes to add the mapping of the hyporheic zone to the habitat mapping proposed in Section 3 of the EMP. The mapping of the extent of the hyporheic zone is no simple matter would involve an array of shallow boreholes and a great deal of effort to obtain anything approaching an accurate representation of the hyporheic zone. In my opinion monitoring of hyporheic invertebrates as described above in Section 5.2.2 would suffice.

### 6.3 OTHER COMMENTS

- » Sub heading numbering issue with numbering restarting after 2.3.4.
- » I like the programme development outlined in Section 2.1, however the Wainuiomata River has been left of the list of baseline monitoring sites.
- » **Page 9–11, Section 2.3.4, Native Fish Communities:** There does not seem to be any fish monitoring sites in the Wainuiomata River.
- » I am encouraged to see the inclusion of reference sites in the baseline-monitoring programme.
- » **Page 11, Section 2.3.1, Riparian Vegetation:** The described riparian vegetation monitoring involves aerial photography with random ground-truthing to confirm interpretation. This is acceptable for broad scale monitoring but I would question its ability to protect native vegetation for the following reasons:
  - » Does this have sufficient resolution to detect small native remnants, those species growing under taller/larger vegetation, or rare or threatened native/endemic plants?
  - » Does it enable identification and protection of ecologically significant vegetation?
  - » What is this monitoring hoping to show over time?

An alternative would be for an appropriately qualified ecologist to walk the riparian areas, map vegetation, and identify any ecologically significant species or areas. The aerial photography would still be useful to examine on a longer time scale to measure gross changes in vegetation cover.

- » **Page 12, Section 2.3.6, Inanga Spawning Habitat:** It is proposed an inanga spawning habitat assessment be conducted at least once every 15 years. With a 15-year period, such surveys would only occur twice over the duration of a 35-year resource consent. I would suggest they are done annually, at least in the first 5–10 years of the consent.
- » The baseline monitoring parameters do not include any macroinvertebrate monitoring despite these widely being used to assess the health of streams and rivers and effects of various activities. While the overriding determinant of macroinvertebrate community composition and abundance in the Hutt, Wainuiomata, Waikanae, and Otaki Rivers is flood disturbance, which may make identifying the effects of FP activities difficult, the inclusion of reference sites will provide the ability to attempt to separate the effects of FP activities. Given native fish and trout are included in the proposed monitoring programme then why are macroinvertebrates not?

## 7 GWRC ENVIRONMENTAL REGULATION KEY ISSUES

### 7.1 USE OF HUTT RIVER MONITORING DATA TO INFORM ASSESSMENT OF WAIKANAЕ AND OTAKI RIVERS

*"Is this use of monitoring data appropriate?"*

Data from wetted bed disturbance trials (i.e., truck crossing, gravel extraction) in the Hutt River has been included in the AEE's for the Waikanae and Otaki Rivers. Given these rivers drain catchments of the same greywacke dominated geology, have upper catchments where significant native vegetation remains, and are subjected to relatively frequent high flow events then it would be expected they would also have similar general sediment characteristics. Hence disturbance of the beds would be expected to have similar fine sediment mobilisation effects in the Otaki, Waikanae, and Hutt Rivers. However the actual values reported for the Hutt River cannot be applied to the other rivers as factors such as channel morphology (e.g. width, depth) and flow dynamics will greatly affect suspended sediment concentrations and turbidity at any sampling locations downstream of the activity, such that results are specific to that

particular site and time.

## 7.2 SITE SPECIFIC EFFECTS MANAGEMENT

*"Are the responses in Table 5 appropriate for the risk of adverse effect?"*

Other than following the methods outlined in the COP, the management responses outlined in Table 5 of the COP are habitat assessments and preparation of site specific management plans. While the table does not include any specific mitigation requirement, I note the scope of the SSEMP (Section 3.3.2 of COP) mentions "any special requirements for habitat protection or restoration" must be covered. Hence any site-specific mitigation would be outlined here presumably. However, the recognition of adverse effect and selecting appropriate mitigation will require specialist input.

*"Please review the Habitat Assessment outlined in Appendix A of the EMP. Are the parameters outlined in Appendix A appropriate?"*

I can see several issues with the Habitat Assessment provided in Appendix A of the EMP:

1. It does not appear to have been designed with consideration of the practicality of collecting data in the field. For example there are fields for average wetted and dry channel widths. Averages are not measured in the field, as they are calculated later from multiple measurements made in the field. Hence the assessment sheet needs to have cells for recording X number of width measurements rather than just a space for a single average. It is also important to record the actual measurements so that one can ascertain 1) the number of measurements used to determine the average, and 2) the variation in the measurements.
2. Some parameters could be improved and others added. The site length is just "approximate". I would have thought an accurate measurement of the length of the worksite is required. The assessment measures the lengths of flow environments (i.e., riffles, rapid, pools, deep and shallow runs). I would have thought the area of such habitats would be more accurate when determining the impacts of works on aquatic habitat. I would also recommend quantifying the area of any backwater habitat rather than the "yes – no" assessment currently included.
3. Why is there no biological information included in the assessments? For example a list of fish species likely to be present would be worthwhile. Where actual fish survey data is lacking, the Freshwater Environments of New Zealand (FENZ) geodatabase could be used to determine the modelled probabilities of encountering various fish species.
4. What are the potential health and safety issues around safely measuring the parameters in large rivers?

*"Advice is to be sought from a suitably trained or qualified ecologist to help inform any SSEMP, is this appropriate?"*

Rather than just seeking their advice I suggest such an ecologist is a key author of any SSEMP.

*"Is it appropriate to only have an ecologist involved in any monitoring required by the SSEMP?"*

It will depend on what items are to be monitored as to what expertise is required. For example, there may be some instances where input from a geomorphologist may be advantageous. Additionally, different specialist fields within the broader 'ecology' field may be required (i.e., a botanist or terrestrial ecologist for activities involving disturbing terrestrial riparian areas).

*"Can SEV be adapted for use in these large rivers to inform any remediation or mitigation? An up-front agreement is better than monitoring over an uncertain timeframe to determine a "statistically significant decline" before considering ecological enhancement."*

SEV was originally designed for use in wadeable, low gradient streams in Auckland. It is now considered applicable for use in most stream and river types in other regions, including Wellington. Storey *et al.* (2011) provides guidance on the applicability of SEV in different stream types and states "We have not tested the performance of SEV in streams and rivers of fourth order or larger. Streams and rivers with highly mobile gravel or cobble beds and extensive gravel/cobble banks have important ecological functions relating to the export of that material and the interactions of the wetted channel with the gravel banks (Storey, 2011). SEV does not include these functions, therefore is incomplete for assessing rivers of this type." The Hutt, Otaki, Waikanae, and Wainuiomata Rivers are all greater than fourth order and have mobile gravel or cobble beds with extensive gravel/cobble banks, and as such the SEV would not be suitable. However, some of the minor tributary waterways that are part of some of the applications would likely be suitable for SEV. In Table 1 of Storey *et al.* (2011) it further states for fourth-order and larger rivers "SEV performance not tested, but could be used if suitable reference data is collected" and that for rivers with mobile gravel beds and extensive gravel banks "Functions concerning gravel export and interaction of rivers with gravel banks are not captured by SEV. SEV can be used provided the absence of these

functions is acknowledged". Hence SEV in its current form would not be an optimal method of informing remediation or mitigation in the main rivers. Modification to include gravel export and gravel bank functions could make it a viable method.

With regards to concerns about "statistically significant declines" being required before considering ecological enhancement, it is important to note that Type I and Type II errors in statistical analysis are greatly influenced by sample size, and that statistical significance does not always mean ecological significance and vice versa. This leads further credence to your assertion that an up-front agreement on any remediation or mitigation is preferable to monitoring over an uncertain timeframe to determine a "statistically significant decline" before considering ecological remediation. For those activities with a high potential for adverse effect, could not a toolbox of remediation or migratory actions be developed and built into the COP with activity-specific actions that can be tailored to each site (e.g., native riparian planting where riparian vegetation is disturbed, installation of woody debris in the channel, reinstatement of mesohabitats in same proportion to those disturbed)?

### 7.3 NO REQUIREMENT FOR ENVIRONMENTAL ENHANCEMENT OR RESTORATION, PARTICULARLY WITH REGARD TO HIGH RISK ADVERSE EFFECTS (CODE OF PRACTICE, SSEMP, EMP)

*"Given that SEV is not appropriate for rivers of this size, what would be appropriate mitigation or restoration and what is the best way to quantify the amount undertaken and ensure that this is done in a timely manner."*

Given the activities to be covered by the consent are so broad, then in my view the only way to do this is to consider each activity and its effects on its own and formulate a toolbox of mitigation or restoration measures that needs to be built into the COP entry for that activity. For some activities mitigation measures are already in the COP (e.g., returning fish to channel following mechanical macrophyte clearance). The first step in such a process would be to agree to a list of adverse effects and their severity for each activity. From there, activity-specific mitigation methodologies for inclusion in the COP could be developed. Ideally mitigation measures would be incorporated into the activity itself for maximum efficiency and to ensure it is undertaken in a timely manner with respect to that specific activity at that site. For example a hypothetical COP rule for bed recontouring where the wetted channel is being moved away from the vegetated bank edge could be "for every X m of bank edge habitat lost, a log or boulder line/groyne needs to be installed in the new channel to compensate for the loss of habitat and cover resulting from moving the river away from the bank edge."

## 8 GENERAL SUBMITTER COMMENTS

### 8.1 DEPARTMENT OF CONSERVATION

- » **Page 4, Point 3:** The submitter notes that the applications are uncertain about the fate of grey and crack willows. While it is my understanding that GWRC FP utilise relatively non-invasive willow cultivars I agree with the submitter that it would be good for the Applicant to provide certainty about how they deal with pest plants in the riparian areas they manage.
- » **Page 4, Points 4 & 5:** The submitter opposes the more intrusive activities in the application (recontouring of channels, beach and bars of the active river bed and extraction of gravel from within the active river bed) as:
  1. The proposed activities are contrary to the objectives and policies relating to significant values contained in the Greater Wellington Regional Policy Statement (GWRPS) and the proposed Natural Resources Plan (pNRP).
  2. The actual and potential effects of the proposed activities on the significant values have not been adequately assessed in the AEE.
  3. The COP contained in the application is inconsistent with the policy framework outlined in the pNRP.
  4. The application documents do not have regard to the National Policy Statement for Freshwater Management 2014.

Points 1, 3, and 4 above are largely planning issues hence outside the scope of my review, however I do note the revised Cameron AEE's do not explicitly address the pNRP. As to Point 2 above, the AEE's do in my opinion indirectly address effects on the "high macroinvertebrate community health", "habitat for indigenous threatened/at risk fish species", and "inanga spawning habitat" pNRP significant values.
- » **Page 4–5, Points 6 & 7:** The submitter states the applications do not address the GWRPS nor the pNRP, specifically around the area of avoidance of significant indigenous ecosystems and the requirement of restoration management plans. Consideration of these is a planning issue given the pNRP is not currently the active plan and outside the scope of my review, however I do note pNRP "Schedule F: Ecosystems and habitats with significant indigenous biodiversity values" is the most up to date information on ecological significance in the region, so should at least be considered in the application. It has also been brought to my attention that such values from the pNRP should be at least considered as an "other matter" under s104 of the RMA.

» **Page 5, Point 8:** The submitter states the Applicant fails to consider options to avoid these ecosystems. This is a planning issue so outside the scope of this review, however I was under the impression this would have been a consideration during community consultation during the Flood Management Plan process in each of the catchments.

» **Page 5 & 6, Point 10:** The submitter states the Applicant has provided limited information on effects of gravel extraction from the wetted riverbeds that have significant indigenous biodiversity values. It is true the Cameron AEE's do not specifically address wet gravel extraction on riverbeds with significant indigenous biodiversity values as identified in the pNRP.

## 8.2 TARANAKI WHANUI KI TE UPOKO O TE IKA – PORT NICHOLSON BLOCK SETTLEMENT TRUST

» This submission does not include any comments relevant to ecological matters.

## 8.3 NGATI TOA RANGATIRA

» **Page 4, Point 13:** The submitter states, "The majority of proposed activities will in some way have an adverse effects on the native fish populations." There is no doubt any in river works involving the disturbance of bed gravels will have some adverse effects on the biota of affected areas.

## 8.4 WELLINGTON FISH AND GAME COUNCIL

» **Page 2, Point 10:** The submitter has some concern GWRC only value trout for their recreational characteristics. Brown trout were only introduced to New Zealand due to being a highly desirable fish to catch in parts of Europe; hence it is reasonable they are valued predominantly for their recreational characteristics. They cannot be used as an indicator for the health of the overall river (as the submitter suggests), as based on the paradigm that ecosystems with a greater proportion of native/endemic species are of higher value than those dominated by exotic/introduced species (which is the current basis for the majority of methodologies to infer ecological value of habitats), the presence of brown trout in these waterways is symptomatic of a decline in "health" of the overall river. Their presence is arguably another example of the great modifications to many rivers following European settlement of New Zealand (just as stop banks, willows, and gravel extraction are). Notwithstanding this, I acknowledge the protection of trout and their habitats is enshrined in the RMA and their societal value is shown by GWRC's identification of trout fishery and spawning waters in Appendix 4 of the Regional Freshwater Plan and Schedule I of the pNRP.

## 8.5 MICHAEL TRACEY

» This submission does not include any comments relevant to ecological matters.

## 8.6 DR STEPHEN LANG

» This submission does not include any comments relevant to ecological matters.

## 8.7 KAPITI FLY FISHING CLUB

» Page 2, Point 9: The submitter has some concern GWRC only value trout for their recreational characteristics. Refer to my response to this in Section 8.4 above.

## 8.8 CALEB ROYAL

» This submission does not include any comments relevant to ecological matters.

## 9 REFERENCES

EIANZ 2015. Ecological Impact Assessment (Ecia) - EIANZ Guidelines for Use in New Zealand: Terrestrial and Freshwater Ecosystems. Environment Institute of Australia and New Zealand, Melbourne, Australia. 100 p.

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James, A. 2015b. Review of ecological components of GWRC's flood protection operations and maintenance in the Otaki River consent application. EOS Job No. GRE01-14074. 8 p.

James, A. 2015c. Review of ecological components of GWRC's flood protection operations and maintenance in the Waikanae River consent application. EOS Job No. GRE01-14074. 8 p.

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- James, A. 2015e. Review of Alton Perrie's memoranda and the Code of Practice and Environmental Management Plan components of GWRC's flood protection operations and maintenance activities consent applications for the Hutt, Otaki, Waikanae, and Wainuiomata Rivers. EOS Job No. GRE01-14074. 18 p.
- James, A. 2016. Assessment of revised Cameron aquatic and riparian ecology reports prepared for GWRC's flood protection operations and maintenance in the Hutt, Wainuiomata, Otaki, and Waikanae River consent applications. EOS Job No. GRE01-14074. 11 p.
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- Storey, R. 2011. *Suitability of the Stream Ecological Valuation (SEV) Method for Assessing Stream Values in Southland*. NIWA Client Report HAM2011-025.
- Storey, R.G., Neale, M.W., Rowe, D.K., Collier, K.J., Hatton, C., Joy, M.K., Maxted, J. R., Moore, S., Parkyn, S.M., Phillips, N. and Quinn, J.M. 2011. *Stream Ecological Valuation (SEV): A Method for Assessing the Ecological Function of Auckland Streams*. Auckland Council Technical Report 2011/009.

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