BEFORE THE PROPOSED NATURAL RESOURCES PLAN HEARINGS PANEL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of Water Allocation
AND	
IN THE MATTER	of supplementary evidence to matters raised during Hearing Stream 3

STATEMENT OF SUPPLEMENTARY EVIDENCE OF MIKE THOMPSON ON BEHALF OF WELLINGTON REGIONAL COUNCIL

TECHNICAL – WATER ALLOCATION: MINIMUM FLOWS AND ALLOCATION

8 December 2017

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1. INTRODUCTION

1.1 My name is Mike Thompson. I work as Senior Environmental Scientist for Wellington Regional Council. I wrote the technical report *Allocation: minimum flows and allocation* dated 7 August 2017, released in advance of Hearing Stream 3 (hereafter referred to as my primary evidence).

1.2 My qualifications and expertise are described in my primary evidence.

2. CODE OF CONDUCT

2.1 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note and that I agree to comply with the code. My evidence in this statement is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions which I express.

3. SCOPE

3.1 This supplementary evidence relates to matters raised by submitters and the Panel since my primary evidence was released and covers the following:

(a) Definition of mean annual low flow

(b) Application of default surface water allocation amounts

(c) Supplementary allocation

4. DEFINITION OF MEAN ANNUAL LOW FLOW

Background

4.1 Several submitters (Horticulture NZ and Federated Farmers in particular) have raised questions about the use of naturalised mean annual low flow (MALF) as the primary reference statistic for minimum flows and allocation amounts (as opposed to observed or measured MALF). They oppose the proposed change in definition of MALF in the pNRP to include the term 'naturalised' as they suggest it leads to a "significantly different" application of MALF in Policy P113 (core allocation amounts).

Response

4.2 The purpose of the proposed change in definition is to remove ambiguity and more accurately reflect the approach and intent of the pNRP. Naturalised MALF has always been the basis of the core allocation amounts in Tables 7.3, 8.2 and 10.2 (as noted in the footnotes to these tables) and therefore, no recalculation of numbers is required as a result of the definition change. Furthermore, minimum flows for all but three of the streams in Tables 7.1, 8.1 and 10.1 are carried over from the existing Plan and are also, therefore, not affected by this clarification of the MALF definition (i.e. no recalculation of numbers is needed). Two of the stream minimum flows that have been added since the previous Plan (the Otukura and Papawai streams - Table 7.1) apply naturalised MALF in the calculation of the minimum flow. This is appropriate in my view and consistent with best practice advice emerging in recent years (e.g. Beca 2008, Young and Hay 2017).

4.3 The Papawai Stream is a useful example with which to further illustrate the importance of naturalising MALF. The table below from Keenan (2009) compares measured and naturalised annual lowest flows for four years. There are three relatively significant consented takes in this catchment that have not historically been fully restricted at low flows. The table shows that measured low flows are generally less than half the rate of the flows that are likely to have occurred in the absence of the consented takes (i.e. natural low flows).

Table 4.1: Comparison of measured and naturalised annual low flows over four years in the Papawai Stream (u/s Oxidation Pond monitoring site). Source: Keenan (2009).

Year	Measured 1-day lowest mean flow (L/s)	Estimated natural 1-day lowest mean flow (L/s)
2005/06	42	175
2006/07	95	180
2007/08	51	130
2008/09	70	145

4.4 In this example, if measured MALF was used instead of naturalised MALF as a primary reference statistic, one consequence would be a minimum flow (for restricting water users) that is much lower than natural low flows and therefore providing a questionable level of protection for instream values. However, another consequence of not naturalising MALF is that it also short-changes water users; measured MALF can give the impression that significantly less water is available to allocate to users than is actually the case. While the Papawai Stream is a relatively stark example, in that the difference between measured and natural low flows is greater than for most rivers and streams, the principle being illustrated is relevant across the region.

4.5 In response to Horticulture NZ concerns about uncertainties in the flow naturalisation calculations (their paragraphs 5.16-5.19), I acknowledge that it is not a perfect science. In the absence of complete and long term water use data, some assumptions are required to estimate the quantum of flow that should be added back in to the observed record. I discuss this in my original evidence in paragraphs 6.15-6.18 and also refer to two background reports that describe in more detail the basis for the flow corrections and likely errors. In general, naturalisation of MALF has involved adjustments for consented surface water and directly connected groundwater takes but not for more remotely connected groundwater takes or permitted/unconsented takes. Naturalisation calculations have made use of groundwater modelling results where available to estimate relevant stream depletion rates. The GWRC approach I note is similar to that taken by Environment Southland.

4.6 Overall I remain of the view that the approach of using naturalised MALF as a primary statistic for flow setting is preferable to using measured MALF.

4.7 While I appreciate that the revised definition may change the way Policy P113 and the default minimum flow rules in the whaitua chapters are interpreted by some submitters, these policies and rules only apply outside of the main areas of water allocation in the region. Applying naturalised MALF instead of measured MALF in these areas will (a) be relatively straightforward (there are very few consents to account for and there is very little directly connected groundwater to consider) and, therefore, (b) not be expected to lead to substantially different numbers in most cases (as was the concern inferred in paragraph 5.15 of Horticulture NZ submission).

5. APPLICATION OF DEFAULT SURFACE WATER ALLOCATION AMOUNTS

Background

5.1 Federated Farmers and Wellington Water Ltd have questioned the application of default surface water allocation amounts and have suggested carrying over existing core allocation limits (established in the Regional Freshwater Plan) and/or adopting existing consented use as the limit until the various whaitua processes are complete.

Response

5.2 In my original evidence (primarily paragraphs 6.1-6.6 and 6.19-6.19) I explain why, in my view, applying the default allocation amounts is preferable. In this supplementary evidence I focus on three particular points raised by the submitters; the rationale for the application of the default limits, how application of the default amounts changes the allocation status of Catchment Management Units and Sub-units and the merit of the default limits in the Wellington Water public supply catchments.

Clarifying rationale for allocation framework

5.3 Ms McGruddy (in her paragraphs 111 to 120) raises concern about the rationale I provided for the adoption of the proposed allocation regime and focuses on a statement in my argument about being "more consistent with contemporary planning requirements…to be ecologically precautionary" (paragraph 6.6 of my primary evidence).

5.4 Ms McGruddy disagrees with the statement and wonders whether it relates to recent reports by Hayes et al (2016) that describe recent research on flow requirements of drift feeding fish.

5.5 To clarify, the statement about "contemporary planning requirements" was made in the context of a discussion (in paragraphs 6.1 to 6.6) about the overall allocation regime and framework and included reference to cumulative effects, broader application of resources as well as being ecologically precautionary.

5.6 The point I was trying to make about being ecologically precautionary is that the proposed allocation regime follows direction given by the National Policy Statement for Freshwater Management to safe-guard life supporting capacity. It achieves this in my view by setting default allocation amounts that, in line with national guidance (Beca 2008) that has emerged since the current regime became operative, are relatively precautionary in favour of instream ecology.

5.7 The Hayes et al (2016) reports do not relate directly to the statement about contemporary planning requirements, nor have they been used (as queried by Ms McGruddy in her paragraph 117) to justify a region-wide default allocation regime. Rather, I referenced this work (paragraph 5.43 of my primary evidence) in a response to a specific submission point about whether the minimum flow in the lower Ruamahanga River should be reduced.

5.8 My argument on this point was not that the Hayes et al (2016) research justifies a change in our approach to allocation or minimum flow setting but that it signals a need with rivers like the Ruamahanga to be cautious (until the research has matured further) about reducing existing minimum flows. This should especially be the case if no supporting technical information to justify minimum flow reductions has been provided.

Change in allocation status

5.9 Ms McGruddy (in her paragraph 93) characterised the general effect of the application of the default allocation amounts on allocation status as *"catchments which are currently under-allocated may now be deemed to be "fully" allocated; catchments which are currently fully allocated may be deemed to be "over" allocated".* While I do not disagree with this general interpretation, the paragraphs below are intended to help clarify status changes at the catchment sub-unit scale.

5.10 Tables A1.1 (Kapiti Coast and Wellington/Hutt) and A1.2 (Ruamahanga) in Attachment A of this evidence compare existing consented use with pNRP default allocation amounts and how allocation status changes as a result of adopting the pNRP amounts. These tables are simplified versions of Tables 1a, 2a and 3a in my original evidence, adapted for the purpose of elaborating on the points raised above.

5.11 There are two ways of considering allocation status under the existing RFP core allocation limits; (1) by considering just the direct surface water take in each catchment in relation to the core allocation limit (since the RFP core allocation limits were established only with direct takes in mind) or (2) by considering what we now understand to be the total surface water depleting take (from direct takes and connected groundwater takes) in relation to the same limits. Both approaches are provided in Tables A1.1 and A1.2 (Columns 1 and 2).

5.12 Column 3 in the same tables shows the allocation status if total surface water depleting take (from direct takes and connected groundwater takes) is related to the pNRP default allocation amounts. The most meaningful comparison of allocation status between existing RFP and the pNRP is, in my view, achieved by the comparing Catchment Sub-units in Columns 2 and 3, both of which include groundwater depleting takes. These two columns have the bold outline in Tables A1.1 and A1.2.

5.13 Three non-public water supply catchments on the Kapiti Coast (Waitohu, Otaki and Mangaone), allocation status is essentially unchanged under the proposed defaults; allocation is available under the existing RFP and remains available under the pNRP (irrespective of whether you include groundwater depleting takes in the comparison).

5.14 The four public water supply catchments (Waikanae, Hutt, Wainuiomata and Orongorongo) do not have a surface water allocation limit under the existing RFP and all move to a fully allocated status under the pNRP.

5.15 In the Ruamahanga and Lake Wairarapa catchments, only one of the thirteen catchment sub-units (Parkvale Stream) moves from having some allocation available (Column 2) to being fully allocated (Column 3). Of the rest, six remain the same (fully allocated) and six move from fully allocated to having some allocation available. However, when a whole of catchment view is taken (Column 4) the six sub-units with allocation available become fully allocated due to the cumulative allocation status in the lower reaches of the Ruamahanga River and Lake Wairarapa. Water in these upstream sub-units would only become available when the allocation for the Ruamahanga and Lake Wairarapa Catchment Management Units falls below 100% of the allocation amounts (noting that existing allocation is only very marginally above these thresholds).

Adopting existing consented use in water supply catchments

5.16 Wellington Water Ltd (Ms Wratt and My Slyfield) opposes the inclusion of the default allocation amounts for the Wainuiomata and Orongorongo rivers in Table 8.2. They suggest allocation amounts in Table 8.2 should reflect the existing consented abstraction. Their arguments include; that ecological monitoring undertaken as condition of consent *"does not indicate that current consent amounts are having any adverse environmental effects on the rive*r" (I assume they are referring to all three supply rivers); that the default amounts in Table 8.2 of the pNRP are not based on catchment specific analysis or new science; that the default amounts being lower than existing use gives the impression of over-allocation while the pNRP amounts are effectively undermined by the parallel policy that allows existing consented use to continue.

5.17 I acknowledge that GWRC had sufficient comfort in the existing water supply takes to grant consent in 2000 and that this was based on a view of impacts that were considered at the time to be no more than minor. Since then, useful ecological monitoring information has also been collected, although predominantly in the Hutt catchment, and together with Councils own monitoring data, the picture is one of generally fair to healthy rivers which are stable over time.

5.18 Consents were issued seventeen years ago (2000). A particular focus at that time around the country was on ensuring minimum flows were set to retain residual flows in rivers; many takes were not historically subject to minimum flows, including the public supply takes in the Wainuiomata and Orongorongo catchments. While the 2000 consenting process usefully introduced minimum flows in these catchments based on (then) recently developed IFIM methodologies, guidance and research at the time on risks associated with abstraction above the minimum flows was less comprehensive. And therefore, in my view, a broader assessment of potential impacts of hydrological alteration might be expected in a similar consenting process today.

5.19 As an example, hydrological alteration downstream of the Wainuiomata take was characterised (Opus 2000) as a proportion of mean river flow (e.g. 20% reduction at Leonard Wook Park), and from this, interpretations about likely changes in recreational opportunities were made. However, the proportional alteration of low flows (around MALF) are more substantial than those occurring at mean flow and more focus on change to the low flow hydrology (as is advocated by recently developed national guidance) *may* have led to different conclusions about the risk of impacts in this example.

5.20 Related to the point above I have reservations that the assessments of hydrological change in the 2000 consenting process took sufficient account of the maximum potential impact of the public supply takes if the consents were exercised to their fullest extent for long periods. I understand that the lowest summer flows could not be reduced beyond what has been experienced already as the available natural flow is generally less than consents allow to be taken. However, in the shoulder periods of flow recessions I understand reductions beyond historical levels could occur (depending on demand changes and reliance on particular catchments to meet demand). I do not know the likelihood of such a scenario occurring in the future, or what the magnitude of any additional reduction (and related consequences) might be, however, it casts doubt in my mind over the argument that we fully understand the potential risks associated with the abstraction regimes.

5.21 Assessments to date have focused on the condition of the rivers with the takes as part of the background environment. This is understandable given how long the takes have been in operation. However, it is difficult to know what the natural biological carrying capacity or conditions of the rivers would be, and how the rivers may or may not be valued differently, in the absence of these relatively large takes.

5.22 The advantage of the default allocation amounts is that they alleviate some of the doubt/uncertainty described above for a period of time until a more holistic determination of the sustainability of the existing use, or higher or lower amounts, can be achieved through whaitua discussions. While not based on catchment specific analysis the default amounts are not arbitrary either, representing thresholds below which we can be confident that abstraction impacts will be minor. They are ecology-focused but they can also be considered in my view to be relatively precautionary in favour of other instream values too (because they describe levels of flow alteration that are quite modest).

5.23 Catchments with allocation levels that are substantially higher than the amounts indicated in the pNRP do, in my view, deserve a higher level of scrutiny through the whaitua process.

5.24 However, I do also concede that I am not aware of any particular concerns raised about the level of allocation in the Wainuiomata and Orongorongo catchments and the argument for applying the defaults, given the impression they create, is less compelling than in other heavily allocated catchments where concerns about abstraction have been raised (and where the presence of multiple consent holders creates more prospect of some reduction in water use in the short term through the sinking lid policy).

5.25 Nevertheless, on balance, I remain of the view that the default amounts are the better option. Beside the reasons given above, they provide conformity with a precautionary regional approach (whilst not materially affecting existing users) as a basis for entering into more detailed whaitua discussions.

5.26 I am confident that the whaitua committee will in good faith focus on the question of “what is the right level?” (as identified by Mr Slyfield for Wellington Water in his paragraph 27) rather than being overly influenced by either the default number in the pNRP or existing use. I anticipate their eventual recommendations will make full use of all information collected to date, including original consenting analysis and more recent pNRP submitter evidence and any further technical assessments, and then balance this with the obvious public-good value gained from the supply abstractions.

6. SUPPLEMENTARY ALLOCATION

Background

6.1 In the notified pNRP, P117 regarding supplementary allocation amounts was:

> *In addition to core allocation, water is available from rivers at flows above the median flow providing flushing flows and a portion of flow above the median remains in the river to meet Objective O25.*

6.2 In the redline version of the pNRP, P117 was changed to:

> *In addition to core allocation, supplementary allocation is available above median flow in the following amounts:*
>
> - *For rivers with mean flows of greater than 5m^3/sec, **up to 50%** of the flow in the river above median flow, or*
> - *For rivers with mean flows of less than or equal to 5m^3/sec, **up to 10%** of the total amount of flow in the river*
>
> *provided flushing flows and a portion of flow above the median flow remains in the river to meet Objective O25.*

6.3 The change to make a distinction between large and small waterways was made after considering submissions received and the rationale is described in my original evidence (paragraphs 7.6-7.15).

6.4 Federated Farmers raise concern in their submission (HS3-S352 Ms McGruddy, paragraphs 167-190) about the supplementary allocation policy (P117). Ms McGruddy's principal concern is that reducing the allocation cap from 50% of flow (above median) for large rivers to 10% of flow (total flow) for smaller rivers and streams has not been well enough justified. She is concerned that the smaller allocation cap is at odds with objectives within the RPS and pNRP (O52e) to enable water storage. The relief sought is to revert to the single allocation cap (50% of flow above median) for all rivers and streams, irrespective of size and flow rate.

6.5 Fish and Game was generally supportive of the principle behind the reduced supplementary allocation from smaller rivers and streams but has concerns about the lack of detail within the pNRP on how the supplementary allocation policies and rules will be implemented (HS3-S308 Mr Wilson, paragraphs 32-34). In particular, the lack of an identified process for setting river specific flow thresholds and limits and clarity on how matters of flow variability within catchments will be addressed.

Response

6.6 My initial inclination to support a change in supplementary allocation policy was based on an analysis of two contrasting waterways, a large river (Waiohine River) and a small stream (Papawai Stream). From that assessment I concluded that there was a significant difference between the two waterways in the scale of potential hydrological alteration under fully exercised supplementary allocation (under the higher 50% cap in the notified pNRP). For the Waiohine River I concluded impacts on instream values were unlikely whereas for the Papawai Stream I viewed the potential alteration as “quite significant”.

6.7 The latter comment was based primarily on the potential flow reduction indicated for Papawai Stream in Figure 6 of my original evidence. Compared with the the Waiohine River (Figure 5), fully exercised supplementary allocation in the Papawai Stream catchment could result in relatively prolonged (continuous) and more substantial reduction in base flows. Knowing that smaller streams are typically less resilient to flow reductions than larger rivers I concluded a differential supplementary allocation policy was justified.

6.8 In her submission for Federated Farmers, Ms McGruddy has made several valid points. Firstly, I accept her view that, by only considering the Waiohine and Papawai, I have based my conclusions on a relatively extreme comparison rather than a broad range of rivers and streams. I also accept Ms McGruddy’s point that the technical reasoning behind the change has not incorporated an assessment of how the change in policy might reduce water availability for users in smaller river/stream catchments and, to some degree, neglects Objective O52e. In response to these points I have undertaken some further analysis, the results of which I discuss in the following paragraphs.

Further analysis

6.9 In my analysis I looked at 11 rivers and streams ranging in mean flow from 360 L/sec (Papawai Stream) to 30,000 L/sec (Otaki River) and covering all parts of the region. The purpose of the analysis was to compare the difference between the 50% and 10% allocation caps in both the likely alteration from natural flows and also the allocable volume they produce. Analysis is based on mean daily flows for a five year period from July 2008 to June 2013; this period covers a good range of climate conditions with abnormally wet and dry years occurring.

6.10 In the modelling supplementary allocation was taken only on receding flows of between median and three times median. An assumption was made that early in the recession (i.e. above three times median) sediment content is likely to be too high for pumping. In practice the magnitude of flows above median that can be harvested will vary significantly between activities and catchments depending on pump scheme capabilities and natural sediment loads. However, the assumption used is considered reasonable for the purpose of this exercise.

6.11 The statistics I have used to characterise change in natural flow are the median and 80th percentile of daily flows. The median characterises 'typical' conditions and can be interpreted as: on average, flow alteration on half of the days in the period of interest will exceed the median result and half will be below. The 80th percentile characterises the more severe, but less frequent, results: on average, flow alteration on one in five of the days in the period of interest will exceed the median result. Allocable volume has been calculated as a daily average.

6.12 Results have been aggregated by month and season. No assumptions have been made about which months and seasons are of most importance for water users to be able to access supplementary allocation; this will vary significantly depending on catchment characteristics and ability to store captured water (e.g.

a relatively large farm storage dam could harvest enough winter/spring flow to meet summer shortfalls while a much smaller dam might have to rely on summer harvesting to top up as well).

6.13 I have also looked at the Parkvale Stream in particular, one of the small stream catchments with the lowest summer reliability for existing users of core allocation. I have assessed for each of the same five years in the period described above what the shortfall in core allocation was (based on days of full restriction) and the extent to which this shortfall could be met by harvesting under the supplementary 50% and 10% cap policies. Existing core allocation for this catchment is 150 L/sec (or 12,690 m^3/day). This assessment has adopted the same assumptions about when water could be taken as described above but also accounts for the fact the core allocation can still be taken (in addition to supplementary allocation) at flows above median and could be stored in the same way. I have also assumed that harvesting and storage to meet peak summer shortfalls occurs from October to March inclusive and is not just harvesting of freshes in the peak summer months. Whether individual users can actually store enough shoulder season flow is a separate question that will depend on their storage capacity – this assessment looks at the catchment scale under some simplified assumptions for the purpose of comparing the 50% and 10% cap regimes.

Findings

6.14 Monthly and seasonally averaged results for each river/stream are summarised in Tables 6.1 to 6.3 and shown graphically in Attachment B.

6.15 Table 6.1 shows that the median change to natural flow under both the fully exercised 50% and 10% cap supplementary allocation regimes is essentially zero in summer and autumn months regardless of waterway size or location. In winter and spring, the median reductions become more significant although are below 10% for both allocation regimes for eight of the eleven waterways (generally the larger ones). Reductions of significantly more than 10% in the median occur under the 50% cap regime in winter and spring in the Papawai (up to 15%), Otukura (up to 26%) and Parkvale (up to 20%) streams.

6.16 Table 6.2 shows that the 80th percentile reduction in natural flow remains near zero for most waterways for the summer months under both allocation regimes and is still quite modest (<10%) for most waterways in autumn. In spring, reductions under the 50% cap regime are about 1.5 to 2.5 times greater than under the 10% cap regime with no strong relationship to waterway size or location. In winter, reductions under the 50% cap regime increase again to about 2 to 3 times greater than under the 10% cap regime. The most significant reductions (>30%) occur in the Otukura, Parkvale streams and the Tauweru River, all of which have relatively low median flows.

6.17 Table 6.3 shows that, broadly speaking, there is about twice as much water available to harvest under the 50% cap regime as the 10% cap regime and this proportional difference is reasonably steady through the seasons for most waterways. The difference between the two allocation regimes is more modest for some of the smaller streams. The Papawai Stream seems to be an exception in that the 10% cap regime would actually be more favourable for water users than the 50% regime (this is because of the proportion of time spent just over median flow where taking 10% of total flow equates to a greater volume than 50% of flow above median).

6.18 Findings from the analysis of core allocation shortfall in the Parkvale catchment are summarised in Figure 6.1. Of the five years between 2008/09 and 2012/13, shortfalls in allocation occurred in three, with the most significant shortfall was in the summer of 2012/13 where users were fully restricted almost continuously for three months. In two of the shortfall years (2008/09 and 2010/11), harvesting under both the 50% and 10% cap regimes (supplemented by core allocation harvesting above median flow) would have easily met the shortfall. In 2012/13, the shortfall far exceeded the amount that could have been harvested by either regime (which was about the same). Across the five years the total sum of allocable water under both supplementary regimes more than meets the core allocation shortfall.

Table 6.1. Median hydrological alteration by season (comparing 50% cap with 10% cap)

River	Mean flow	Median flow	Flow alteration – median % change 50% cap [10% cap]			
			Winter JJA	Spring SON	Summer DJF	Autumn MAM
Papawai Stream	360	290	15 [10]	7 [7]	0 [0]	2 [3]
Otukura Stream	540	400	26 [10]	13 [7]	0 [0]	0 [0]
Pauatahanui Stream	690	365	6 [7]	8 [7]	0 [0]	0 [0]
Parkvale Stream	760	690	20 [10]	8 [10]	0 [0]	0 [0]
Kopuaranga River	1210	1265	3 [3]	0 [0]	0 [0]	0 [0]
Mangatarere River	1800	880	1 [3]	1 [3]	0 [0]	0 [0]
Wainuiomata River	2320	1230	8 [7]	6 [7]	0 [0]	0 [0]
Tauweru River	5024	1360	5 [3]	8 [7]	0 [0]	0 [0]
Whareama River	7920	7640	0 [0]	0 [0]	0 [0]	0 [0]
Waiohine River	29000	18305	0 [7]	1 [3]	0 [0]	1 [3]
Otaki River	30450	16500	0 [3	2[3]	0 [0]	0 [0]

Table 6.2. 80th percentile hydrological alteration by season (comparing 50% cap with 10% cap)

River	Mean flow	Median flow	Flow alteration – 80th percentile change (i.e. reduction in flow) 50% cap [10% cap]			
			Winter JJA	Spring SON	Summer DJF	Autumn MAM
Papawai Stream	360	290	21 [10]	11 [10]	0 [0]	6 [10]
Otukura Stream	540	400	35 [10]	20 [10]	0 [0]	6 [3]
Pauatahanui Stream	690	365	25 [10]	19 [10]	2 [3]	6 [3]
Parkvale Stream	760	690	30 [10]	16 [10]	0 [0]	5 [3]
Kopuaranga River	1210	1265	24 [10]	15 [10]	0 [0]	6 [3]
Mangatarere River	1800	880	22 [10]	11 [10]	0 [0]	11 [3]
Wainuiomata River	2320	1230	25 [10]	15 [7]	0 [0]	5 [3]
Tauweru River	5024	1360	31 [10]	26 [10]	0 [0]	8 [3]
Whareama River	7920	7640	2 [3]	14 [7]	0 [0]	4 [3]
Waiohine River	29000	18305	21 [10]	13 [10]	1 [3]	15 [10]
Otaki River	30450	16500	20 [10]	19 [10]	8 [7]	5 [4]

Table 6.3. Difference in allocable volume under the 50% and 10% cap regimes

River	Mean flow	Median flow	Seasonal allocable volume Percentage difference between 50% cap and 10% cap[1]			
			Winter JJA	Spring SON	Summer DJF	Autumn MAM
Papawai Stream	360	290	38	-24	8	-28
Otukura Stream	540	400	58	29	-13	48
Pauatahanui Stream	690	365	56	50	46	54
Parkvale Stream	760	690	59	37	26	36
Kopuaranga River	1210	1265	57	51	50	46
Mangatarere River	1800	880	52	49	51	53
Wainuiomata River	2320	1230	54	40	44	46
Tauweru River	5024	1360	69	63	50	63
Whareama River	7920	7640	62	48	50	58
Waiohine River	29000	18305	51	50	45	51
Otaki River	30450	16500	49	49	48	51

[1] Positive number means 50% cap volume is higher, negative number the 10% cap volume is higher

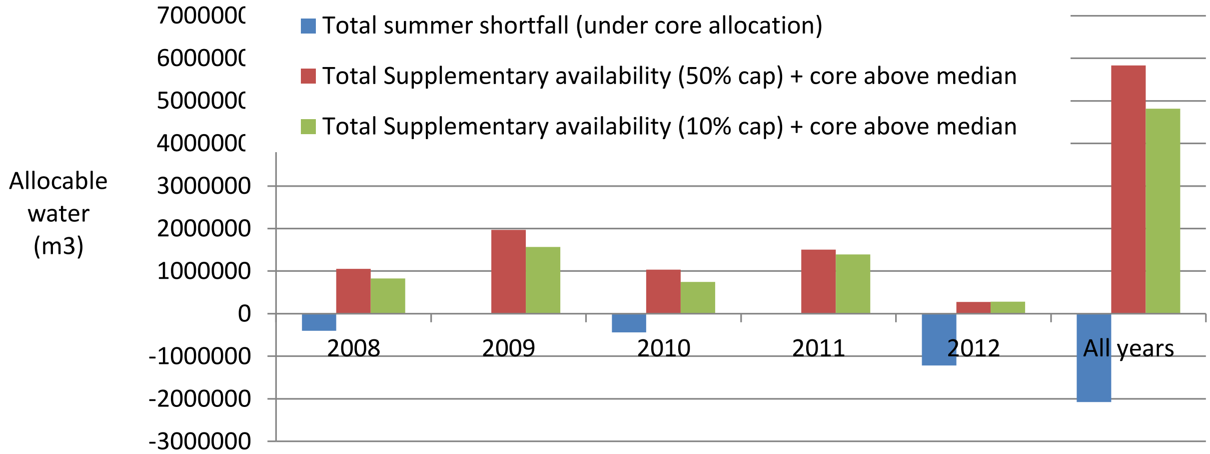

Figure 6.1. Parkvale Stream catchment. Comparison of core (below median) allocation shortfall in summer months with supplementary (+core above median) allocation that could have been stored.

Conclusions

6.19 The analysis of a broader range of rivers/streams over a longer time period (five years) has confirmed the finding in my original evidence that the proportional flow alteration of smaller streams under the 50% cap regime is significantly higher for longer durations than for larger rivers durations (as evidenced by the median results in Table 6.1).

6.20 However, there are some aspects of the new analysis that suggest the policy wording as currently proposed may be overly conservative and not achieving the appropriate balance between instream and out of stream values that the pNRP advocates for. Firstly, there is a strong seasonal element to the level of flow alteration. In summer and autumn there is very little difference in terms of instream impacts between the 50% cap and 10% cap regimes but the small amount of extra water that could be drawn under the 50% cap regime in these seasons may be of material benefit to water users.

6.21 Secondly, the currently proposed flow threshold to separate large from small rivers (mean flow of 5 m^3/sec) does not appear to be particularly well supported by the evidence when a wider range of rivers is considered than was previously. Table 6.1 especially (median results) does not show any notable change in the degree or pattern of alteration between rivers above and below the 5 m^3/sec threshold. Rather, the most significant differences (when considering median results) associated with the 50% cap regime appear to be limited to streams with mean flow rates of less than 1 m^3/sec. And more specifically, of the streams considered in this analysis, it is the ones that are essentially spring-fed on the Wairarapa Valley floor that are most affected (rather than all types of small stream, e.g. Pauatahanui Stream).

6.22 The Tauweru River is the only waterway in this analysis that stands out as having a mean flow of greater than 1 m^3/sec but also relatively significant flow alteration under the 50% cap compared with the 10% cap regime. However, this distinction only becomes apparent when considering the 80th percentile results (Table 6.2) rather than the median results so equates to a lower overall risk than for the smaller streams.

6.23 Overall, in my opinion the results of this analysis confirm there is a valid argument for making a distinction between large and small rivers/streams (based on flow rate) when allocating supplementary flow. However, the flow threshold used to make this distinction could justifiably be reduced from 5 m^3/sec (currently proposed) to 1 m^3/sec to ensure that the policy more appropriately targets the streams of highest risk and does not unreasonably lock up water where impacts of the 50% cap regime are likely to be minor.

6.24 My analysis of Parkvale Stream (Figure 6.1) suggests that, compared with a 50% cap, the 10% cap regime is unlikely to fundamentally change the capacity for supplementary allocation to meet shortfalls experienced under current core allocation provisions.

6.25 There will be circumstances when streams with a mean flow of less than 1 m^3/sec can still support a supplementary allocation regime based on the 50% cap but I suggest these are best dealt with on a case by case basis using the discretion that is already available in the pNRP when allocating supplementary flow. Likewise there may be circumstances when rivers with a mean flow of greater than 1 m^3/sec need to be treated with a little more caution than the 50% cap regime allows and these could also be dealt with case by case using available discretion.

6.26 I also am of the view that discretion could be used to allow takes from small streams with a 10% cap regime to take higher amounts during summer and autumn months (but not exceeding the 50% cap). The impact of this on the stream is likely to be minor but the benefit could be material.

6.27 In Fish & Game's submission (paragraphs 32 and 33), Mr Wilson suggests that the implementation of the supplementary allocation policy with respect to trigger levels and other methodology should be more clearly spelt out. I agree this would be helpful for applicants and Council consent officers alike and I have made some suggestions in Attachment C of this evidence. Primarily, I have covered how the supplementary allocation amount for an individual take should be calculated and listed management points (flow monitoring sites) and median flow trigger values for catchments where these are available. It may be useful for this to form the basis of a schedule in the Plan.

6.28 In paragraph 34, Mr Wilson suggests a ‘block’ allocation regime should be considered rather than the proportional flow sharing (50% or 10% of flow) regime that GWRC has opted for. This would, as I understand it, involve defining blocks of supplementary allocation (in L/sec) for specific catchment areas. I agree with Mr Wilson that this would provide greater certainty to users about how much water is generally available. It may also be simpler to administer in some senses. However, I also think it potentially reduces some of the flexibility that the flow sharing regime allows for blocks of allocation to be tailored to site specific characteristics and individual users needs (within the limits of the flow sharing regime). Certainty for users about water availability can still be achieved by accounting for individual blocks in a supplementary allocation database operated by GWRC, which will also ensure catchment limits are not exceeded.

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Attachment A. Change in allocation status under proposed default limits

Table A1.1. Existing consented allocation versus allocation amounts – Kapiti Coast and Wellington/Hutt

	Existing consented use **well below** RFP core allocation limit or pNRP default amount – therefore **allocation available**
	Existing consented use **slightly below** RFP core allocation limit or pNRP default amount – therefore **some allocation available**
	Existing consented use **at or above** RFP core allocation limit or pNRP default amount – therefore **no allocation available**

Part of region	River	Existing consented use (L/sec)[1]	pNRP allocation amount (L/sec)	Comparing allocation status under existing (RFP) and new (pNRP) Plan		
				Column 1 Status under existing RFP core allocation limit (considering only direct surface water takes)	Column 2 Status under existing RFP core allocation limit when stream depleting groundwater takes accounted for as well as direct surface water takes	Column 3 Status under pNRP with default allocation amounts for each sub catchment
Kapiti Coast	Waitohu Stream	10	45			
	Otaki River	360	1970			
	Mangaone Stream	25	45			
	Waikanae River	495	220	No limit	No limit	
Wellington/Hutt	Hutt River	2425	2140	No limit	No limit	
	Wainuiomata River	460	180	No limit	No limit	
	Orongorongo River	460	95	No limit	No limit	

[1] Includes all direct surface water and stream depleting groundwater consented takes

Table A1.2. Existing consented allocation v allocation amounts – Ruamahanga River catchment

	Existing consented use **well below** RFP core allocation limit or pNRP default amount – therefore **allocation available**
	Existing consented use **slightly below** RFP core allocation limit or pNRP default amount – therefore **some allocation available**
	Existing consented use **at or above** RFP core allocation limit or pNRP default amount – therefore **no allocation available**

Part of region	**River catchment management sub-unit**	**Existing consented use (L/sec)** [1]	**pNRP allocation amount (L/sec)**	**Comparing allocation status under existing (RFP) and new (pNRP) Plan**			
				Column 1 **Status under existing RFP core allocation limit (considering only direct surface water takes)**	**Column 2** **Status under existing RFP (1998) core allocation limit when stream depleting groundwater takes accounted for as well as direct surface water takes**	**Column 3** **Status under pNRP with default allocation amounts for each sub catchment**	**Column 4** **pNRP with default limits when whole of catchment status is accounted for**
Ruamahanga	Kopuaranga River	150	180				
	Waipoua River	130	145				
	Waingawa River	1200	920				
	Upper Ruamahanga River	955	1200				
	Parkvale Stream	150	40				
	Booths Creek	110	25				
	Mangatarere Stream	470	110				
	Waiohine River	1005	1590				
	Papawai Stream	340	105				
	Middle Ruamahanga River	975	1240				
	Lower Ruamahanga River	1920	1370				
	RUAMAHANGA	7460	7430	No limit	No limit		
Lake Wairarapa	Otukura Stream	140	30				
	Tauherenikau River	235	410				
	LAKE WAIRARAPA	1800	1800	No limit	No limit		

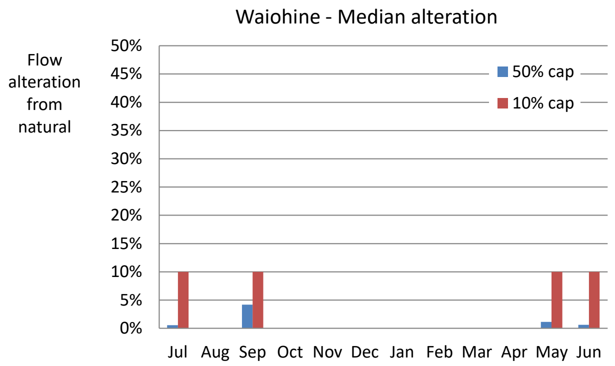
[1] Includes all direct surface water and stream depleting groundwater consented takes

Attachment B

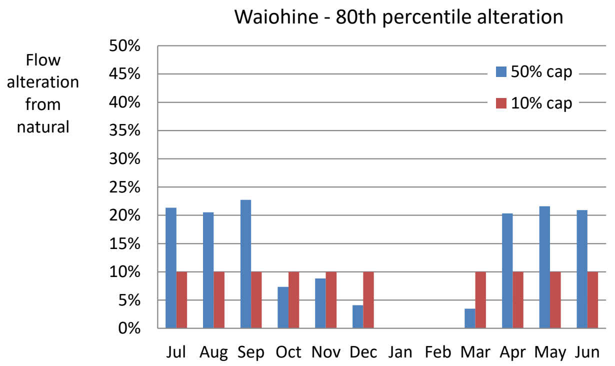
Hydrological alteration and allocable volume under alternative supplementary allocation regimes (50% cap and 10% cap)

Waiohine River

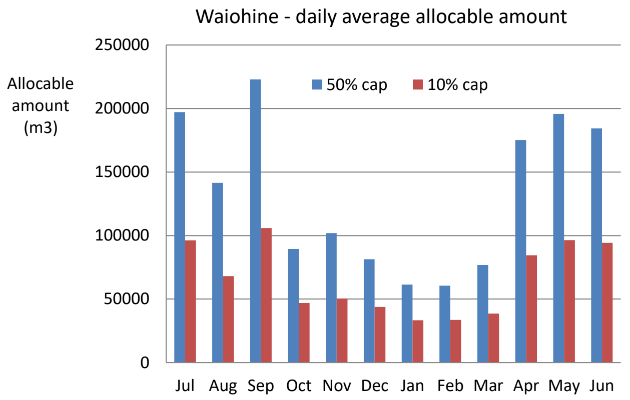
Median hydrological alteration



80th percentile hydrological alteration

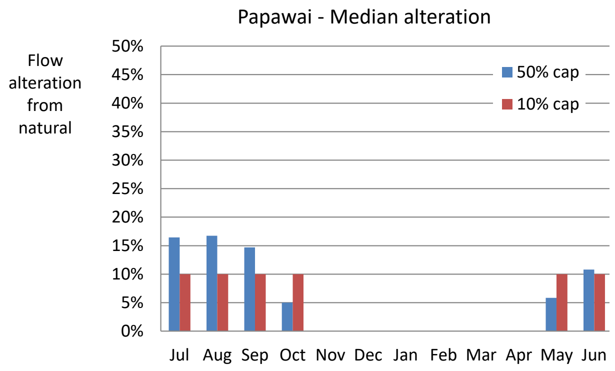


Allocable amount



Papawai Stream

Median hydrological alteration



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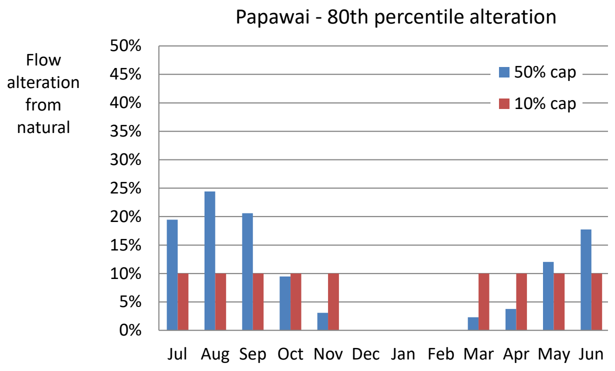
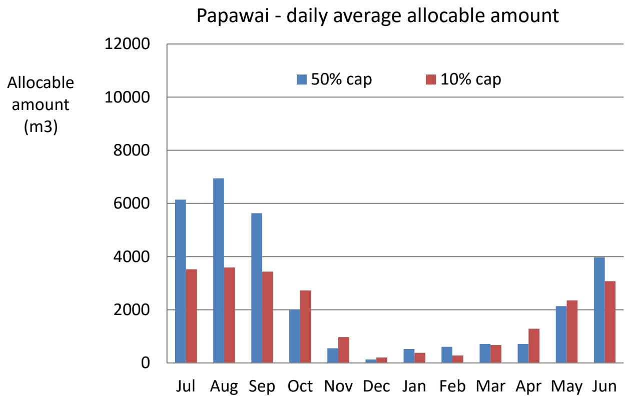
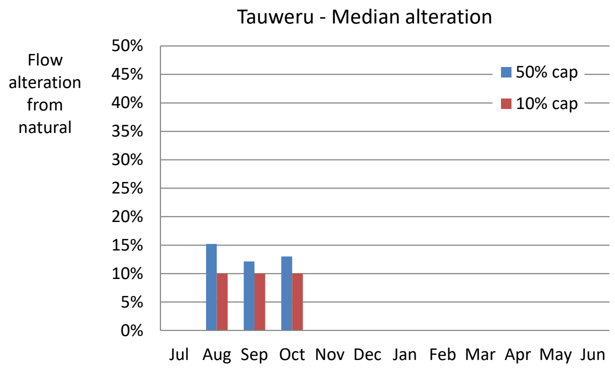


Allocable amount



Tauweru River

Median hydrological alteration



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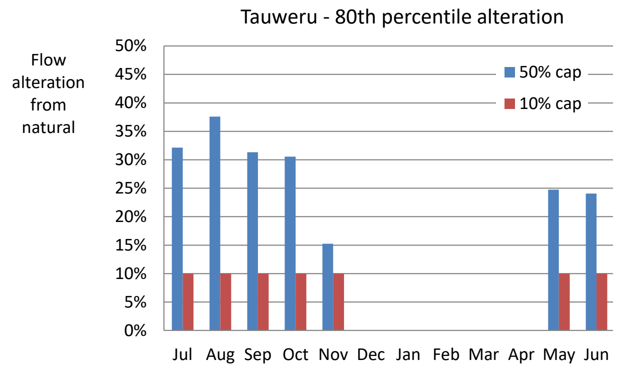
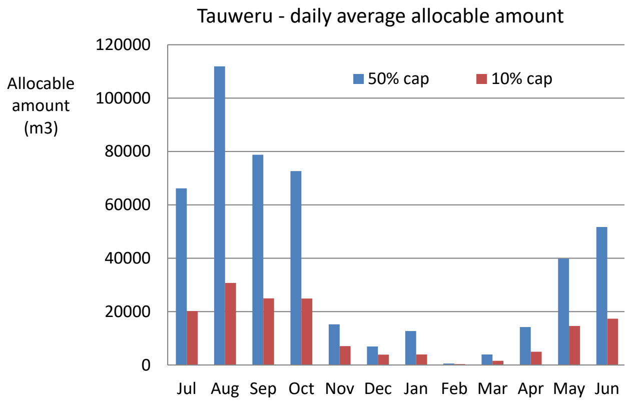
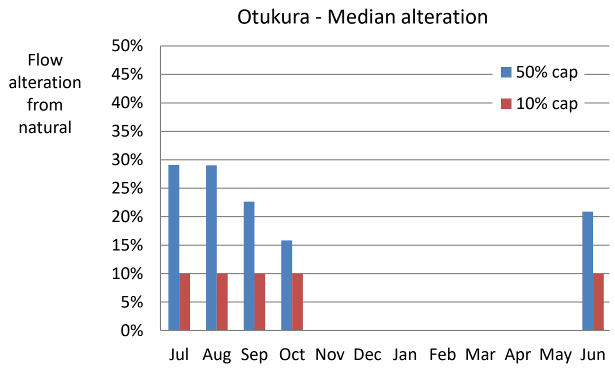


Allocable amount

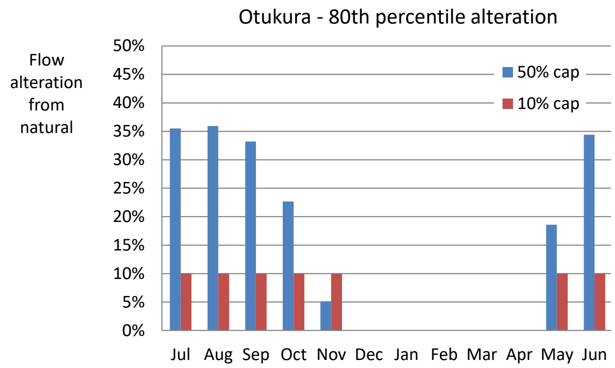


Otukura Stream

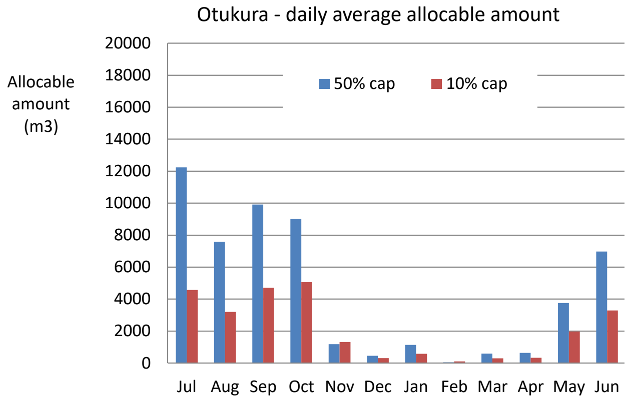
Median hydrological alteration



80th percentile hydrological alteration

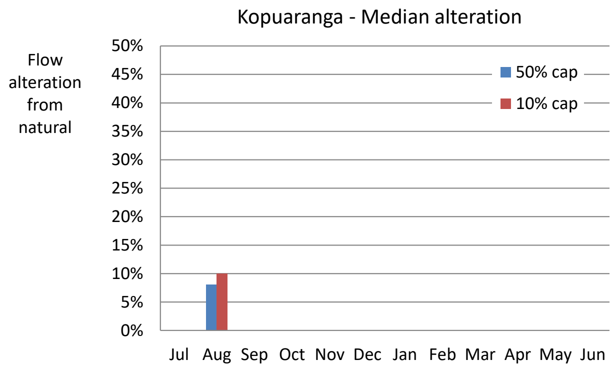


Allocable amount

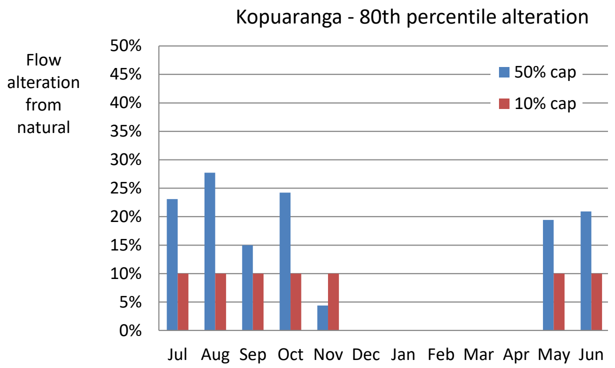


Kopuaranga River

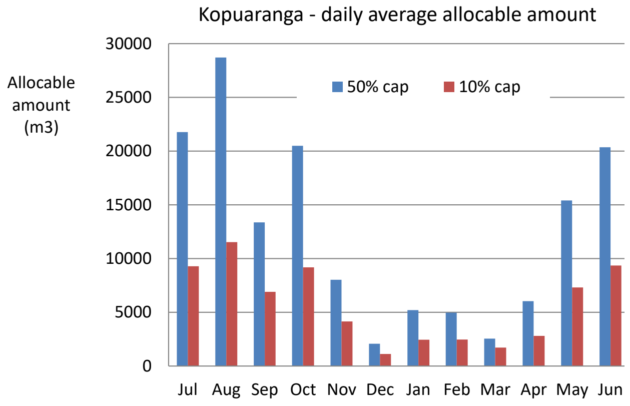
Median hydrological alteration



80th percentile hydrological alteration

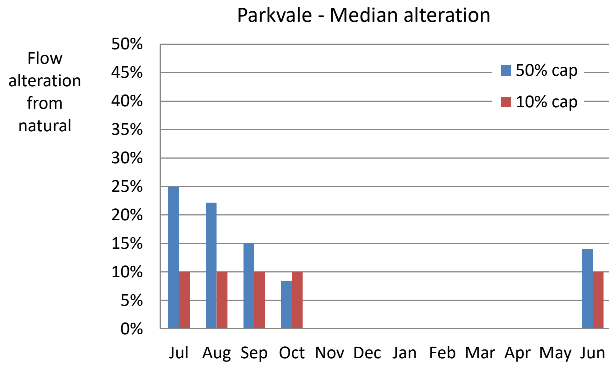


Allocable amount

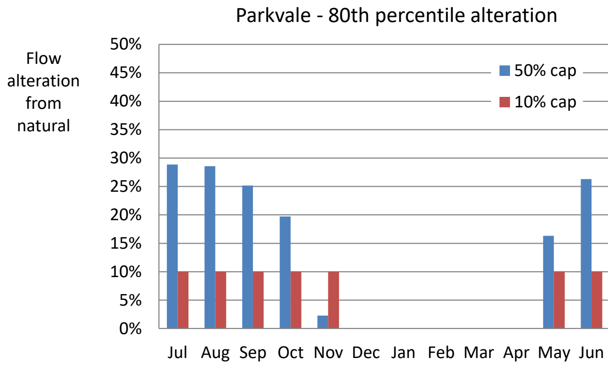


Parkvale Stream

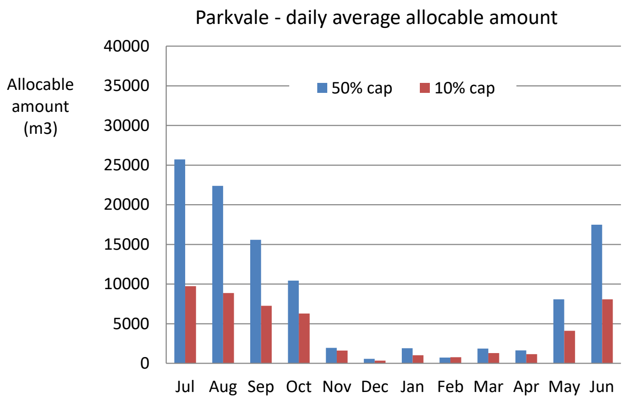
Median hydrological alteration



80th percentile hydrological alteration

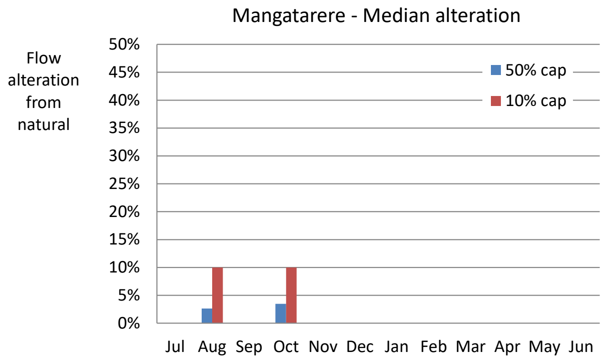


Allocable amount



Mangatarere Stream

Median hydrological alteration



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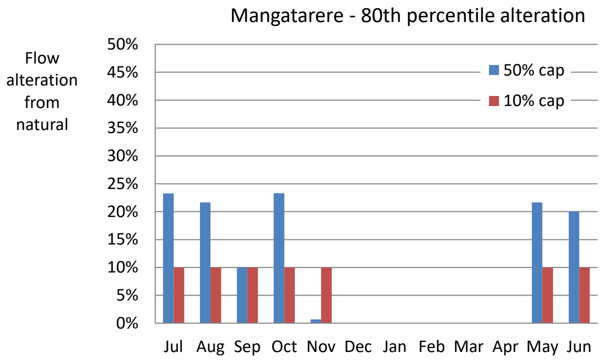
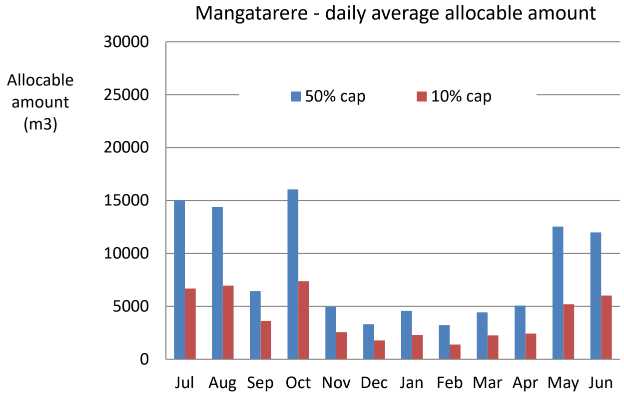
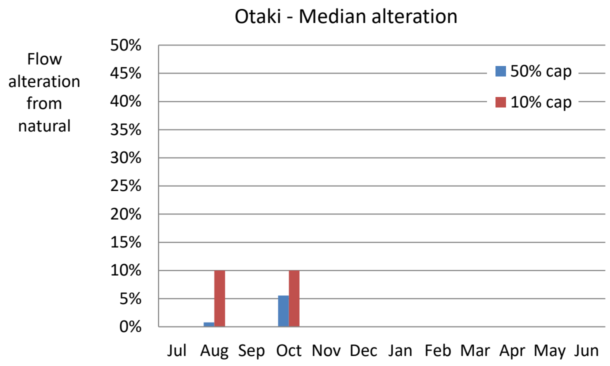


Allocable amount

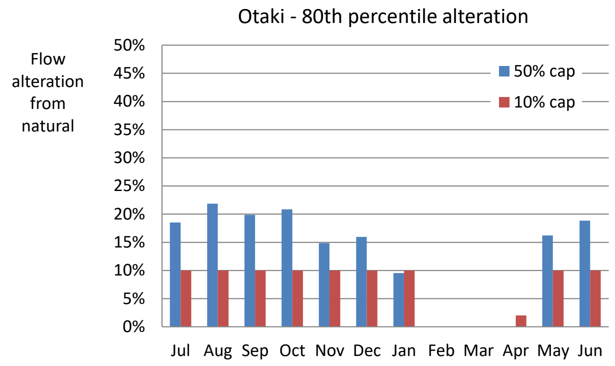


Otaki River

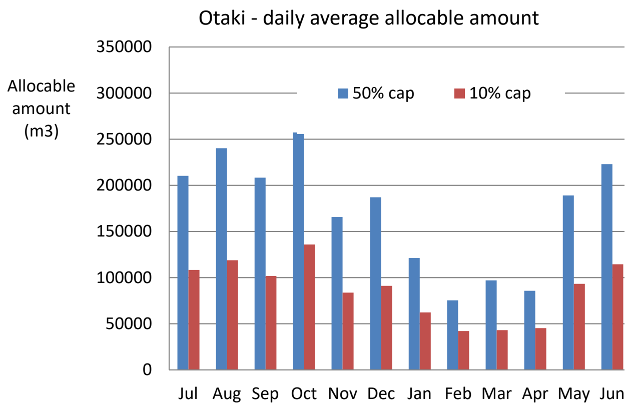
Median hydrological alteration



80th percentile hydrological alteration

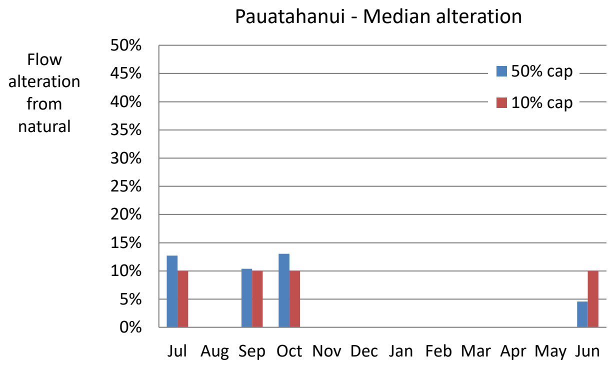


Allocable amount

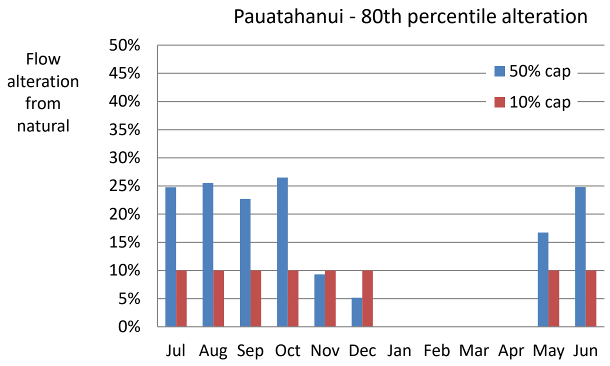


Pauatahanui Stream

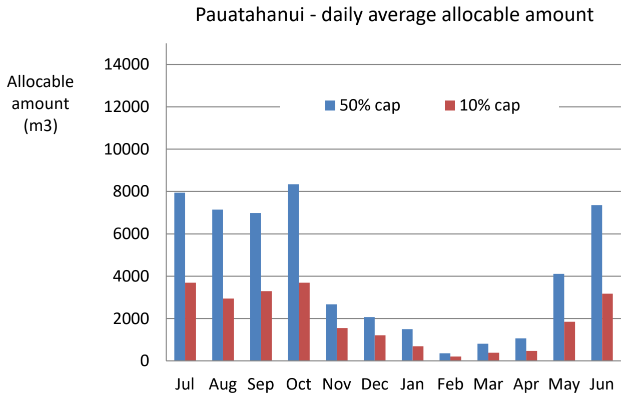
Median hydrological alteration



80th percentile hydrological alteration

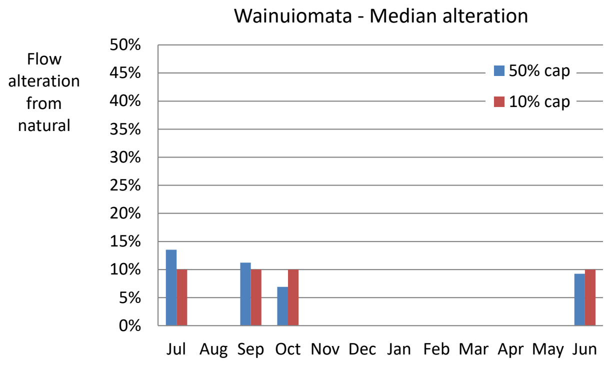


Allocable amount

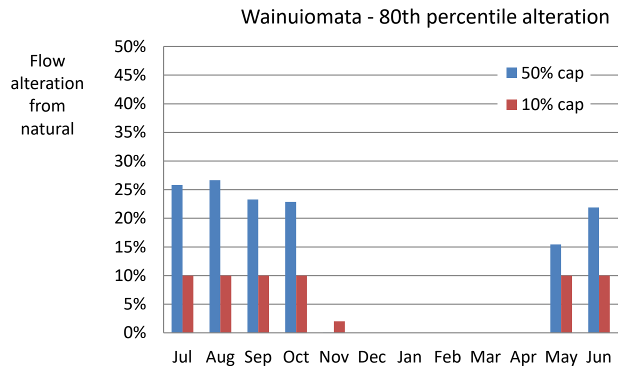


Wainuiomata River

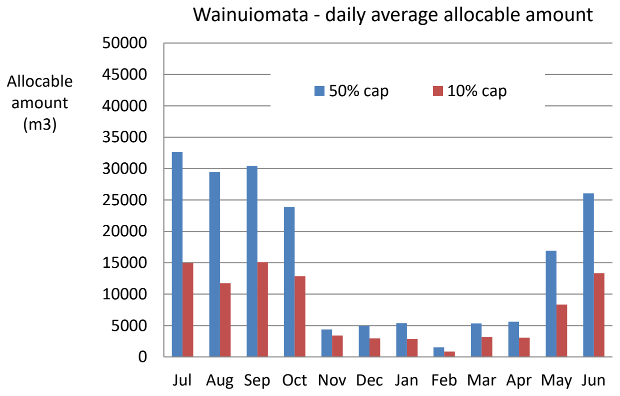
Median hydrological alteration



80th percentile hydrological alteration

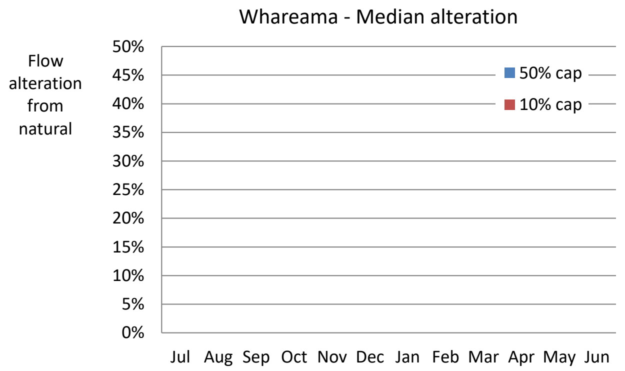


Allocable amount

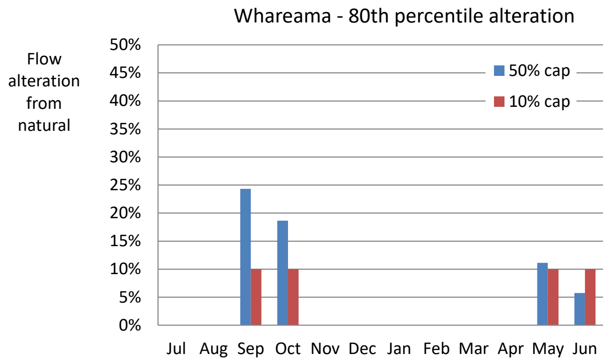


Whareama River

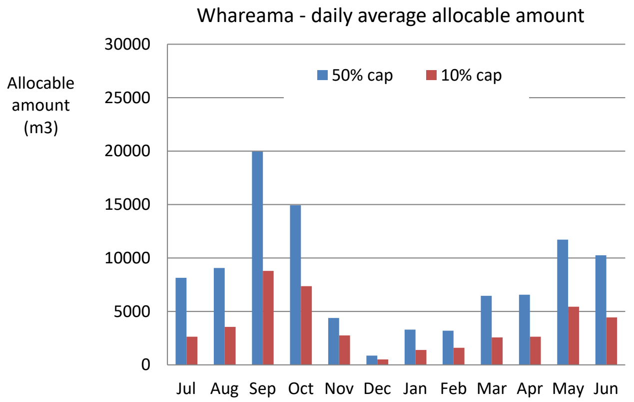
Median hydrological alteration



80th percentile hydrological alteration



Allocable amount



Attachment C

Guideline for implementation of supplementary allocation policy

When rivers are flowing at a rate above median flow, supplementary allocation may be taken in addition to core allocation (in accordance with P117 and WH.R1, K.R1 and R.R1).

The following approach will be used to determine when supplementary allocation can be taken and the supplementary allocation amount (in L/sec):

- The flow at which the supplementary take must cease is the median flow measured at the management point (telemetered flow monitoring site) for that catchment [see **Notes 1** and **3**].

- The maximum amount of available allocation will be calculated as:

For takes from rivers (and their tributaries) in Table 1 [mean flow > $1m^3/sec$]	**For takes from rivers (and their tributaries) in Table 2** [mean flow < $1m^3/sec$]	**For takes from rivers (and their tributaries) not listed in Table 1 or Table 2**
50% of the portion of natural flow (at point of take) above median minus all existing upstream supplementary allocation *[see **Note 2**]*	*10% of total natural flow at point of take minus all existing upstream supplementary allocation* *[see **Note 2**]*	*10% of total natural flow at point of take minus all existing upstream supplementary allocation* *[see **Notes 2** and **3**]*

This calculation may be made for one or more flow bands above median flow (depending on individual circumstances) to arrive at one or more allocation blocks specific to the take. Each block will have a flow threshold referenced to the management point**.**

- The take must not cause total supplementary allocation at any downstream location to exceed the amounts relevant to that downstream location.

- Calculation of the amount of flow available above median flow at the point of take may require site specific flow measurements to be supplied by the consent applicant. This will normally take the form of a flow correlation between the point of take and the relevant management point.

Note 1.

The time interval over which compliance should be checked needs to reflect risk to the river but also take into account practical considerations (eg, over what time intervals should water users be reasonably expected to check and respond?). During a flow recession, especially in summer, river flows in some rivers and streams can transition from well above to well below median within hours rather than days. Therefore it may be necessary for compliance with the supplementary flow threshold in these rivers to be based on relatively instantaneous data (e.g. water users should check every few hours and respond accordingly). On larger rivers (such as the Ruamahanga) the recessions below median to low flows occur much more slowly (over many days) and the time interval for compliance check-and-respond can be greater. Flow for management points should be published and updated on the GWRC website at time intervals appropriate to the catchment, along with an alert when flow has risen above or fallen below median.

Note 2.

In general, median flow is a sufficiently high enough statistic that core allocation (which can also be taken at flow above median) does not need to be accounted for when deriving supplementary allocation flows and amounts. However, in some catchments existing core allocation comprises a relatively substantial portion of main stem median flow (i.e. >20%). In these catchments, discretion should be exercised as to whether core allocation should also be accounted for in the calculation of supplementary flow and the allocation amount.

Note 3.

For takes from rivers (and their tributaries) in Tables 1 and 2 or elsewhere for which no GWRC management point or median flow value is available, calculating the supplementary allocation cease take and allocation amount will be the same as described above, except that:

- *The median flow (L/sec) cease take will need to be either derived from the nearest appropriate telemetered flow monitoring site (based on correlation of data between the point of take and the telemetered flow site) or measured at the point of take by the consent holder with an appropriately configured flow monitoring site.*

- *The allocation amount will need to be calculated from a derived flow record based on correlation of data between the point of take and the nearest appropriate flow monitoring site.*

Table 1. Rivers (and their tributaries) with mean flow of greater than 1 m^3/sec

Whaitua	**River (and tributaries)** [excluding tributaries listed in separate rows of this table or Table 2]	**Management point** [Telemetred GWRC flow monitoring site]	**Median flow (L/sec)**[1]
Kapiti Coast	Waikanae River upstream of the coastal marine area boundary	Wastewater Treatment Plant (WTP) recorder	2,855
	Otaki River upstream of the coastal marine area boundary	Pukehinau recorder	16,080
Hutt/Wellington	Akatarawa River	Cemetery recorder	3,110
	Mangaroa River	Te Marua recorder	1,780
	Te Awa Kairangi/Hutt River downstream of the confluence with the Pakuratahi River	Birchville recorder	11,495
	Wainuiomata River upstream of the coastal marine boundary	*[see Note 3]*	*[see Note 3]*
	Orongorongo River upstream of the coastal marine boundary	*[see Note 3]*	*[see Note 3]*
Ruamahanga	Kopuaranga River upstream of the confluence with the Ruamahanga River	Palmers recorder	1,200
	Tauweru River upstream of the confluence with the Ruamahanga River	Te Whiti Bridge recorder	1,330*
	Whangaehu River upstream of the confluence with the Ruamahanga River	Waihi Recorder	155
	Waipoua River upstream of the confluence with the Ruamahanga River	Mikimiki Bridge recorder	1,825*
	Tauherenikau River upstream of the confluence with Lake Wairarapa	Renalls Weir recorder	4,660
	Waingawa River upstream of the confluence with the Ruamahanga River	Kaituna recorder	4,880
	Mangatarere Stream upstream of the confluence with the Waiohine River	Gorge recorder	880
	Waiohine River upstream of the confluence with the Ruamahanga River	Gorge recorder	12,295
	Huangarua River upstream of the confluence with the Ruamahanga River	Hautotora recorder	850*
	Tauanui River upstream of confluence with the Ruamahanga River	*[see Note 3]*	*[see Note 3]*
	Turanganui River upstream of confluence with the Ruamahanga River/Lake Onoke	*[see Note 3]*	*[see Note 3]*
	Upper and Middle Ruamahanga River upstream of the confluence with the Waiohine River	Wardells recorder	12,270
	Lower Ruamahanga River between the boundary with the coastal marine area and the confluence with the Waiohine River	Waihenga recorder	46,035
Wairarapa Coast	Pahaoa River upstream of the coastal marine area	Hinakura recorder	2,180
	Kaiwhata River upstream of the coastal marine area	*[see Note 3]*	*[see Note 3]*
	Whareama River upstream of the coastal marine area	*[see Note 3]*	*[see Note 3]*
	Awhea River upstream of the coastal marine area	*[see Note 3]*	*[see Note 3]*
	Opouawe River upstream of the coastal marine area	*[see Note 3]*	*[see Note 3]*
	Mataikona River upstream of the coastal marine area	*[see Note 3]*	*[see Note 3]*

[1] Median is calculated from 20 year period of data from 01 July 1997 to 30 June 2017 for all sites except those with an asterisk (*) where the period of record is between 10-15 years. Median flow is generally a very stable statistic over time but these values should be reviewed and updated on a 10 year cycle to account for possible future climate/flow trends.

Table 2. Rivers (and their tributaries) with mean flow of less than 1 m^3/sec

Whaitua	River (and tributaries)	Management point [Telemetred GWRC flow monitoring site]	Median flow (L/sec)[1]
Kapiti Coast	Mangaone Stream upstream of the coastal marine area boundary	Ratanui recorder	200
	Waitohu Stream upstream of the coastal marine area boundary	Water Supply Intake (WSI) recorder	450
Porirua	Pauatahanui Stream upstream of the coastal marine area boundary	Gorge recorder	335
	Horokiri Stream upstream of the coastal marine area	Snodgrass Recorder	300
Ruamahanga	Papawai Stream upstream of the confluence with the Ruamahanga River	Fabians Road recorder	310
	Otukura Stream upstream of the confluence with Lake Wairarapa	Weir recorder	355
	Parkvale Stream upstream of the confluence with the Ruamahanga River	Renalls Weir recorder	550*
	Muhunoa Stream upstream of the confluence with the Waiohine River	*[see Note 3]*	*[see Note 3]*
	Beef Creek upstream of the confluence with the Mangatarere Stream	*[see Note 3]*	*[see Note 3]*
	Kaipatangata Stream upstream of the confluence with the Mangatarere Stream	*[see Note 3]*	*[see Note 3]*
	Poterau Stream upstream of the confluence with the Whangaehu River	*[see Note 3]*	*[see Note 3]*
	Makoura Stream upstream of the confluence with the Ruamahanga River	*[see Note 3]*	*[see Note 3]*

[1] Median is calculated from 20 year period of data from 01 July 1997 to 30 June 2017 for all sites except those with an asterisk (*) where the period of record is between 10-15 years. Median flow is generally a very stable statistic over time but these values should be reviewed and updated on a 10 year cycle to account for possible future climate/flow trends.