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Kirsty van Reenen
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[Internal]

Dear Kirsty

Response to further information request under section 92(1) of the Resource Management Act 1991

1. Introduction

At a meeting dated Wednesday 1 November 2017 (2.00pm – 3.45pm) GWRC, Flood Protection agreed to provide specified items of information in relation to the Western River Resource consent applications, as detailed in the minutes prepared by you. The following response follows the section numbering used in the meeting minutes.

2.1 Hutt River

(a) **Request:** NRWQN and GWRC SOE data. It was agreed that providing this information would not add value to the assessment of environmental effects.

Response: No further information required.

(b) **Request:** Information on Bluegill bully.

Response: The Bluegill bully is part of the core fish community of the Hutt River and is abundant in the reaches managed by GWRC FP (Cameron, 2016). A study conducted in 2009 by Atkinson & Joy (2009) focused on longitudinal size distributions of bluegill bullies in the Hutt River. The results of that study are referenced in the consent documentation and are not repeated here. A more recent investigation focusing on the spawning and early life history of the bluegill bully was reported by Jarvis *et al* (2017), but was not available at the time the consent application was lodged. Prior to that study there was very little information on the early life stages of the bluegill bully (or

New Zealands other Gobiomorphus eleotrids). Newly hatched larvae are known to drift downstream immediatey following sunset during November and December, but little else is known about the larval ecology and behaviours of the species.

Jarvis *et al* (2017) conducted bluegill bully nest searches during the austral summer at four sites on the Waianakarua River, on the eastern South Island, north of Dunedin. The Waianakarua, which is a known population stronghold for bluegill bully, is a relatively short river (c. 33km) which drains a catchment of c. 260 km^2. By comparison the Hutt River has a length of c. 55km length and a catchment area of 655 km^2.

The study results showed that bluegill bully spawning sites were predominantly located in the lower reaches of the stream (<2-5km stream distance from the sea) on the undersides of flat, unimbedded cobbles lying in shallow broken water. Male bluegill bullies were often seen holding position under the stones with nests on them. High densities of nests were found at sites located furthest downstream, where egg plaques were found on the underside of nearly every suitable cobble. The middle site had a lower number of the nests, and no nests were found at the site located furthest upstream. The authors concluded that while some reproduction does occur > 10 km inland, these fish contribute little to the overall reproductive output of the system.

The results suggest strong competition between males for preferred spawning sites. The authors observed that this seems intuitive for amphidromous fish, as sites located close to the sea would seem to have a clear advantage over those further upstream, maximising chances of the larvae reaching the pelagic environment before starvation due to retention in pools and eddies. However, these results are at odds with the finding of Atkinson and Joy (2009), who concluded based on longitudinal size distributions of bluegill bully on the Hutt and Raikaia rivers that bluegill bully continuously migrate upstream throughout their life. Such a strategy would seem at odds with the need to expedite larval transport to the marine environment, and may suggest a down stream migration undertaken by adults prior to spawning, as has been described in a number of other amphidromous species (Scrimgeour & Eldon, 1989).

The extent to which the Waianakarua River study results are transferrable to the Hutt River is not known and, given the importance of bluegill bully the fish community of the Hutt River, the applicant will propose consent conditions and a time frame for a one-off study on blue-gill spawning behaviour in the Hutt River. The wording of the condition for the study of bluegill bully has been drafted and is provided below:

"*The consent holder shall, within two years of the granting of this consent, undertake a one-off study of bluegill bully spawning habitat in the Hutt River, to provide information on the location and type of habitat utilised for spawning, and prepare a report on the findings of the study, to be provided to the Manager, Environmental Regulation, Greater Wellington Regional Council.*"

(c) **Request:** Information on the commercial and recreational fishing.

Response: Commercial longfin eel fishing statistics obtained from the Ministry for Primary Industries MPI indicate that thirty five percent of all New Zealand longfin river habitat is commercially fished (Beentjes, Sykes, & Crow, 2016). Of the watercourses included in the Western Rivers consent applications, only the Waikanae and Otaki Rivers (and their tributaries) have been fished commercially, and in both cases fishing intensities are relatively low at less than once per year.

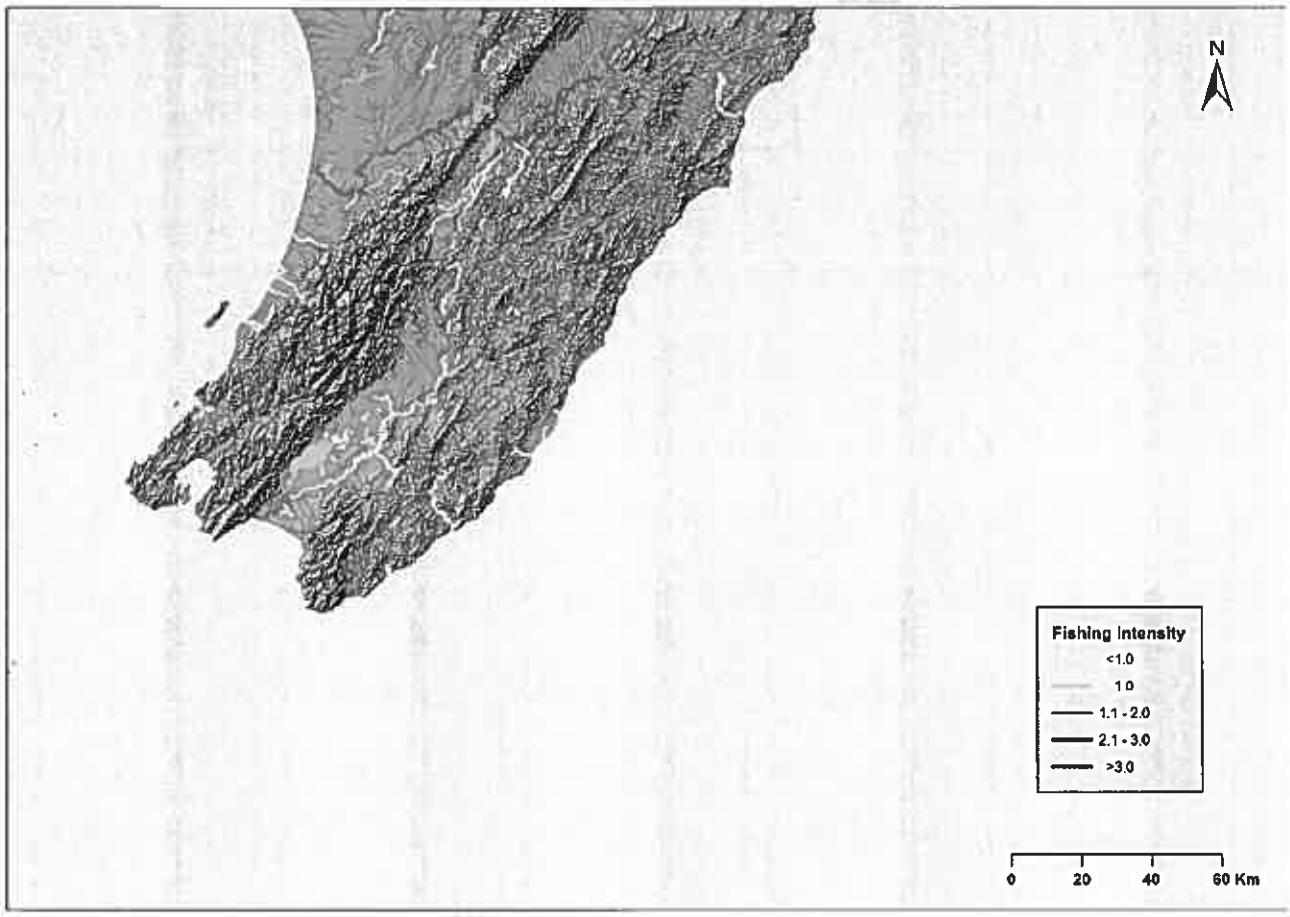

Figure 1: Lower North Island commercial fishing effort where longfin eels have been caught over the period 2009-10 to 2013-14 (from Beentjes, et al, 2016)

F&G **angler usage** of New Zealand river trout fisheries is described by Unwin (2016) based on results from the 2014/15 National Angling Survey. The Wainuiomata River had relatively light angling use of 210 ±80 angler days between October and March while the Hutt River was fished more intensively with 5,560 ± 710 angler days spread across the entire year (refer Table 1) The Waikanae and Otaki rivers had moderate usage with 920 ± 250 and 830 ± 160, respectively.

Within the lower North Island the only river to exceed the Hutt River angler usage was the Manawatu River with 9,200 ± 1100.

Table 1: Angler usage of river fisheries in the Wellington Region (from Unwin, 2016)

Wellington Region

		New Zealand resident whole-season, all part-season						Overseas	
Catchment	Angling water	Oct-Nov	Dec-Jan	Feb-Mar	Apr-May	Jun-Jul	Aug-Sep	Oct-Sep	Total
Pahaoa River	Wainuioru River		30 ± 30						30 ± 30
Ruamahanga River	Kourarau Dam		< 10						< 10
	Lake Onoke		10 ± 10						10 ± 10
	Ruamahanga R (above Mount Bruce)		20 ± 20		40 ± 40				60 ± 40
	Ruamahanga R (Mount Bruce - Masterton)	80 ± 40	110 ± 50	230 ± 160	210 ± 120				630 ± 210
	Ruamahanga R (Masterton - Martinborough)	240 ± 90	680 ± 170	820 ± 230	220 ± 130	190 ± 90	170 ± 150	130 ± 90	2,440 ± 380
	Ruamahanga R (below Martinborough)	70 ± 30	150 ± 60	< 10	200 ± 120	30 ± 30			460 ± 140
	Ruamahanga River (total)	390 ± 100	960 ± 190	1,060 ± 280	670 ± 210	220 ± 100	170 ± 150	130 ± 90	3,590 ± 460
	Lake Wairarapa	30 ± 20	160 ± 100	100 ± 90					280 ± 140
	Tauherenikau River	40 ± 30	30 ± 30	80 ± 60					150 ± 70
	Huangarua River	30 ± 20		20 ± 20					50 ± 30
	Waiohine River	180 ± 80	50 ± 30		80 ± 80				310 ± 110
	Tauweru River	10 ± 10							10 ± 10
	Waingawa River		20 ± 20	40 ± 30					60 ± 30
	Atiwhakatu Stream	10 ± 10	10 ± 10						20 ± 10
	Waipoua River		20 ± 20						20 ± 20
	Kopuaranga River		40 ± 40	40 ± 40					80 ± 60
Total, Ruamahanga catchment		690 ± 140	1,310 ± 230	1,340 ± 310	750 ± 230	220 ± 100	170 ± 150	130 ± 90	4,600 ± 500
Wainuiomata River	Wainuiomata River	90 ± 40	70 ± 40	60 ± 60					210 ± 80
Hutt River	Hutt River	1,140 ± 280	1,350 ± 280	920 ± 250	810 ± 210	850 ± 430	430 ± 250	60 ± 60	5,560 ± 710
	Whakatikei River		20 ± 20						20 ± 20
	Akatarawa River	30 ± 20	10 ± 10						40 ± 20

Table 1 (continued): Angler usage of River fisheries in the Wellington Region

		New Zealand resident whole-season, all part-season						Overseas	
Catchment	Angling water	Oct-Nov	Dec-Jan	Feb-Mar	Apr-May	Jun-Jul	Aug-Sep	Oct-Sep	Total
	Mangaroa River	10 ± 10							10 ± 10
	Pakuratahi River	200 ± 190							200 ± 190
Total, Hutt catchment		1,380 ± 340	1,390 ± 280	920 ± 250	810 ± 210	850 ± 430	430 ± 250	60 ± 60	5,840 ± 740
Porirua Stream	Porirua Stream							40 ± 40	40 ± 40
Pauatahanui Stream	Whitby Lakes		30 ± 30						30 ± 30
Wainui Stream	Wainui Stream		30 ± 20						30 ± 20
Waikanae River	Waikanae River	80 ± 40	320 ± 110	450 ± 210		60 ± 60			920 ± 250
	Maungakotukuku Stream			40 ± 40					40 ± 40
Otaki River	Otaki River	230 ± 100	160 ± 50	240 ± 100	90 ± 50	90 ± 50		20 ± 20	830 ± 160
	Waiotauru River			40 ± 40					40 ± 40

2.2 Otaki River

(d) **Request:** Updates of vegetation information for the Otaki River Estuary.

Response: A number of publications have recently updated the vegetation information for the Otaki River Estuary, and in particular the Key Native Ecosystem (KNE) Plan for Otaki Coast (GWRC, 2017). The Otaki KNE site (119ha) includes the lower reaches of the Otaki River and estuary, the Otaki river mouth lagoon, and the Katihiku and Rangiuru freshwater wetlands, parts of which lie within the application area.

The Otaki Coast KNE site is considered to be of regional importance. The Otaki River mouth and lagoon are described as a geological feature known as a hapua. Hapua are recognised as a distinct landform feature to differentiate them from more conventional river mouth estuaries. They are a type of river moth lagoon common on mixed sand and gravel coasts and is characterised by the absence of regular saltwater flushing with the tides. Instead the estuary is dominated by outward flowing freshwater.

The KNE identifies four At Risk plant species within the site. These are sea sedge (*Carex litorosa*), sand coprosma (*Coprosma acerosa*), sand pimelea (Primelea villosa) and kokihi (*Tetragonia tetragonoides*).

The KNE identifies six key wetland habitats located around the Otaki river mouth. These wetlands, known as 'Otaki river mouth lagoon and associated wetlands', 'Ngatoko wetland', Coastal turf (estuarine)', 'Backwater wetland', 'Eastern wetland' and 'Whakapawaewae wetland' shown in Figure 2. The following descriptions should be read in conjunction with the summary given in Section 3.2.3 of the Otaki River ecology report (Cameron, 2016).

The lagoon edges are dominated by freshwater wetland species such as wiwi (*Juncus edgariae*), lake club rush (*Schoenoplectus tabernaemontani*), raupo, *Isolepsis prolifera* and rautahi (*Carex geminata*). The wetland was fenced off to prevent stock access in 2013.

The Ngatoko wetland occupies the area beside Ngatoko Stream. It is dominated by raupo (*Tyha orientalis*) reedland, while the spring-fed stream (Ngatoko and Rangiuru) supports a suite of native aquatic plants such as *Chara* and *Nitella* species.

The Katihiku wetland area has three distinct freshwater wetland areas: Whakapawaewae wetlands, the backwater wetlands and the eastern wetlands. The Whakapawaewae wetlands are dominated by flax, toetoe (*Austroderia toetoe*) and cabbage trees (*Cordyline australis*). The low saturated eastern wetlands are dominated by flax, sedges and raupo. And the backwater wetlands are largely dominated by exotic woody species with some elements of regenerating coastal forest such as mahoe, karamu and the tree ferns mamaku and wheki.

The Otaki KNE identifies key threats to these areas as ecological weed species, pest animals, altered hydrology, and off road recreational driving. Weed species around the estuary and wetlands

are currently dominated by blackberry, gorse, Japanese honeysuckle, willow species, pampas grass and brush wattle. The gravel beaches are impacted by ecological weeds such as iceplant, gorse, spike rush and the non-local native tree karo.

Otaki KNE management activities include ecological weed control and revegetation which, over the last six years, has focused on the Otaki River Estuary. See Otaki Coast KNE (GWRC, 2017) for details.

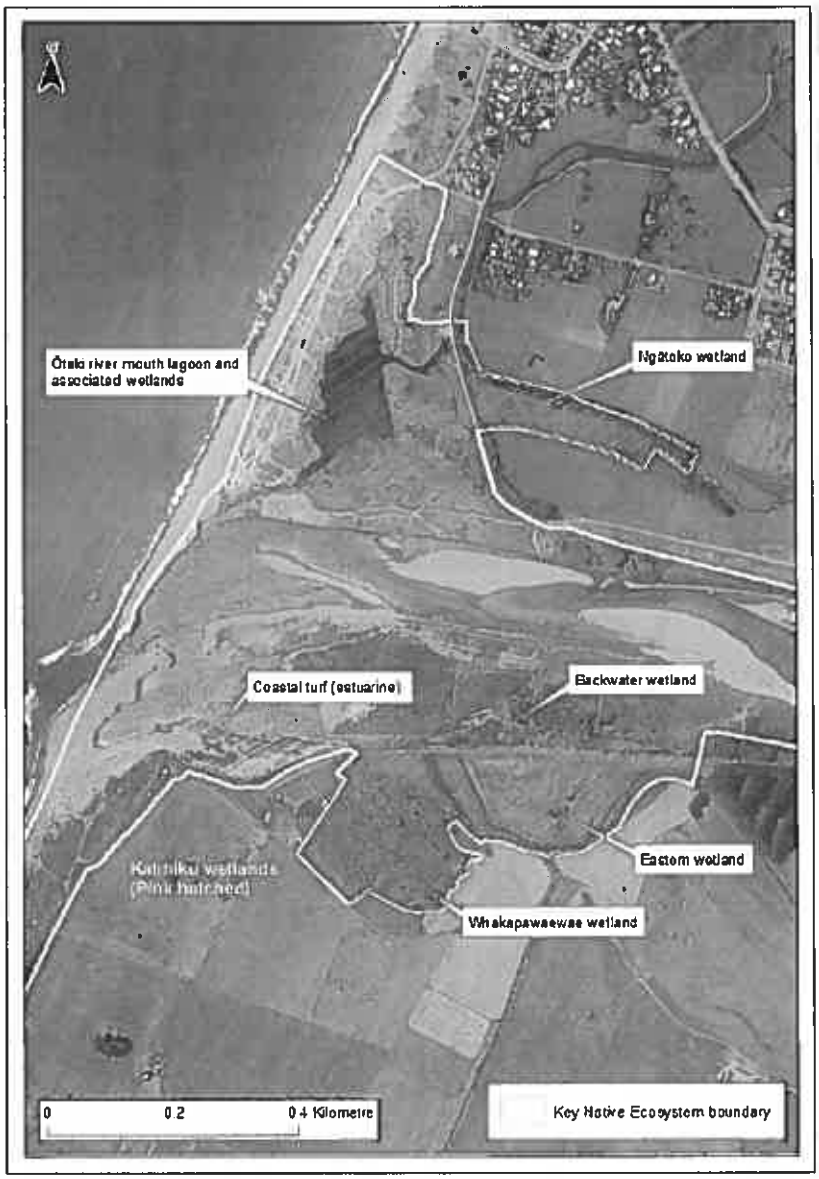

Figure 2: Key wetland habitats located around Otaki river mouth

(e) **Request:** It has been agreed that the applicant would undertake a one off study into the presence and abundance of **freshwater mussels** in the Rangiuru (Otaki) and Waimeha (Waikanae) streams. The results of the study would be used to inform the next review of the Code of Practice and GIS platform. .

Response: The wording of the condition for the study of freshwater mussels has been drafted and provided below:

"The consent holder shall, within two years of the granting of this consent, undertake a one-off study of freshwater mussels in the Rangiuru and Waimeha streams, to provide information on the presence and distribution of freshwater mussels and prepare a report on the findings of the study, to be provided to the Manager, Environmental Regulation, Greater Wellington Regional Council."

(f) **Request:** Trout drift dive results for the Otaki River

Response: Trout drift dive results for the Otaki River are included in the Fish & Game monitoring report covering the period 1999 to 2016.

(g) **Request**: Updates to the Code of Practice to include operator education and procedures and procedures for identifying and protecting native macrophytes.

Response: The updates to the Code of Practice will be provided as part of updates to general practices sections of the Code of Practice. These updates are currently being undertaken. Detailed education programmes and training regimes will be prepared as part of the implementation phase of the regime.

-- [Unnumbered entry] **Request:** Commercial and recreational fishing information.

Response: Refer to item (c) above.

(h) **Request:** Effects of upstream activities on the wetland and lagoon system in the lower Otaki River estuary.

Response: The potential effects of upstream gravel extraction on the southern part of the Otaki River estuary are described in Section 5.11.5 (page 54) of the ecology report (Cameron 2016). The northern part of the Otaki River estuary, including the wetlands and lagoon system, are located outside of the design channel alignment, and are not greatly influenced by surface waters from the Otaki River, which mostly flow directly out to sea. Freshwater inputs to the northern estuary come mostly from the The Rangiuru and Ngatoko streams. The annual weed clearance of these watercourses may temporarily result in increased suspended sediment concentrations and increased sediment deposition in the estuary, but this is an occasional short term event, conducted by weed boat rather than digger, which is unlikely to have any sustained adverse effect on the estuary.

(i) **Request:** further information on the hyporheic habitat

Response: It was agreed that providing this information would not add value to the assessment of environmental effects and code of practice. No further information required.

2.3 Waikanae River

(j) **Request:** Works requiring vegetation removal in the Waikanae Estuary.

Response: There is no work in the Waikanae Estuary which would result in vegetation removal. Therefore, no further information on the vegetation in the estuary is required.

(k) **Request:** Commercial and recreational fishing information.

Response: Refer to item (c) above.

(l) **Request:** Monitoring undertaken by Te Ati awa ki Whakarongotai – possibly for the Jim Cooke Stopbank consent. GWRC Environmental Regulation will source the results of this monitoring.

Response: Yet to receive information from GWRC Environmental Regulation.

2.4 Wainuiomata River

(m) **Request:** Commercial and recreational fishing information.

Response: Refer to item (c) above.

2.5 Code of Practice

(n) **Request:** Spawning periods and information.

With regard to trout spawning periods, GWRC Environmental Regulation will continue to work with Fish and Game to determine what this period should be.

Response: In terms of native fish spawning/migration, the activity constraints for the flowing channel of the Wainuiomata, Hutt, Waikanae and Otaki rivers (refer COP Tables 11 to 15) currently apply for the period September to December, inclusive. A memorandum from Alton Perrie summarising the technical background information behind the indigenous fish spawning and migration calendar listed in Schedule F1a of the PNRP (dated 11 September 2014) includes the following statement, attributed to Dr Rowe (NIWA):

- An exclusion period of August to December is still the most appropriate period is a 'one size fits all approach' is required to exclude instream works because this period protects a range of species' juvenile upstream migrations and also some of the spring-summer spawning by bullies.

This period has therefore been adopted in the COP. Subsequently, Alton Perrie has provided additional comment (email to David Cameron, Stantec, dated 9 December 2017) in which he states that these periods could be tailored to individual river values, for example extending the exclusion period to February in the Hutt River, to manage effects on bluegill bullies.

We consider that the August to December period is still the most appropriate, noting that the COP would not apply a complete ban on works, but rather requires the applicant to "*Limit activities that disturb the wetted channel at these times to no more than 3 days at any works site of 15 days per 10 km reach or, if unavoidable, follow the requirements for site specific effects management as per Section 3.3*".

(o) **Request:** Review the inanga spawning restriction areas in the resource consent application against the areas in the Proposed Natural Resources Plan.

Response: As follows:

- The Hutt River inanga spawning habitat, as shown in COP Table 11, extends from XS100 to XS210, with XS100 being the downstream extent of the application area. The PNRP shows inanga spawning habitat extending from the river mouth to approximately XS210. The extent of potential inanga spawning habitat shown in the application is appropriate and no change is required

- The Waikanae River (including Waimeha Stream) zone of potential inanga spawning habitat, as shown in COP Table 12, extends from XS20 to XS110 (and all of Waimeha Stream downstream of the Ngarara confluence). This is similar to the PNRP zone, except that the PNRP extends the downstream end of inanga habitat to the coast. In our view this is conservative as there is very little likelihood of inanga spawning below XS20. The extent of potential inanga spawning habitat shown in the application is appropriate and no change is required.

- The Otaki River (including Rangiuru/Ngatoko streams and Katihiku/Pahiko drains) zone of potential inanga spawning habitat, as shown in COP Table 13, extends from XS20 to XS120 (including the Rangiuru/Ngatoko streams and Katihiku/Pahiko drains). This corresponds with PNRP, except that the downstream end of the PNRP extends to the coast. In practice however, there is very little likelihood of inanga spawning below XS20. The extent of potential inanga spawning habitat shown in the application is appropriate and no change is required.

- There is no inanga spawning habitat in the managed reach of the Wainuiomata River.

(p) **Request:** Assess flood protection works which have been undertaken over the last 5 years to identify if a site specific management plan would have been triggered for each piece of work, and whether any changes to the triggers for a SSEMP are proposed to address the concerns raised.

Response: It would be difficult to retrospectively apply the assessment for past work undertaken, as the required level of information may not have been captured for previous work. We are

comfortable that an SSEMP would be required where the proposed works have a risk level that requires additional mitigation. The draft consent conditions, while subject to ongoing discussions and finalisation, provide an appropriate indicative scope of activities that require an SSEMP. The relevant draft condition (subject to change) is copied below:

(a) *"major works that disturb inanga spawning habitat, being the tidal estuary edge vegetation identified in Tables 11-13 and 15 of the Code for each river, during spawning season between 1 March and 31 May;*

(b) *major works that significantly disturb inanga spawning habitat, being the tidal estuary edge vegetation identified in Tables 11-13 and 15 of the Code for each river, between 1 June and 28 February;*

(c) *for all rivers except the Ōtaki River, major works in trout spawning habitat as identified in Tables 11-12 and 15 of the Code, between 1 May to 31 July;*

(d) *major works that significantly disturb the wetted channel between 1 August and 31 December (the period of peak native fish migration);*

(e) *major works within the flowing channel during periods when the river flow recedes below the minimum flow for each river, being:*

  (i) *for the Ōtaki River: 2,500 L/s minimum flow as measured at the Puhinui recorder;*

  (ii) *for Te Awa Kairangi/Hutt River: 1,200 L/s minimum flow as measured at the Birchville recorder;*

  (iii) *for the Waikanae River: 750 L/s minimum flow as measured at the WTP recorder;*

  (iv) *for the Wainuiomata River: 300 L/s minimum flow as measured at the Leonard Wood Park recorder; and*

(f) *the mechanical clearance of 800 metres or more (measured by lineal stream length) per work site of bottom rooted plant community in low gradient streams;*

(g) *clearance of 100m^2 or more per work site of riparian vegetation identified in the Operative Natural Resources Plan or by flood protection surveys as having significant indigenous biodiversity value; and*

(h) *any other activities identified in Table 4 of the Code from time to time as being of high risk."*

(q) **Request:** Requirements for spill kits in the Code of Practice and information on wash bays.

Response: The Code of Practice will be updated to clarify that spill kits will be available on sites where machinery may be located within proximity to waterways. With regard to the requirement to provide information on wash bays, these wash bays are not located at the specific works sites and are instead located at the GWRC Flood Protection depots. These sites will have existing stormwater and wastewater infrastructure and be subject to the relevant regional rules including for

discharges. Therefore providing information on the wash bays at the depot sites is not considered necessary.

(r) **Request:** Include vegetation information from District Plans and Department of Conservation databases in the Code of Practice.

Response: It has been agreed that there is no need to include district plan and Department of Conservation information on significant vegetation in the Code of Practice.

(s) **Request:** Update the Code of Practice to make ambiguous wording more directive.

Response: This is subject to a larger piece of work currently being undertaken to update the Code, and an updated version of the Code of Practice will be provided once this is complete.

(t) **Request:** Provide detail of the process for identifying opportunities for environmental enhancement, and who will be involved in this process.

Response: The works supervisor for the specific works will be responsible for identifying opportunities for environmental enhancement, based on the site specific features and constraints. The works supervisor will consult the Code of Practice for guidance on the appropriate measures to use for the site. The annual work programme prepared will identify the works proposed to be undertaken through the year, and will identify possible opportunities. A continuous improvement process will be in place through a review process of the works once undertaken. The learnings from these reviews will then be taken forward for consideration when undertaking future works.

(u) Request: Include additional details on stranding and relocation of fish and mega-invertebrates.

Response: The potential for fish and mega-invertebrates stranding will be added to the list of potential adverse effects, and mitigation measures will be added to all appropriate sections of the Code of Practice. The proposed wording is similar to the below:

> "*Stranding of fish if works result in dewatering of existing wetted channel, side channel or backwaters. Fish, koura (freshwater crayfish), and kakahi (freshwater mussel) rescue and relocation are undertaken from any habitats dewatered by the cutting of diversion channels without delay'.*

(v) **Request:** Include details of the potential effects and mitigation of fish and macroinvertebrate strandings relating to channel shaping – channel diversion cut and bed recontouring.

Response: These matters will be inserted into the Code of Practice through updates to the content that are currently being undertaken.

(w) **Request:** Include details of the potential effects and mitigation of fish and macroinvertebrate strandings relating to channel maintenance – removal of flood debris, mechanical clearing of minor watercourses, Opahu Stream and Chrystalls Lagoon.

Response: These matters will be inserted into the Code of Practice through updates to the content that are currently being undertaken.

(x) **Request:** Include details of the potential effects and mitigation of fish strandings relating to river mouth cutting.

Response: These matters will be inserted into the Code of Practice through updates to the content that are currently being undertaken.

(y) **Request:** Inclusion of the provisions on restoration management plans from the proposed Natural Resources Plan into the Code of Practice.

Response: This matter is subject to ongoing discussions with the Department of Conservation.

(z) **Request:** Information on the hyporheic zone to be inserted into the assessment of effects on the environment and Code of Practice.

Response: As agreed, providing further information on the **hyporheic zone** would not add value to the assessment of effects on the environment and Code of Practice. No further information required.

(aa) **Request:** Consider amending the Code of Practice regarding measures implemented to mitigate for habitat loss for specific activities.

Response: As described in Section 3.3.2 of the Code of Practice, the scope of a Site Specific Environmental Management Plan (SSEMP) includes:

- Any specific requirements for habitat protection or restoration".

It is envisioned that works that remove areas of important habitat, for instance the loss of a well formed riffle, would be designed to re-establish that habitat element in the final form of the river post works. To provide clearer direction on this, the Code will be amended to include wording similar to that below:

- Any specific requirements for habitat protection or restoration, which will be guided by the general principal that over the managed reach of each river, flood protection works will not result is a net loss in the total area of key habitat types (including pools, riffles and bankside cover).

(bb) **Request:** Consider integrating site specific effects management into the Code of Practice.

Response: The current documents adequately provide for specific mitigation measures to be assessed for the individual works site. We consider that the regime and integration of documents as currently set out is appropriate, and no amendments to the layout are necessary to achieve the anticipated outcomes of the regime.

(cc) **Request:** Review the intent of the proposed triggers and responses and whether alternatives to 'statistically significant' need to be considered.

Response: The following comments relate to the trigger values in Table 6 of the Code:

- Deposited sediment. The baseline monitoring method specifies three replicate samples annually which provides some ability to detect changes over time by trend analysis. Proposed wording for trigger is: "Determination of a clear increasing trend of deposited fine sediment cover over any five year period."
- Riverbank vegetation/undercutting. Determination of a statistically significant change is probably not possible using the method proposed. Proposed wording for trigger is: "More than a 20% decline in the average length of undercut bank or overhanging vegetation over any five year period."
- Trout abundance. The trigger as currently worded is appropriate.
- Riparian vegetation. It would not be appropriate to apply a trigger value for baseline mapping of riparian vegetation. Consequently, riparian vegetation should not be included in Table 6.
- River birds: The trigger as currently worded is appropriate.
- Native fish communities. The current wording of the trigger is problematic because (a) the survey is to be conducted only once every three years and (b) differences in species richness may occur from one survey to the next for a variety of reasons including the timing and frequency of flood events, and the timing of fish migrations. Such variability does not necessarily indicate a decline. Consequently, native fish communities should not be included in Table 6.
- Aerial photography. The trigger as currently worded is appropriate.
- Pool and riffle counts. The trigger as currently worded is appropriate.
- River bed levels. The trigger as currently worded is appropriate.
- Inanga spawning habitat. Based on the findings of a recent inanga spawning habitat survey (Taylor and Marshall, 2016) which describes considerable difficulty in establishing the location and extent of inanga spawning, it would not be appropriate to specify a trigger. Consequently, inanga spawning habitat should not be included in Table 6.

(dd) **Request:** Update the broken webpage link.

Response: This update will be provided as part of the broader updates to the Code of Practice currently being undertaken.

2.6 Environmental Monitoring Plan

(ee) **Request:** Respond to the matters raised in previous reviews.

Response: As follows:

- **Deposited sediment**, %sediment cover can be calculated from the Wolman pebble count (SAM-3), so no need to also include SAM-2.
- **Trout drift dive surveys** are proposed through until the end of 2018 at which time a comprehensive assessment the 20 year monitoring record should be conducted. The need for further trout monitoring beyond 2018 will be reviewed as part of that assessment.
- **Fish monitoring in low gradient watercourses** which are mechanically cleared of weed is proposed in order to characterise existing fish communities in these habitats.
- **Riparian vegetation** has been mapped on the riparian margins of the Ruamahanga River and it is intended that similar surveys would be conducted within the riparian margins of the Hutt, Wainuiomata, Waikanae and Otaki Rivers. It is intended that this would be supplemented by site specific assessments of riparian vegetation at works sites as outlined below in (gg).
- **Pool and riffle counts** by expert assessment are proposed. This relies on the expertise available within Fish & Game and GWRC. Emerging technologies such as water penetrating LiDAR and aerial drones have the potential to improve existing methods and will be considered in the future.
- **Inanga habitat** has been assessed recently by Taylor and Marshall (2016) in rivers and streams across the region, and it is proposed that a similar survey would be conducted at 15 year intervals. The 2016 report made site specific management recommendations that will be considered by FP as part of the annual review process.

(ff) **Request:** Include the Wainuiomata River as a baseline monitoring site.

Response: It was agreed that the Wainuiomata River does not need to be included at this stage but there is the ability to include it at a later date.

(gg) **Request:** Include information on riparian vegetation.

Response: The management of site specific effects, including the disturbance of bank or berm riparian vegetation, is described in Section 3.3 of the Code:

- Table 1 lists activities identified as having high potential for adverse effects, for which a site specific effects management process is required. This includes the clearance of areas of riparian vegetation identified as having significant ecological values;

- Table 2 determines the magnitude of activity disturbance based on the area of bank or berm to be disturbed. For instance the disturbance of >100m^2 bank or berm area is assigned a "Large" magnitude;

- Table 3 provides a habitat sensitivity ranking based on the values assigned to the area of disturbance. For instance, riparian vegetation identified as having high ecological or conservation value is ranked as being "Most" sensitive to disturbance

- Table 4 determines the risk of adverse impact based on the sensitivity of the works site and the magnitude of the disturbance. All activities proposed at a "most" sensitive location or having a "large" magnitude of disturbance are determined to have a high risk of adverse effect and therefore trigger specified management responses including the preparation of a site specific management plan (SSEMP).

- The scope of an SSEMP is specified in the Code including timing of works, special restrictions, communications, final design form of the river post works, special requirements for habitat protection or restoration, and requirements for monitoring.

(hh) **Request:** Discuss the frequency of inanga spawning habitat monitoring with Alton Perrie.

Response: Alton Perrie provided comment via email to David Cameron (Stantec) on 9 December. In this response, Mr Perrie considers that there is justification for more frequent surveys, whereas previously the frequency was a result of a lack of funding and a lower priority. Mr Perrie noted Taylor and Marshal's (2016) recommendation (on page 74) that where stable habitat is expected, then surveying every five to ten years is acceptable. Therefore we consider that surveys every ten years are appropriate.

(ii) **Request:** Discuss including macroinvertebrate monitoring in the baseline monitoring.

Response: It was agreed that there is enough information on macroinvertebrates so it does not need to be included in the baseline monitoring. No further information required.

(jj) **Request:** Review the Habitat Assessment in Appendix A of the Environmental Monitoring Plan.

Response: Please refer to response listed in item (ee) above.

2.7 Other

(kk) **Request:** Provide an assessment of effects on the estuaries and open coast beach system from gravel extraction.

Response: This work is currently being undertaken and a copy of the report will be provided once it has been finalised.

(ll) **Request:** Address the inclusion of requirement for environmental enhancement measures with regard to high risk adverse effects.

Response: We consider that the Code of Practice currently appropriately provides for environmental enhancement through the good practice activity methods.

(mm) **Request:** Discuss the management of pest plants.

Response: We have discussed this issue with the Department of Conservation, and as a consequence we have updated the draft consent conditions to refer to the avoidance of the spread of pest plants. This will be included in the Code of Practice where relevant.

References

Atkinson, N., & Joy, M. (2009). Longitudinal size distribution of the bluegill bullies (Gobiomorphus hubbsi) and torrentfish (Cheimarrichthys fosteri) in tow large New Zealand Rivers. *New Zealand Journal of Marine and Freshwater Research, 43:2, 643-651*, 643-651.

Beentjes, M., Sykes, J., & Crow, S. (2016). *GIS mapping of the longfin eel commercial fishery throughout New Zealand, and estimates of longfin habitat and proportion fished.* Ministry for Primary Industries.

Cameron, D. J. (2016). *Ecological Effects of Flood Protection Activities in the Hutt River.* Prepared for Greater Wellington Regional Council.

GWRC. (2017). *Key Native Ecosystem Plan for Otaki Coast.* Greater Wellington Regional Council.

Jarvis, M., Harland, H., Warburton, M., & Closs, G. (2017). The spawning and early life history of a New Zeland endemic amphipdromous eleotrid, bluegill bully (Gobiomorphus hubbsi). *New Zealand Journal of Marine and Freshwater Research, DOI: 101080/00288330.2017.1330760.*

Scrimgeour, G., & Eldon, G. (1989). Aspects of the reproductive biology of torrentfish, Cheimarrichthys fosteri, in toe braided rivers of Canterbury, New Zealand. *New Zealand Journal of Marine and Freshwater Research. 23:19-25.*

Unwin, M. (2016). *Angler usage of New Zealand lake and river fisheries.* NIWA report prepared for Fish & Game New Zealand.

greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

Please contact me if you wish to discuss this matter further.

Yours sincerely

Tracy Berghan
Principal Planning Advisor
Flood Protection

Kirsty van Reenen

To: Tracy Berghan
Subject: RE: Response to further information letter - Western Rivers

Hi Tracy,
Sorry it's taken so long to get back to you about this response. Alex James and the processing officers have reviewed this and have the following comments and requests. Where further detail has been requested can this please be incorporated into the final response (those questions in blue)?:

- With regard to the suggested consent conditions, these need further work to link any finding back to changes in the Code of Practice. We can do this as part of our assessment.
- With respect to commercial and recreation fishing can you please provide information regarding shortfin eel?

  We have not been able to obtain river specific commercial fishing statistics for the shortfin eel, however Beentjes & Mckenzie (2017) **report that commercial eel catches in western Wellington region have been landed on only eight of the 25 year period to 2015, and not since 2008. Over the 25-year period western Wellington rivers' have contributed only 0.1% of the total North Island eel catch, and longfin eels have been the dominant species.**

- With regrad to request f) Trout draft dive for the Otaki River can you please provide a copy (or link) of the Fish and Game monitoring report for 1999 to 2016?

<< File: Project report 1113 Sports fish monitoing Hutt Waikanae Otaki May 2017.docx >>

- Please provide a copy of the Waikanae River constraints calendar (request p)

  Updated in the Code – Table 13 page 61 – need to confirm Inanga spawning periods with DOC and correct exclusion periods for trout [refer to Peter Wilson's comments about pNRP]

- With respect to request q) and testing the Site Specific Management Plan criteria we think this would be a worthwhile exercise to do to fully understand what types of activities will be captured by this requirement. In terms of the magnitude of disturbance you would require the length of riverbed, number of days at one site and area of bank/berm disturbed. The sensitivity of work can be determined based on the timing of the work, flow at the time of works, spawning habitat (inanga and trout), riparian vegetation and macrophytes (in low gradient streams). Please undertake this exercise for some recent work sites (even if the information can only be accurately estimated).

  We are undertaking this work now

- With respect to the draft condition in response to q) please define 'major works'

Major works deleted and replace with significant

In condition 0, **significant works** means one or more of the following types of works:

(a) bed recontouring;

(b) channel diversion cuts;

(c) construction of impermeable erosion protection structures;

(d) **ripping in the wet channel; and**

(e) **wet gravel extraction.**

The activities are:

(a) **significant works that disturb inanga spawning habitat, being the tidal estuary edge vegetation identified in Tables 11-13 and 15 of the Code for each river, during spawning season between 1 March and 31 May;**

(b) **significant works that disturb large areas (defined in Table 2 of the Code) of inanga spawning habitat, being the tidal estuary edge vegetation identified in Tables 11-13 and 15 of the Code for each river, between 1 June and 28 February;**

(c) **for all rivers except the Ōtaki River, significant works in trout spawning habitat as identified in Tables 11-12 and 15 of the Code, between 1 May to 31 October;**

(d) **significant works in the wetted channel between 1 September and 31 December (the period of peak native fish migration);**

(e) **significant works within the flowing channel during periods when the river flow recedes below the minimum flow for each river;**

(f) **the mechanical clearance of 800 metres or more (measured by lineal stream length) of bottom rooted plant community in low gradient streams;**

(g) **clearance of 100m^2 or more of riparian vegetation identified in the Operative Natural Resources Plan or by flood protection surveys as having significant indigenous biodiversity value;**

(h) **any additional activities assessed as having a high risk of adverse impact identified in Table 4 of the Code; and**

Include an advice note explaining the importance of the codes tables 1-4 in determining this

(i) **any additional activities identified by the relevant OMP as requiring an SSEMP.**

- With respect to '*tidal estuary edge vegetation*' used in the draft condition in response to q) this is not strictly correct as it's not really the estuary, but rather in the vicinity of the upstream extent of the salt wedge.

  Schedule F5 of the PNRP describes inanga spawning habitat as "The moist litter layer on the banks of rivers and streams, inundated by the spring tide". Elsewhere in the PNRP it is described as "tidally inundated vegetation near the mouths of rivers and streams". Suggest we use the words "tidally inundated riparian vegetation" in consent conditions.

- With respect to response u) we are uncomfortable with the works supervisor having responsibility for identifying opportunities for environmental enhancement as they are not necessarily trained in the area of environmental enhancement and may also have concerns over budget and resources which may influence the outcome. Further if they are to use the COP for guidance this needs to include some detailed enhancement methodologies. We suggest as a minimum a suitably experienced ecologist review at least the annual work programme to assist in identifying possible opportunities.

  Propose – adding to section 2.6 Annual Work Programme – page 9

Condition – Annual work Plans @page 9 - opportunities for environmental enhancement,

- **Walkovers, page 15 – Add attended by a suitably qualified ecologist to help in the preparation of work programmes to identify opportunities for environmental enhancement**

- With respect to response cc) - integrating site specific effects management into the COP, the COP does not include sufficient detail of any specific mitigation measures (e.g., indicative plans, cost estimates, materials lists). If field staff and contractors are expected to implement these measures then surely the COP should provide a "menu" of options with sufficient detail to enable their construction. For example if the installation of small boulder groynes, boulder clusters, or log vanes has been identified to compensate for say the loss of bank edge habitat where channel straightening has occurred, then field staff will need instructions on boulder/log size, quantity of groynes/clusters/logs, and where to locate them. The current COP certainly does not have this detail.

  In medium to large gravel bed rivers, where the majority of these works occur, the objective of achieving no net loss of pools or riffles over the managed reach is achieved by conducting the works in accordance with a design channel alignment which includes a stable meander pattern with a natural slope to the beach, and incorporating a well-defined low flow channel with well-formed pools and riffles.
  In terms of bankside cover FP is unlikely to be proposing installation of additional structures such as log veins because of the short life expectancy of such structures in in a mobile gravel bed river. However, it would be reasonable to expect that any works involving the removal of riparian vegetation would include re-planting of the area lost as part of the works program.
  Where an SSEMP identifies a habitat feature that requires specific protection, advice would be sought from an aquatic ecologist to assist in the development of site specific solution. That might include an alternative design to avoid or minimise disruption to the feature, or restoration of the feature as part of the works program.

- With respect to response dd)
  - Riverbank vegetation/undercutting - We consider that any flood protection activities that reduce undercut banks and overhanging vegetation will be obvious and the length measurable. Where these are deemed to have adverse effects based on the five-step system then some form of mitigation should occur anyway. Please explain how this will be achieved?

    suggest separating bank undercutting from overhanging vegetation so that we can respond to each separately
    For riverbank vegetation, could we have a blanket requirement that any works involving the removal of riparian vegetation would include re-planting of an equivalent area as part of the works program. That could be a consent condition rather than a trigger.

    Bank undercutting is more difficult because it indicates active erosion, which FP wants to prevent. It is also quite dynamic, with new areas of undercut banks created by flood events, some of which is subsequently removed by FP works. The suggested trigger of more than 20% decline over any five year period based on annual monitoring surveys seems reasonable, as is the response on Table 6.

  - Trout abundance – We have concerns over the consistency of the 20 year record or the ability to ever attribute any changes directly to Flood Protection activities given the other variables at play. Is there an alternative?
    The 20 year record may not be perfect but represents a huge amount of work by F&G. It is far and away the best dataset available on trout abundance in Wellington Rivers. Part of the dataset has already been analysed to investigate temporal changes in the Hutt River brown trout fishery and elucidate the environmental conditions which drive population changes (Jordan 2012). The conclusion of that study was that high flow events (>200 L/s) during brown trout spawning and emergence are the most significant driver of population change. We are proposing a follow-up investigation to examine an expanded dataset, including post 2010 result not included in the study by Corina Jordan.

- Native fish communities – While we agree that the trigger is problematic we query the value of monitoring them at all in relation to flood protection activities given the variability. Please explain the value of the monitoring and how it will be reflected in flood protections (adaptive) activities?

  There is plenty of information about fish communities in smaller watercourses in Wellington but coverage is patchy for the main stem of larger rivers such as Hutt and Otaki where FP does most of its work. The objective of baseline surveys is to properly characterise the fish communities in habitats affected by FP. Also includes low gradient streams where FP undertake aquatic weed removal mechanically.

- Inanga spawning habitat – Can we please get a copy (or link) to the report Taylor and Marshall 2016? We agree that it wouldn't be appropriate to establish a trigger but appropriate avoidance and mitigation measures will need to be employed.
  Already provided

- With respect to response ff) environmental monitoring plan
  - Deposited sediment - The SAM-2 method specifically is targeted at accurately measuring fine deposited sediment on hard-bottom riverbeds using an underwater viewer. SAM-3 is a method to characterize overall substrate size distribution. SAM-2 is far more appropriate for the monitoring of deposited sediment cover and should be included. Please include the SAM-2 method.

    SAM-3 provides an assessment of % fine particles as well as grain size distribution (including D50). Both grain size (D50) and %sediment are potential inputs to a Habitat Quality Index, so we want to collect both, but cannot justify doing both SAM-2 and SAM-3 (time consuming).

  - Inanga habitat – The original review comments were with respect to identifying likely spawning habitat that has been lost due to historic FP activities. This information may be helpful as proposed enhancement/restoration could be used as future mitigation/compensation options.

    Where would we start? And then where would we draw the line ?

- With respect to response ii) frequency of inanga spawning habitat monitoring. We are still concerned about the monitoring frequency and the length of time required before any trend analysis can be made. We would like to see the Taylor & Marshal report before we comment further.

  Report provided. Note that flood protection was involved as part of the wider review undertaken as part of a much bigger look at spawning habitat across a number of rivers / stream in the Wellington region.

- With respect to response nn) the comments above under cc) apply. We do not believe the draft COP currently provides sufficient detail of any specific mitigation measure.

The good practice sheets document the opportunities for enhancement and mitigation. They form the overarching way we intend to work rather than on a job by job basis. I refer to comments above:
In medium to large gravel bed rivers, where the majority of these works occur, the objective of achieving no net loss of pools or riffles over the managed reach is achieved by conducting the works in accordance with a design channel alignment which includes a stable meander pattern with a natural slope to the beach, and incorporating a well-defined low flow channel with well-formed pools and riffles.

In terms of a hierarchy of mitigation it is :

BAU – good practice sheets and overall philosophy

- **Significant work - SSEMP**

- **Adaptation – Monitoring and review process to adapt work if required**
- **Work over and above maintenance and operations – separate resource consent**
- **Offsetting of effects – proposed fund**

- Some responses cannot be assessed until we have an updated copy of the Code of Practice, we will do this once the code is in a final draft.

  We are complying a version of proposed conditions and COP to go back to DOC and FG early next week – Do you want this copy or should I wait until I hear back from them?

Happy to chat about any of this.

Kind Regards
Kirsty

-----Original Message-----
From: Tracy Berghan
Sent: Tuesday, 12 December 2017 5:33 p.m.
To: Kirsty van Reenen
Subject: Response to further information letter

Hi Kirsty

Please find attached

http://ourspace.gw.govt.nz/ws/floodmgt/imptmp/11%20Dec%20GWRC%20template%20for%20RFI%20response_DCameron%20and%20SDB%20updates%20and%20comments.docx?web=1

cheers

Tracy

Wellington Fish and Game Council

The Chairman, Wellington Fish and Game Council

PROJECT REPORT 1113 – *River Control Fishery Assessment*

Purpose: Contribute to the Wellington Fish and Game Council Sports Fish and Game Management Plan specifically:

Goal A9.1: "Sustainability of trout as an angling resource."

Objective A9.3.5: Sports fisheries that exhibit characteristics that are valued by anglers will be identified and safeguarded."

2016/17 Annual Operational Plan Objective

"The quality and quantity of trout habitat in the Wellington Fish and Game region will remain stable over time."

Recommendation

That Council receives the report "Report No.16, Hutt, Waikanae and Otaki Rivers Sports fish Monitoring Results 1999-2016" dated May 2017, in fulfilment of Project 1113, River Control Fishery Assessment.

MJ Kavermann

Senior Fish and Game Officer

May 2017

Report No.16

Hutt, Waikanae and Otaki Rivers Sportsfish Monitoring Results 1999-2017

Prepared on behalf of the Flood Protection Group, Wellington Regional Council and the Wellington Fish and Game Council

By
Matt Kavermann
Senior Fish and Game Officer
Wellington Fish and Game Council

May 2017

Introduction and methods

In 1999 a regional sport-fish monitoring program was established to survey the abundance and distribution of brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) within the Hutt, Waikanae and Otaki rivers. The monitoring program, established in response to the potential deleterious effects caused by river remediation and diversion works permitted under a resource consent granted to the Wellington Regional Council (WRC), aimed to explore the relationship between trout abundance and the frequency and extent of river control works, in particular cross-blading.

Cross-blading (also known as transverse-blading) is a river diversion method where the gravel is pushed from one side of the river channel to the other to alter the channel alignment (Westlake & Manolache, 2016). Death (1996) has found that substrate disturbance removes both invertebrates and periphyton (a potential food source for invertebrates) thereby reducing a food source for trout and other higher-order species. Moreover the technique is particularly harmful to the natural river environment, compromising the preferred diverse habitat requirements of trout (Taylor, 2005) such as deep pools and riffles. The WRC Flood Protection Group acknowledged the likelihood of adverse effects from mechanical river diversion work and, since 1999, have worked with Fish and Game NZ to monitor trout abundance at core river reaches (Appendix 1) to monitor the potential effects of permitted works on the trout populations.

The regional monitoring program has established 15 core reaches (Hutt n= 8 [approx. 14 km], Waikanae n = 4 [approx. 3.7 km], Otaki n = 2 [approx. 4.7 km]) where trout abundance data is collected using drift-dive surveys (Appendix 2). The survey method requires divers to drift downstream, line abreast, within underwater sight of each other recording trout they encounter. Three to eight divers are required for the Hutt River depending on river width and water clarity compared with three on the Waikanae and five on the Otaki reaches. Spring and summer storms proved a major challenge this year with the continual freshes increasing water turbidity and making sampling unfeasible for much of the season. These weather events contributed to an overall decrease in sampling intensity within the region. Nonetheless core site surveys were achieved for the Hutt (24 and 26/2/2017, 18/3/17), Waikanae (7/12/2017) and Otaki (16/3/2017) rivers with the timing of sampling similar to previous years (see Appendix 1).

Data were examined and compared as mean numbers of trout seen per kilometre across all reaches within a river system and using route regression (Geissler & Noon, 1981) to estimate trends in population change (increases or declines) over 7-year periods (and 5- and 6-year periods where sufficient data for 7-year trends was lacking) for all reaches surveyed within a river system.

Results

Hutt River

Figure 1 shows the mean number of trout observed per km in the Hutt River catchments halved to 24 trout/km compared with 2016 ($\bar{x}$ = 48 trout/km) and has continued a downward trend since the high counts of 2013 ($\bar{x}$ = 155 trout/km) and 2014 ($\bar{x}$ = 119 trout/km).

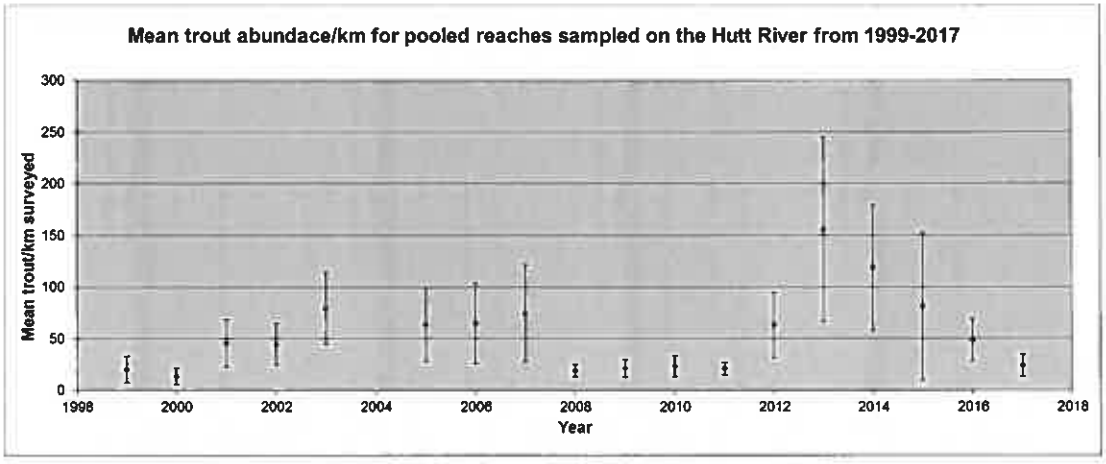

Figure 1. Mean number of trout surveyed during drift-dives within all reaches within the Hutt River. Error bars represent ±95% confidence intervals

The four years of decline are also shown in the seven-year trend in proportional change where 2017 marked the first proportional decline in trout abundance since 2012 (Figure 2). However, Figure 1 also highlights that in the 18 years since monitoring began the Hutt River fishery has remained stable, showing an overall 7% increase within the reaches surveyed.

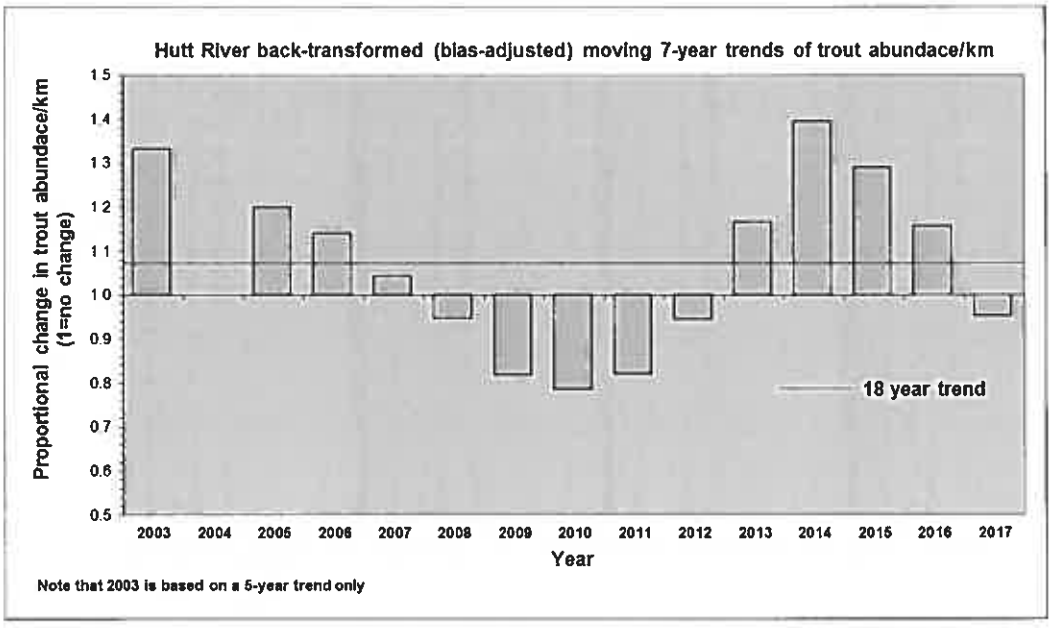

Figure 2. Moving 7-year trend bias-adjusted back-transformed means for surveyed trout/km from 8 reaches of the Hutt River showing the positive overall increase in trout numbers over the 18 year survey period (red line).

Waikanae River

Mean trout densities across the four reaches of the Waikanae River remained relatively stable in 2017 compared to 2016 ($\bar{x}$ = 5.5 trout/km and $\bar{x}$ = 5.7 trout/km respectively) but remained considerably lower than pre-2015 levels where mean trout numbers had been >10 for the previous six years and as high as 34 trout/km in 2013 (Figure 3).

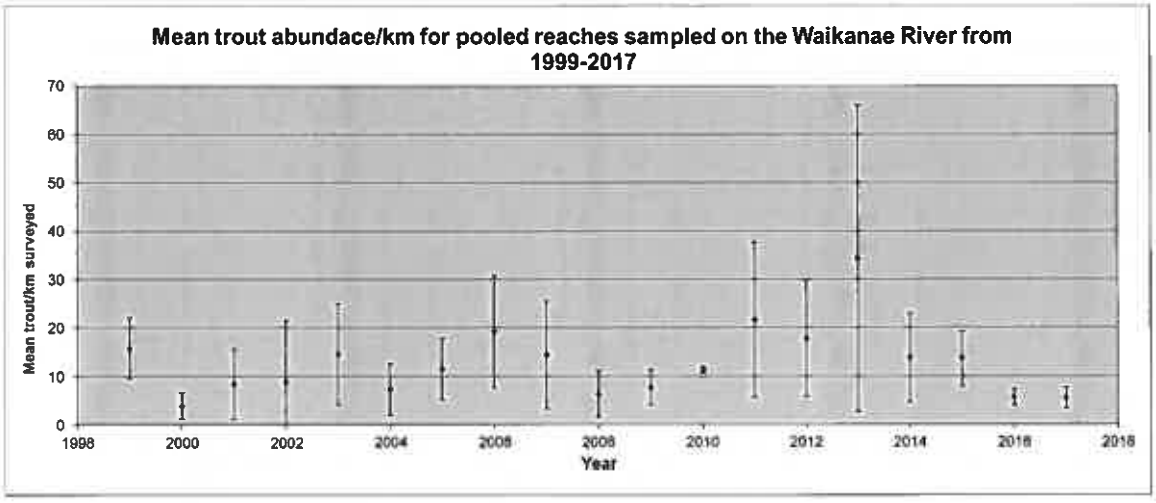

Figure 3. Mean number of trout surveyed during drift-dives within all reaches within the Waikanae River. Error bars represent ±95% confidence intervals.

However, like the Hutt, the four years of declining counts contributed to the declining seven-year trend in proportional change in trout densities within the river (Figure 4). Despite this, the Waikanae fishery has shown a mean 2% increase in trout/km within the reaches surveyed so appears stable.

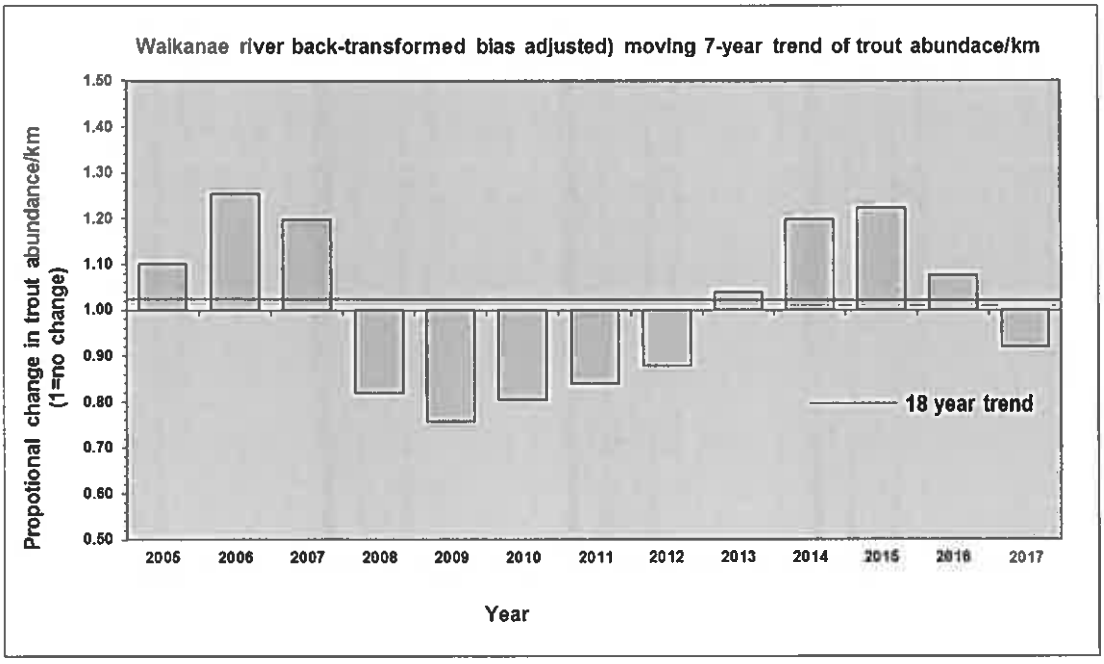

Figure 4. Moving 7-year trend bias-adjusted back-transformed means for surveyed trout/km from 4 reaches of the Waikanae River showing the positive overall increase in trout numbers over the 18 year survey period (red line).

Otaki River

Data from the two Otaki reaches indicated a similar trend to the Waikanae river with mean trout abundance/km remaining relatively stable over the 2016 ($\bar{x}$ = 8 trout/km) and 2017 ($\bar{x}$ = 6.7 trout/km) but lower than the 2013/14 surveys where abundances of > 45 trout/km were observed (Figure 5).

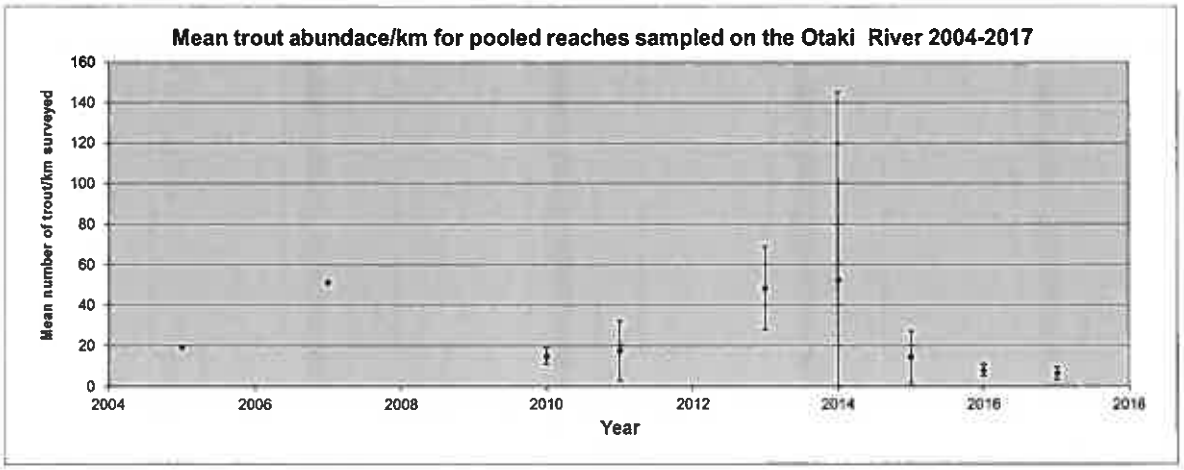

Figure 5. Mean number of trout surveyed during drift-dives within all reaches within the Otaki River. Error bars represent ±95% confidence intervals.

Proportional change in trout densities remained positive despite the lower survey counts and overall the Otaki trout survey data (influenced by the 2013/14 counts) indicates the fishery has increased by 20% in those reaches surveyed over the past 13 years (Figure 6).

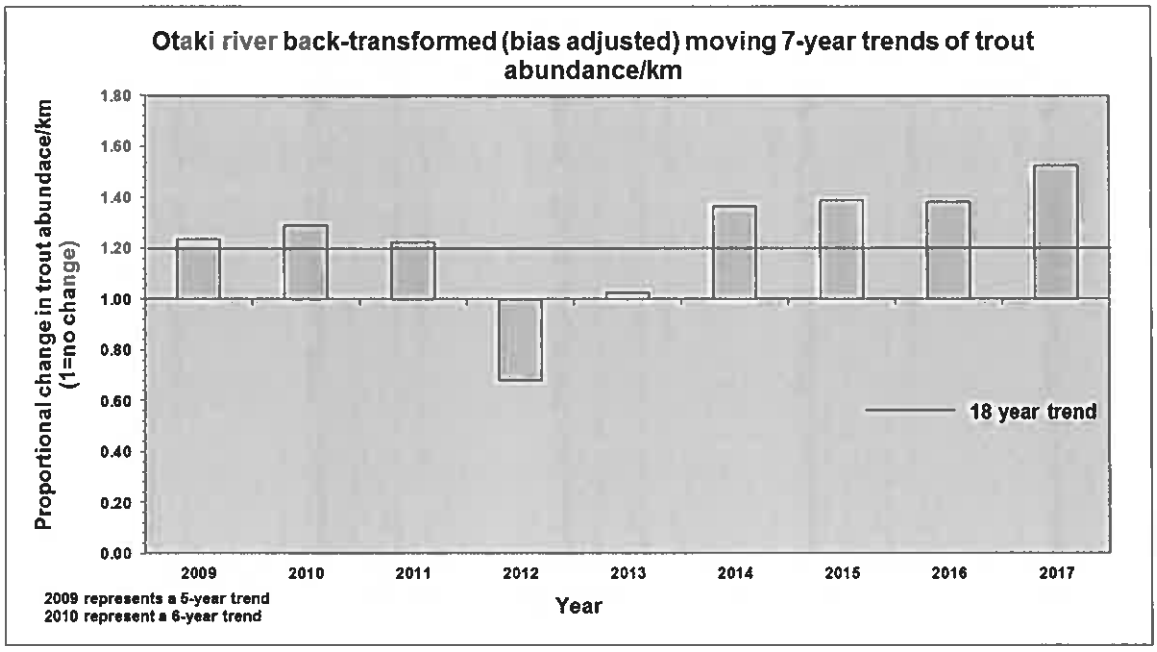

Figure 6. Moving 7-year trend bias-adjusted back-transformed means for surveyed trout/km from 2 reaches of the Otaki River showing the positive overall increase in trout numbers over the 18 year survey period (red line).

Discussion

The Fish and Game Wellington region's sport-fish monitoring program for the Hutt, Waikanae and Otaki rivers has been monitoring trout populations within each river to look at the possible deleterious effects of in-stream river diversion work by the WRC Flood Protection Group on trout population densities. Data has been collected from many sites for 19 years however identifying drivers of population change over that time is not a simple process and more data is needed. Various possibilities are being investigated including research work completed by Adam Canning, a Ph.D. student at Massey University who recently handed in his doctoral thesis titled "The application of network analysis to assess the structure and function of aquatic food webs". Adam, who is currently working for Fish and Game Wellington, has examined food web structure and function in aquatic systems and his work could be useful for examining the impacts of frequent disturbances and land use change in riverine systems to help identify possible drivers of population abundance within the Wellington region more broadly.

Overall, each river system surveyed provides evidence that the trout populations have remained stable (Waikanae) or increased (Hutt and Otaki) during the course of the monitoring program despite the fluctuations in observed trout numbers over time. The result must be carefully considered however as 7-year trend data suggests that two of the river systems (Waikanae and the Hutt) are currently in a downward trend following the significantly higher trout counts in 2013/14 with survey results from the Hutt River showing trout numbers at half the densities record in 2016. There are a number of reasons for the Hutt River result which will not be discussed here however the observed results, though at the lower end, are still within the bounds of historical counts.

Current sport fish regulations for the three rivers are identified in Table 1 below. Given the current data it is recommended that the 2016/17regulations for the Hutt and Waikanae rivers be applied for the 2017/2018 season. There is evidence to suggest that trout caught bait fishing and released have a 70-80% chance of survival compared to 96% chance when fly-caught (Schisler & Bergersen, 1996). The lower Otaki River, downstream of the Tararua Forest park boundary (where surveys occur), is the only river where bait fishing is allowed of those surveyed. This section of the river has shown an increase in trout abundance and so the effect of bait fishing appears to be non-existent at this stage. As such, it is recommend that the 2016/17 regulations also be applied for the 2017/18 season.

Table 1. 2016-2017 sport fishing regulations including season, permitted fishing methods and daily bag limits per angler on the Hutt, Waikanae and Otaki rivers.

River	Open Season	Permitted methods	Daily bag limits
Hutt River	All year	Fly and spin fishing only	2 (max 450 mm)
Waikanae	1 Oct- 30 Apr	Fly and spin fishing only	1 (max 450 mm)
Otaki	All year	Fly, spin and bait fishing	1 (max 450 mm)

Appendix 1. Drift dive survey core site data for the Hutt, Waikanae and Otaki rivers for the Wellington Fish and Game Council sportfish regional monitoring program.

River System	Reach	Reach Length	Date surveyed	Large brown trout <400 mm	Medium brown trout	Large rainbow trout <400 mm	Medium rainbow trout	Total
Hutt	Avalon A	1150	26/02/2017	5	9	0	0	14
Hutt	Avalon B	2000	26/02/2017	7	2	0	0	9
Hutt	Birchville	1400	26/02/2017	24	24	0	0	48
Hutt	Heretaunga	2500	26/02/2017	16	7	0	0	23
Hutt	Kaitoki	1400	24/02/2017	17	5	0	0	22
Hutt	Melling	1800	26/02/2017	29	52	0	0	81
Hutt	Taita	1000	26/02/2017	18	26	0	0	44
Hutt	Te Marua	1800	18/03/2017	16	14	0	0	30
Hutt	Whakatikei	1400	26/02/2017	16	10	0	0	26
Otaki	Below SH 1	2750	16/03/2017	10	3	0	0	13
Otaki	Pylons	2000	16/03/2017	11	4	0	1	16
Waikenae	Cooke Park 1	870	7/12/2016	1	3	0	0	4
Waikenae	Cooke Park 2	570	7/12/2016	1	1	0	0	2
Waikenae	Treatment 1	1000	7/12/2016	4	1	0	0	5
Waikenae	Treatment 2	1250	7/12/2016	9	2	0	0	11

Appendix 2. Geographic coordinates of core-river reaches start and end points for the Hutt, Waikanae and Otaki rivers

River system	Reach	Latitude start	Longitude start	Latitude end	Longitude end
Hutt	Avalon A	41°10'12.42"S	174°57'37.26"E	41°10'37.42"S	174°57'0.95"E
Hutt	Avalon B	41°10'37.42"S	174°57'0.95"E	41°11'25.58"S	174°56'5.82"E
Hutt	Birchville	41° 5'24.85"S	175° 5'57.36"E	41° 5'56.54"S	175° 5'24.96"E
Hutt	Heretaunga	41° 7'33.11"S	175° 1'51.63"E	41° 8'19.47"S	175° 0'30.67"E
Hutt	Kaitoke	41° 3'24.08"S	175°11'33.57"E	41° 3'19.30"S	175°10'57.96"E
Hutt	Melling	41°11'41.05"S	174°55'22.41"E	41°12'17.76"S	174°54'20.64"E
Hutt	Taita	41° 8'51.80"S	174°59'38.75"E	41° 9'16.85"S	174°59'10.76"E
Hutt	Te Marua	41° 5'14.25"S	175° 7'59.31"E	41° 5'37.46"S	175° 7'32.39"E
Hutt	Whakatikei	41° 6'49.21"S	175° 3'4.51"E	41° 7'15.78"S	175° 2'21.53"E
Otaki	Below SH 1	40°46'16.23"S	175° 8'39.52"E	40°45'38.27"S	175° 6'58.21"E
Otaki	Pylons	40°48'20.56"S	175°11'14.30"E	40°47'26.62"S	175°10'39.22"E
Waikenae	Cooke Park 1	40°52'57.61"S	175° 3'9.47"E	40°52'54.95"S	175° 2'35.58"E
Waikenae	Cooke Park 2	40°52'54.95"S	175° 2'35.58"E	40°52'42.28"S	175° 2'26.41"E
Waikenae	Treatment 1	40°53'41.87"S	175° 4'27.91"E	40°53'18.66"S	175° 4'17.59"E
Waikenae	Treatment 2	40°53'18.66"S	175° 4'17.59"E	40°52'55.06"S	175° 3'44.75"E

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