Upper Motueka Water Management Review

(including the Tapawera Plains and Motupiko Zones and Water Harvesting and Storage Policy)

Policy Options Paper

Contents

Upper Motueka Water Allocation Review
(including the Tapawera Plains and Motupiko Zones and Water Harvesting and Storage Policy)

Policy Options Paper and Draft Plan Change

August 2014

Purpose of the Report

The report sets out the water management history and provides an update of the technical information and modelling of ground and surface water in the Upper Motueka Water management zones. It considers a range of possible responses and describes the Council's preferred option.

1 Executive Summary

This report describes the history of management in the upper Motueka catchment and introduces the results of new water resource investigations

The new investigation included modelling that explains in detail the patterns of water flow between groundwater and the Motueka River. It shows that additional water can be allocated from the lower part of the existing Tapawera Plains Zone without adverse effect on river values and water users' security of supply

This has prompted the need to consider additional rationing provisions that reflect the connection between water use in the Tapawera Plains and the Motueka River above its confluence with the Wangapeka River more accurately. In addition, installation of water meters for all permits has now occurred since upper Motueka water management provisions were added to the Plan. This means a more targeted approach to managing water takes to ensure water flows are maintained in the relevant rivers and still maintain water users' security of supply as much as possible can now be adopted.

New water takes will be required to setback from the relevant rivers to take advantage of the buffering provided by groundwater takes and reduce impacts on spring flow.

The Motupiko and Rainy River catchments are contained in the same water management zone subject to the same allocation limit and a small amount of water has become available for allocation following a review of permits. However, the Rainy River catchment is considered fully allocated on the basis of river flow and security of supply standards.

Permits in the Motupiko are only subject to a rationing trigger based on Motueka River flows while the Rainy River permits are also subject to a trigger based on Motupiko River flows. There is no trigger for Motupiko water takes based on Motupiko River flows. There is an opportunity to update these provisions to ensure consistency and transparency.

Recent water permit applications to take water to storage, including one for the Wangapeka River have highlighted a need to consider further guidance and interpretation of the policy that promotes harvesting of water at times of high flow and storage for later use.

This report considers the issues and options and includes a draft Plan Change implementing the recommendations.

2. Background

2.1 History of Management Actions

The Council introduced water management provisions (Part V of the Plan) in 2001 including allocation limits for the Motueka Plains Zones. It introduced an allocation limit of 700 l/sec for the catchments above Woodstock. It was based on the need to maintain minimum flows in the Motueka River that would allow the requirements of the Water Conservation Order for the Motueka River to be met. As a result of submissions, further analysis of the contributions from the main tributaries of the Motueka led to the inclusion in 2004 of separate management zones and allocation limits for the Motupiko, Wangapeka and Tapawera Plains.

The analysis required for setting these limits confirmed that there was insufficient water in the Motupiko and Tadmor catchments to meet demand for irrigation of all potentially irrigable land. There was also unmet demand for irrigation water within the Tapawera Plains Zone and a waiting list has been maintained for some years.

The allocation limits were set in relation to total abstraction of ground and surface water within the relevant zones. While it was known that all groundwater abstraction would not have the same river depletion effects (depending on location and depth) there was no hydro-geological information to enable a more sophisticated approach to the setting of sustainable limits.

At this time, very little hydro-geological work had been undertaken to quantify the groundwater interaction with Motueka River flows, groundwater availability in these river terraces, their link to the river, the recharge components (river and rainfall), and the groundwater quality. This data is critical in the accurate evaluation of river depletion effects due to groundwater abstraction, as well as to determine holistic and integrated allocation limits for the resource i.e. surface and groundwater and effects of this on river flow.

Work then commenced by Landcare Research and other stakeholders on the Motueka Integrated Catchment management project (Motueka ICM). A key output of the ICM project in 2005 was the development of a computer model for the river-aquifer system between the Goldpine Mill on the Upper Motueka and the Wangapeka confluence.

2.2 New Modelling Results

The model was reapplied in 2013 using actual data gathered since the Tapawera Plains Zone became fully allocated in 2008, with all takes having water meters by then.

The modelling and investigation shows the pattern of water losses and gains to the Motueka River from groundwater aquifers adjacent to the river. The technical information is in the report Landcare Research: Water Allocation Limits for the Upper Motueka Catchment Fenemor A and Thomas J, 2013[1].

In particular, the investigation showed water generally flows into groundwater from the river downstream of Kohatu. River flows increase again downstream of the Tapawera Bridge.

2.3 Management Scenarios

A number of management scenarios (principally for increased irrigation) looking at various irrigation area combinations based on what is now known about aquifer/river water relationships were modelled. Other commercial or industrial water uses within any allocation limit are also possible, but waiting lists for further irrigation would account for any new allocations within any new limit.

The scenarios modelled were:

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[1]Water Allocation Limits For The Upper Motueka Catchment: Andrew Fenemor, Landcare Research, Nelson Joseph Thomas, Resource Scientist, TDC September 2013.

- Status quo water use
- All irrigable land at maximum allocation and use
- All irrigable land at actual water (metered) use
- New zone below bridge with irrigation at actual water use on all irrigable land

Additional scenarios that predict the impacts of:
- River bed level changes in the Motueka River,
- Changes in land cover, and
- Climate change

were also considered in this review. Bed levels are being managed in the Motueka so that further degradation is avoided and the need to account for this effect is not considered necessary.

Land use change to plantation forest is possible, though not particularly likely, on hill country to the east of the Tapawera Plains. The impact of afforestation here is not likely to be significant as the land area is only a small proportion of the total land area and effects likely to be insignificant. Afforestation to the west of the new zone is possible but given the scale of already afforested areas further significant afforestation is unlikely.

2.4 Motueka River Tributaries – Motupiko and Rainy Rivers

The Motupiko Zone has been fully allocated since 2001 and a waiting list is being maintained. Consents in this Zone are subject to conditions requiring rationing in relation to both the Woodstock trigger and to a specific winter time flow trigger that maintains trout spawning of 500 litres/second in the Motupiko River immediately above its confluence with the Motueka River (at N28:961 731) (during May to October inclusive).

The Rainy River is a tributary of the Motupiko River and is currently within the same water management zone. The two Rainy River water permits are subject to summer rationing (based on flows in the Motupiko at Christies).

Neither the Motupiko nor the Rainy River has a summer rationing trigger specified in the TRMP.

Both the Rainy and the Motupiko rivers are subject to provisions in the Motueka River Water Conservation Order with specific value as trout spawning rivers contributing to the trout fishery of the Motueka River. In addition, the upper Rainy River has wild and scenic value.

During the most recent droughts (2007 and 2013) Step 1 rationing was imposed on Motupiko Zone under Section 329 water shortage directions.

3. Policy Framework

There are existing policies and provisions with which any proposal to amend allocation limits must be consistent. They include:
- The Tasman Regional Policy Statement (RPS)
- The Tasman Resource Management Plan (TRMP)
- The National Policy Statement for Freshwater Management 2011 (NPSFM) including proposed amendments to the NPS
- The Water Conservation (Motueka River) Order 2004 (WCO)

The policies and provisions of the RPS and TRMP are related and consistent with each other. The TRMP contains more specific and up-to-date provisions. The plans require the management of water quantity within limits that reflect instream and other values of water bodies and reasonable security of supply for water users. The plans require water quality to be managed so that the needs of water values and uses can be met. Water quality is required to be maintained or improved.

3.1 Water Conservation Order

The Order requires protection of the trout fishery in this part of the Motueka River by ensuring no more than a 12% change in flows at Woodstock as a result of activities that alter the flow, including water takes.

Other provisions in the WCO require protection of water quality, including requirements for clarity and suspended solids, temperature, pH, periphyton and bacteria.

3.2 Tasman Resource Management Plan

The Plan contains a number of provisions that are relevant to this Plan Change proposal:

3.2.1 Water Quantity

The management objectives for the Motueka River are already contained within Schedule 30A of the Plan. The Plan Change proposal does not seek to amend these and ensures that these values will continue to be provided for.

Relevant policies include:

30.1.3.1	Managing flows so that values and uses of water bodies maintained.
30.1.3.4	Establishing sustainable yields for aquifers.
30.1.3.6	Accounting for water yield effects of activities and events.
30.1.3.7	Adopting allocation limits in the Motueka Catchment that account for irrigation in all sections of the catchment.
30.1.3.10	Preferring groundwater over surface water takes in the Motueka catchment.
30.1.3.11	Accounting for ground and surface water interactions in setting limits.
30.2.3.6	Priority in time allocation
30.2.3.16	Security of supply standards

The TRMP ensures the provisions of the WCO are complied with by managing abstractive use through the establishment of minimum flows, allocation limits and rationing triggers.

3.2.2 Water Quality

Water quality policies generally seek to maintain or improve water quality so that the needs of identified water values and uses can be met.

Relevant policies include:

33.1.3.1–4	Maintaining or improving water quality to meet needs of water uses and values
33.1.3.7	Working with stakeholders to understand and develop good management practice
33.1.3.8	Managing non-point source contamination of water
33.1.3.11	Improving water quality affected by disease-causing organisms, dissolved oxygen, fine sediment or nutrients.

Recent Plan Changes (PC45 – 48) have introduced new specific requirements for irrigation management plans as part of managing nutrient leaching risks from irrigated land uses.

Water permits will also be subject to requirements for recording stock and plant production and nutrient usage to assist with future limit setting and modelling. This work is part of preparing nutrient management provisions that are still to be developed further.

3.3 The National Policy Statement for Freshwater Management 2014

The NPS requires the setting of objectives and limits to manage both water quality and water quantity.

Management objectives for the Motueka are already contained in Schedule 30A.

This Plan Change proposal alters an existing zone and establishes a new management zone and allocation limit that refines existing water allocation provisions and meets the requirements of the relevant NPS Policies B1, and B2.

The NPS also requires setting freshwater quality limits to avoid over- allocation (Policy A1).

The Motueka River and adjacent groundwater are currently of high water quality and meet the needs of the values and uses already established. The Council's NPS Implementation Plan commits Council to preparing plan provisions to manage contaminants as part of a catchment based approach for the Motueka River by 2018.

The NPS further requires that any plan change manages impacts of activities on both water quality and quantity in an integrated fashion (Policy C1).

There is a potential risk to water quality as a result of nutrient leaching or run-off caused by poor land management practices and as land use intensifies, including through inefficient irrigation, high stocking rates or inappropriate nutrient management. The risk is dependent on the pattern of land use change.

This Plan Change proposal considers those risks and addresses measures to ensure integrated management of freshwater and the use and development of land as required by Policy C1.

The NPS contains two compulsory values for which water must be managed, including aquatic ecosystems and water quality must be suitable for secondary contact recreation.

A number of attributes essential for providing for these values have been included for river water. The relevant attributes are nitrate toxicity and ammonia toxicity, dissolved oxygen (below point source discharges of contaminants), periphyton (using milligrams chlorophyll-a per square meter) and *E.coli* .

3.4 Iwi

There is no relevant iwi environmental management plan that the Council must account for.
The NPSFM requires the Council to take reasonable steps to:

(a) involve iwi and hapu in the management of fresh water and freshwater ecosystems in the region
(b) work with iwi and hapu to identify tangata whenua values and interests in fresh water and freshwater ecosystems in the region and
(c) reflect tangata whenua values and interests in the management of, and decision making regarding, fresh water and freshwater ecosystems in the region.

Tiakina te Taiao indicated a strong interest in the management of the Motueka River and described a deep cultural connection. Tiakina members expressed concern over the current level of management and advised they would strong object to any proposal that would result in any deterioration of the health of the river.

As a result of preliminary discussion about the proposal, Tiakina was provided with a draft of this policy paper.

4. Issues Arising

Initial consultation with iwi and stakeholders about the proposal to increase the allocation limit of the Tapawera Plains was carried out in May 2013. A public meeting was held in Tapawera on 6 May with discussions reflected in the discussion below. Additional written feedback has also been received and is summarised and included in attachment 2.

This feedback from iwi and stakeholders and further staff analysis has raised a number of concerns and opportunities which are covered below.

4.1 Confidence in Model, Data, and Assessment of Effects

A number of parties are concerned about the robustness of the model and the data used to derive the recommendation for an increase in the allocation limit.

Some parties seek further peer review to confirm the approach used. There have already been a series of peer reviews in this work stream.

For the groundwater modelling, which was done by GNS, peer review was done by Andrew Fenemor (Landcare Research) and Joseph Thomas while the model was being developed. The GNS report was reworked as a result.

More independently, the work was reviewed formally by two anonymous reviewers when the research was published in the Journal of Hydrology. That review covered the science of the model, especially the way in which water losses between the upper Motueka River and adjacent groundwater are modelled.

The reviewers observed some deficiencies in the model and these are also noted in the Landcare technical report. The simplifications in the model are not significant considering the authors' recommendations on allocation limits. The recommendation for a new limit is considerably below those tested in the modelling, so are highly conservative.

The report in which the allocation limits are recommended (LC1631) and the associated report to Council take the additional step of summarising relevant modelling results from the GNS model and drawing conclusions about the likely acceptability of the modelled effects on the river flows and groundwater levels, which are quite small. The LC1631 report was internally peer reviewed by Les Basher prior to release by Landcare Research.

4.2 Modelling Data and Interpretation

In general, the queries in respect of the modelling and data used more reflect a lack of familiarity with modelling science than real issues with the accuracy or effectiveness of the model in helping predict and understand the groundwater surface water system.

The model is based on triangulating substantial amounts of real data ranging from groundwater levels to river flow losses, transmissivity and storativity determined from pump testing, isotope analyses to validate groundwater transit times, water chemistry, climate, pumping and metered water use data.

In terms of the robustness and value of the model, it used as good quality datasets as would be available for any groundwater system (Fenemor pers comm).

Specific queries were raised in relation to the following matters.

4.2.1 Significance of Hill Slope Recharge

Hill slope recharge is a small proportion of total recharge which is predominantly from river flow losses near the river and from rainfall recharge across the valley flats.

The main management goal used in modelling was to ensure adequate residual river flows, and hillslope recharge has negligible effect on those.

In any case, Figure 5 of Landcare Research report LC1631 shows that modelled hillslope recharge approximately equals average measured recharge; it only overestimates immediately after rain. For the more critical dry summer periods the model actually underestimates hillslope recharge so is conservative anyway.

4.2.2 Validation and Calibration of the Model

Confidence is gained by looking at the return period for flows and rainfalls of the 2-year calibration period, and relating that to the return period desired for the management regime.

Those return periods are based on much longer periods of rainfall and river flow data. One of the two years of flow data had a return period in the 7-10 year range and the management return period is 10 years so that is near ideal (Fenemor pers comm.) In addition, for higher return periods, a conservative recommendation has been made, (page 17 of LC1631).

It is possible that during a drought of a 20-year return period or more, parts of the upper Motueka River could come close to drying up. The technical report authors stated it would be prudent not to increase the allocation limit above Tapawera because the river reach between Kohatu and Tapawera is the reach where water is more often lost from the river (and hence the impact on aquatic values would increase) compared to downstream of Tapawera where groundwater re-enters the river.

4.2.3 Uncertainties

The report is clear in commenting on the uncertainties around the modelling of the river-aquifer interaction. It is also important to recognise that river gaugings carry high error bounds, particularly loss gaugings when river flows themselves are not entirely stable. The scientific response to this is a high level of precaution in increasing water allocations, which is what has been applied in the recommendations.

4.2.4 Data used in to Inform Modelling Scenarios

The report authors advise that this is actually incredibly fine scale data-rich modelling; a scale that would not ordinarily be affordable for a council (the work was supported by considerable research funding through the ICM project). (Fenemor pers comm.)

There are gauges in the Upper Motueka at Blue Glen, also in the Wangapeka, Motupiko and Tadmor rivers. Flow gauging series are carried out during low flows along the upper Motueka River.

Scenario 1 is irrigation water demand calculated from soil moisture deficits and applied to all the wells existing as at 2008 instead of 2001-3. This is well-established water balance and groundwater modelling methodology.

Scenario 2 is valid as it is based on actual water permits allocations. It may be unlikely under current patterns of use, but site to-site transfers might change this pattern of use.

Scenario 3 is the extreme scenario of applying current irrigation practice across all potentially irrigable land, and as expected, was designed to show that there are limits to the water resource which mean that groundwater cannot fully irrigate the upper Motueka plain. It helps define the upper limits of demand in relation to water availability.

Scenario 4 is a reasonable intermediate level of irrigation to model and used to predict groundwater and river flow outcomes. The point of the modelling project is to help predict and understand the impact of various possible future scenarios.

Scenarios 5 test possible changes in river bed level with 5a representing what groundwater levels would have been like in 1960. Water abstraction does not affect river bed levels.

4.2.5 Impact on Groundwater Levels and River Levels

The report (Landcare 1631) shows that in the river reach from Tapawera Bridge to just above the Wangapeka confluence, the groundwater level could be drawn down by up to 0.2m if the irrigable area below Tapawera Bridge were completely irrigated (modelled scenarios 3 and 4). This is a broad-scale change in the water table, not the drawdown effect of a pumped well, which would be larger. The groundwater drawdown effect is more relevant to managing the spring fed Hinetai Spring.

A drop of 0.2m in groundwater does not draw river levels down by the same amount because water is flowing in from upstream.

4.3 Timing

Landowners seek that allocation limits be revised as soon as possible as any delays prevent uptake of water for new irrigation.

Water users also note that the lead-in time required for planning and installing a new irrigation system is significant. Delays in Plan Change processes also mean opportunity to access available water in time for the next irrigation season of 2014/15 will be affected.

Delays in investment into new irrigation represent an opportunity cost to landowners and the community generally.

4.4 Impact on Motueka River Flows

The proposal is not predicted to affect river flows in the stretch between Kohatu and the Tapawera Bridge. This reach is already affected by the loss of river water to groundwater and further abstraction will impact more significantly on river flow.

The river reach below the Tapawera Bridge is more likely to be affected as the new allocation zone allows for abstraction before groundwater re-enters the river below this.

Abstractions in all the Upper Motueka Water Management Zones are all directed by the minimum flow and rationing trigger at Woodstock, i.e., 7000 l/sec in the Motueka River at Woodstock except for those in the Tadmor Zone (the Tadmor and Hope Rivers have separate triggers.)

An increase in abstraction above this point will theoretically lead to lower flows and therefore increased rationing so that minimum flows are maintained.

A particular issue of concern is that the rationing trigger at Woodstock - below the Wangapeka River is triggered at a point that is significantly influenced by the flows from the Wangapeka and Baton at the bottom of the system.

Concerns are being raised about the pattern of low flows in the Upper Motueka and the impact of existing and new takes on this stretch of the river. While increasing the allocation limit is not expected to increase any adverse effects on the part of the river above Tapawera, the measures for monitoring abstraction effects on the reach below the Tapawera bridge and above the contributions of the Wangapeka Riverare considered inadequate to properly manage the increased abstraction.

The river flow data at Woodstock and the Upper Motueka River has been correlated with flow below the new (lower) Tapawera Plains Zone.

Correlating the flow data for flows above the Wangapeka confluence and the recorder at Woodstock shows that at flows of 7000 l/sec at Woodstock, the flow in the Motueka River above the Wangapeka confluence will be 1400 l/sec.

The WCO specifies a streamflow depletion limit of 12 percent of the natural flow for the Motueka River at Woodstock. This is reflected in the Plan currently and management of rationing is currently described in Schedule 31C as follows:

"(5) For the purpose of implementing rationing to comply with the Motueka WCO flow extraction limits of 12% above Woodstock, and 6% for Wangapeka above Walter Peak, and in the absence of specific groundwater depletion estimates for groundwater allocations, these will be deemed to be depleting stream flows by 80% of their weekly allocation (for streamflow allocations, depletion is 100%). The respective triggers for rationing will be triggered when the sum of these depletions for the Upper Motueka Zone exceeds 13.6% of the actual 7-day flow measured at Woodstock, and for the Wangapeka Zone, exceeds 6.4% of 7-day flows measured at Walter Peak."

These provisions can be updated and reviewed given the completion of the groundwater modelling and also given the installation of water meters by all water users since then.

Rationing will continue to be triggered by the 7000 l/sec flow at Woodstock as this is based on the total allocation for all of the Upper Motueka zones.

A second rationing trigger to provide a more direct link to water takes in the Tapawera Plains Zones that is not overshadowed by Wangapeka flows is being recommended. This should be based on the 1400 l/sec flow is expected in this part of the river when flows at Woodstock are 7000 l/sec.

Furthermore, given that water metering is now carried out by all permit holders, Council's response to rationing can now be informed by real time water use and river flow. The need for any progression of rationing beyond the first step can now be assessed by taking into account actual water use as well as water flows at the time.

In making decisions for rationing, the combination of water use as well as the contribution to Motueka River flows from its tributary rivers will need to be taken into account.

This enables a more sophisticated response to rationing that reflects a similar approach adopted for the Waimea Plains and described by the following section of Policy 30.1.3.19B:

"(b) manages the decision to impose progressive rationing steps in consultation with the Dry Weather Task Force taking into account:
- (i) the time of year and season
- (ii) rate of recession of river flows and groundwater levels and changes in salinity levels in groundwater;
- (iii) the current weather and weather forecast;
- (iv) patterns of current and likely on-going water use;
- (v) the extent and effectiveness of any water saving measures already in place."

4.5 Buffering Effects of New Takes

4.5.1 Motueka River Flows

The impact of water takes direct from the river or immediately adjacent gravels on instantaneous river flow can be avoided if new takes are required to set back from the river.

Existing policy (Policy 30.1.3.10) favours water takes from groundwater or storage to manage this effect. There is currently little in the way of regulatory requirements and it may be referred to only when setting conditions.

The policy might be given better effect if associated with a requirement for new takes within these zones to be set back at least 100m from the river bed (which includes the banks of the river).

4.5.2 Groundwater Fed Springs

The Hinetai Stream is a groundwater fed spring that arises in the lower part of the Tapawera Plains and flows to the Motueka River. It is not separately identified in Schedule 30 of the Plan as having any significant values. There are several unnamed springs and water courses that flow intermittently to the Motueka River. The Hinetai Spring is one of the more significant springs and it does support a freshwater ecosystem.

Increased groundwater abstraction near the Springs may reduce flows in the spring.

Impacts on spring flow may be reduced by ensuring new groundwater takes are set back from the spring by at least 50m.

4.6 Water Temperatures

Concerns have been raised about the effect of the proposal on Motueka River water temperatures.

The ICM research programme[2] developed a groundwater-surface water model to describe the patterns of up-welling and down-welling along the Motueka Valley and to determine the likely influence of groundwater abstraction.

In one of the ICM studies[3], temperature loggers were deployed over 18 months in two gaining reaches of the Motueka River and three reaches that were predicted to be losing water to groundwater. Groundwater inputs had a small effect on water temperature at the reach-scale and modelling suggests that the differences observed were unlikely to result in appreciable differences in trout growth.

Temperatures in excess of 22°C were recorded on multiple occasions at all sites in the river and temperatures regularly exceeded 19°C during the peak foraging period. Thus, it is likely that high summer temperatures reduce the suitability of the study reach of the Motueka River for brown trout and account for the relatively low numbers of trout reported by anglers during summer months.

Comparison of temperatures recorded in reaches of the upper Motueka River that were predicted to gain from groundwater inputs with reaches that lose to groundwater over a 20-month period indicate that that maximum daily water temperatures exceeded 19°C more frequently in losing reaches. There is also evidence of these large-scale groundwater inputs buffering daily fluctuations in temperature in gaining reaches under some circumstances (such as stable, low flows).

The limited extent and depth of these cold-water patches are likely to restrict their contribution to availability of suitable habitat for brown trout within the study reach during summer months. The study concluded that the temperature differences are unlikely to result in appreciable differences in trout growth potential between these reach types.

The exception was Hinetai Spring, which had a mean water temperature of close to 16°C during the period January to March, when temperatures in the river regularly exceeded 19°C (the upper limit for feeding by brown trout). Growth modelling conducted on the temperature regime of Hinetai Spring suggests much higher trout growth potential than in any of the mainstem sites. Water from Hinetai Spring flows for 2.2 km before entering the Motueka River at the downstream end of the study reach. During summer months, brown trout were observed sitting in the cold-water plume at the mouth of Hinetai Stream and moving into the main channel to feed in the evening. Such behaviour would allow fish to utilise the cold-water plume to thermo-regulate when mainstem temperatures are unfavourable while still being able to capitalise on food resources available in the mainstem.

The reach of the river above the proposed new zone (i.e. the reach downstream of Kohatu) has always been relatively warm in summer. It's because the water has flowed down a wide valley with a northerly aspect, with minimal inputs from cooler tributaries. Temperatures of 22 to 24 degrees have been regularly noted on gauging cards and while a natural phenomenon, could be aggravated by further abstractions that affect the loosing reach of the river.

Below the Tapawera bridge, the Motueka River gets cool water injections from groundwater, as well as the Wangapeka, Baton, Pearse, Graham, Pokororo rivers etc. This proposal does not affect the loosing reach.

4.7 Security of Supply

A higher rate of water abstraction and no alteration to the trigger for rationing means that rationing may be imposed slightly more often.

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[2] Report ref required

[3] Significance of river-aquifer interactions for reach-scale thermal patterns and trout growth potential in the Motueka River, New Zealand 5 Dean A. Olsen1, and Roger G. Young 2008

Analysis of river flow data shows that an additional 90 l/sec taken from the new zone (and assuming a similar pattern of water use), may result in step 1 rationing happening with an average 1-in-10 year frequency rather than the current calculated frequency of 1-in-12 years. This meets the Plan security standard.

Most recent low flow years have been 2013 when the Motueka River flow at Woodstock was 1-in-15 year drought and in 2014 it was close to a 1-in-10 year low flow. In both years water users only faced step 1 rationing. Note however that total water use was likely to be at rates less than 50% of the total allocated amount.

Rationing records for the last 10 years show abstractive users have been actually rationed at step 1 on two occasions.

2007 – 2 days March
2013 - 8 days in March
2014 - 1 day in March – imposed and immediately removed

The current water permits are due for renewal in 2019. There is a possibility that allocations will be reduced for some users following a bona fide review (the review is based on actual and reasonable use and on the basis of soil type but not crop type). Water may be made available for re-allocation to new water users within the relevant zone and may result in an increase in the total quantity of water being abstracted within the limits set, particularly since there are other people currently on the waiting list. The extent to which this will be significant is not known but not expected to be high.

The combination of an increase in the allocation limit along with a potential increase in water use following 2019 (if a bona fide review results in reallocation of water), may affect security of supply, but it is calculated to still meet the specified security of supply standard.

4.8 Water Quality

This Plan Change does not include any specific water quality provisions. The setting of limits to manage water quality for the Motueka River and its tributaries is not scheduled to commence until 2016-2018. (NPSFM Implementation Plan 2012)

However, an assessment has been made of the potential water quality effects of increasing water allocation limits in the new Tapawera Zone in order to comply with Policy C1 of the NPSFM.

Any water impacts of land use as a result of this Plan Change in the upper Tapawera Plains Zone would be manifest in the Motueka River downstream of the Tapawera Bridge. There are no indications that this pattern of land use is having an adverse effect on water quality at this point. Dissolved inorganic nitrogen is only over 0.444g/m3 less than 25% of the time and dissolved reactive phosphorus always below 0.01g/m3.

The irrigable area in the current Upper Tapawera Zone is 2759 ha with some 737 ha currently being irrigated. The proposal to increase the allocation limit by 90 l/sec would allow for a further 180 ha of irrigation.

The greatest risks to water quality arise from poor management of nutrients, inefficient irrigation practices and from intensive livestock farming such as dairying.

The resource consent provisions relating to efficient irrigation and the preparation of irrigation management plans and the requirement for recording nutrient use and production data (recently added to the plan as part of Plan Change 48) are applicable in this zone.

Current consents are due for renewal in 2019 and any new consents that may be issued for the additional water will be subject to these provisions.

In the interim, further work locally and nationally will have been carried out in relation to better understanding and definition of what constitutes good farm management practices and also in relation to modelling tools such as Overseer.

Furthermore, new land uses likely with the increased irrigation opportunity are already largely determined by land owners with priority on the waiting list. The two larger priority applicants on the waiting list seek an additional for 130 ha and both already irrigate land in this zone. Neither landowner plans conversion to dairy. One hundred hectares will be farmed more intensively through greater irrigation of animal feed crops. Animal numbers are expected to increase, but by a relatively insignificant proportion compared to total numbers. Some 30 ha will be converted from dry land farming to hops.

It is possible that land within this zone and wider catchment area will convert to more intensive animal farming such as dairy or dairy support in the future. This is a much wider issue than managing the impact of an additional irrigated 180 ha in this zone. The wider implications of land use change are part of the development of nutrient limits still to be done for the Motueka water management zones.

The total new irrigation is a small percentage of the current irrigated land both in the Tapawera Plains and the wider catchment and will not have a significant impact on water quality.

Given all of these considerations, the risk to water quality is thought to be managed with current provisions. Any land use changes likely in the short to medium term are unlikely to have a significant effect on water quality, or on water quality limits that may yet be set for the Motueka Catchment. No changes are proposed in respect of this aspect of this plan change.

4.9 Value of Irrigation

Research by the ANZ (October 2013[4]) shows average per hectare returns for the various land uses under irrigation of: $2,380/ha for dairying; $2,000/ha for arable and processed crops; $700-$900/ha for sheep, beef and dairy support; and a wide range (and significantly higher than for dairy) for horticulture depending on crop, variety and location. The analysis stressed the highly variable nature of returns at a property scale and did not explicitly account for any additional costs on production that may be imposed to protect water quality.

A study in the Wairarapa[5] based on installation of the most efficient centre pivot irrigation system compared to dry land farming showed additional disposable profit from dairy intensification, dairy conversion, viticulture and intensification of arable/cropping use will cover direct on- farm irrigation costs but other livestock systems including dairy support will not.

The study noted that New Zealand wide studies have shown that the benefits to the community as a whole are around 2.2 to 6 times greater than the additional on-farm gross returns that are achieved. This increased turnover filters down through to the community supplying goods and services.

There is no question that the application of irrigation water to has the capacity to substantially increase farm production. The extent to which this applies to individuals in increasing profitability will depend upon their motivation and ability to change and adopt farm practices that will achieve this.

One landowner gaining extra water by virtue of waiting list position advises that in converting to hop production, the gross revenue per hectare increases from relatively low returns under dry land farming to $30,000 per hectare (or an estimated $750,000) on approximately 25 hectares in the zone.

Providing for more intensive farming will a more reliable irrigation supply over an additional 105 hectares will allow a potential increase in $3612.50 per hectare (or an estimated total of $379,260) in additional income as a result of increased dry matter production.

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[4] ANZ Agri Focus / October 2013 Bagrie C, Williams C, Croy D.

[5] Report Prepared at the Request of Wairarapa Regional Irrigation Trust(WRIT) and Meridian Energy Limited Report 30 to WRIT – 2009

4.10 Flow Management and Allocation in the Motupiko and Rainy Rivers.

The Motupiko River contribution as a trout spawning river to the significant trout fishery of the Motueka is recognised in the Water Conservation Order and winter flows are protected for this reason. The Motupiko River tributaries include the Rainy River. This river is also recognised in the WCO as having wild and scenic value in its upper reaches and trout spawning habitat contributing to the Motueka fishery.

The Motupiko Zone is subject to rationing when the flow in the Motueka River reaches 7000 l/sec. The Motupiko Zone is not subject to controls that otherwise maintain flow in the Motupiko River however, the two existing water takes in the Rainy River catchment are managed by consent conditions that impose rationing based on triggers flows at *Christies*, which is a Council flow recorder site in the upper Motupiko.

The Motupiko Zone including the Rainy River is subject to unmet water demand for irrigation[6]. Following recent permit reviews, a small amount within the total is now available for re-allocation.

Motupiko River and groundwater	12 permits	65.8 l/sec allocated
Rainy River and groundwater	2 permits	24.8 l/sec allocated
Total Allocated		90.6 l/sec

Flow and water use data indicate that further abstraction should be limited to groundwater not directly from the river so as to take advantage of groundwater storage and reduce surface water take effects on instantaneous flow.

There is also concern that if additional water were available for allocation it could be sought within the Rainy catchment where there is insufficient supply to meet the needs of both abstracters and instream values.

Note that the current waiting list for the Motupiko Zone contains three entries all seeking additional water in the Motupiko River Catchment so the immediate risk is low, however river specific limits will avoid risk of transfers within the zone amending points of take.

There is good correlation between flows in the Motupiko River at Christie's flow recorder site and the Rainy River below Big Gully – the currently allocated 25 l/s is about 18% of the 7-day MALF and 21% of the 1-day MALF. This rate of abstraction is at a level that still protects instream values during summer and provides acceptable security of supply.

The overall limit should be distributed between the two catchments to provide a more targeted and sustainable allocation management in each catchment. This would mean the Rainy catchment allocation is capped at the current level with on-going rationing based on the flow at Christies.

In addition, any new takes in the Motupiko Zone should take advantage of the buffering that groundwater storage provides, thus reducing any impact on instantaneous river flow. This requirement would be consistent with existing policy.

4.11 Wangapeka River - Takes to Storage during High Flow

An amendment to the water management provisions for the water harvesting and storage is also included in this plan change proposal.

Flow in the Wangapeka is managed in compliance with the Motueka River Conservation Order. Plan provisions must ensure that flow is managed so that depletion is limited to 6 percent of the natural flow for the Wangapeka River at the Council's Walter Peak flow recorder.

The Plan contains a Wangapeka Zone allocation limits and Motueka River flow triggers for rationing that ensure this objective can be met.

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[6] LOWAG ref

A landowner in the lower Wangapeka Valley is investigating a potential water harvesting proposal to take water from a small tributary creek of the Wangapeka River for storage.

The flow to be harvested is relatively insignificant however, it falls within the allocation limit calculation and has given rise to consideration of the relationship between 'flow harvesting' and allocation limits when it occurs during November to April.

The Plan currently has policies encouraging water storage:

"30.2.3.17 To encourage taking of water for storage during high flow and to acknowledge that some water users can improve their security of supply above the minimum level through the storage or augmentation of water."

The Plan also prefers water storage and groundwater takes in the Motueka catchment to reduce impacts on Motueka River flows:

"30.1.3.10 To encourage and promote the taking of water for irrigation from dams and from groundwater in preference to new takes from surface water resources in the Motueka catchment so as to reduce the impact of surface water takes on the values of the Motueka River and its tributaries."

The allocation limits in litres per second are for takes for consumption use and are for the period November to April. They are calculated as the sum of weekly permit allocations, and refer to surface water or groundwater takes, but do not include takes from storage (see rule 31.1.2.4). They potentially do include takes to storage where they are between November and April as there is some uncertainty as to the circumstances allowing for flow harvesting.

In particular, Policy 30.1.3.9 refers to the need not to exceed allocation limits, and provides an exception for harvesting water at high flow, provided adverse effects are managed.

Consumptive use is defined in the plan to mean any taking and use of fresh water that alters the flows and or levels in a water body (either on a temporary or permanent basis), but excludes any use that returns fresh water to the same water body at or about the same location; and does not affect the spatial or temporal availability of the fresh water.

As limits for water abstractions are reached, there is increasing consideration of water augmentation options. There is a range of augmentation options possible from instream dams capturing all of the surface flow to off-stream storage which are filled by pumping or diverting water from ground or surface supplies.

The extent to which these 'storage' or 'augmentation' systems fall within allocation limits or within the concept of 'consumptive use' where flows and levels are altered can be a matter of degree.

Interpretation of what limits these various concepts might mean is increasingly under pressure as variations of takes to storage are explored by landowners. There is currently little guidance about appropriate thresholds when working at this level of detail. This is illustrated by the Wangapeka example and also by a separate proposal in Golden Bay that is contemplating construction of a water storage reservoir that is to be filled by pumping from the adjacent river when flows are high. At proposed irrigation levels for this case, the stored water will last approximately one week.

Determination of an appropriate 'high river flow' is not supported by policy guidance for these sorts of applications. Also, these proposals test the concept of 'storage' in ways not envisaged at the time when most storage systems involved relatively straight forward dams that captured winter run-off for use in summer, and which had provisions for low flows and flood flows from the dam.

High river flow might occur during the irrigation season as well as any time outside those months. Sustainable management requires ensuring abstraction at these high flow times does not adversely affect the healthy functioning of the river.

Healthy ecological functioning of rivers is dependant not just on ensuring minimum flows, but also on a range of flows that provide for different aspects of river functioning. A recent Cawthron report[7] lists the ecologically important components of the flow regime:

1. **Large floods**, which are responsible for maintaining channel form and large scale sediment transport. These are often referred to as channel forming flows. These are likely to be in the order of the mean annual maximum flow.

2. **Smaller floods and freshes**, which flush fine sediment, periphyton and other aquatic vegetation. Often referred to as flushing flows.

3. **Low flows**, the period of minimum wetted habitat availability, but also potentially of relatively high productivity in the remaining habitat.

4. **Flow recessions**, higher than usual flow in the few days following a flood may offer enhanced recreational opportunity, and increased wetted area during flow recession over longer periods (i.e. weeks) may enhance ecosystem productivity.

5. **Flow variability**, at a range of scales. From seasonal variability comprising the annual flow regime to small scale flow variations (which many people consider are an essential element of the regime that should be maintained, avoiding long periods of artificial "flat lining"). In some situations the timing of flow variability may be a critical factor, e.g. to provide a stimulus for fish migrations.

Increasing numbers of dams and storage systems within a catchment will have cumulative impacts on these flows.

The management of river flows over this range of flow types should be informed by the management objectives for the river concerned. The focus of the TRMP to date has been largely on managing low flows.

This is because water abstracted directly for use when it is required is the most cost effective way of obtaining water when it is available. This 'easy' water is increasingly reaching the limits set with more focus now on acquiring access to water at other times.

The Council's water damming policy (30.1.3.22) was recently adjusted by Plan Changes 45 – 48, and now provides better direction about managing the range of river flows potentially affected by a dam. However, this does not deal with water takes to off-stream storage nor does it set specific flows which describe the times of high flow envisaged by the existing policy.

There are a number of methods that assess effects of different water allocation regimes for high flows including flow sharing and limits based on percentages of specified flows and allocation caps. Council objectives and policies seek to maintain or improve existing aquatic ecosystems. Any high flow allocation regime needs to be set in the context of these instream management objectives and policies.

Hawke's Bay Regional Council explored in detail the options for high flow allocation regimes for several rivers as part of a recent plan change process for the Tukituki River. They carried out investigations[8] into allocation regimes that limited the potential impact to ecological values of each river by only testing methods that resulted in a change of ≤10 percent to the naturalised flows that exceeded three times the median flow. They tested these regimes using methodology that describes the degree of hydrologic alteration (Range of Variability Approach (RVA)) developed to comprehensively characterise ecologically relevant attributes of a flow regime in order to develop flow-based river management targets that incorporate the concepts of natural hydrological variability and river ecosystem integrity.

[7] Hay J, Kitson J Flow Harvesting: A Review of Policy and Potential Effects. Cawthron Report 2408 2013
[8] Waldron R 201; Tukituki Catchment High Allocation Flow Modelling HBRC Report 4258

For the Hawkes Bay rivers tested in this investigation, an allocation cap based on a percentage of the flows above median flow was adopted as the one leading to least impact on the natural flow regime.

For Tasman Rivers, significant further water data analysis and assessment of this against river specific management objectives would be required to specify allocations to this level of certainty. However, a default (rule of thumb) regime has been developed and applied by a range of councils that accounts for flow variability requirements and, like the Hawkes' Bay work, is based on a percentage of median flow.

The median flow threshold is supported by current science, including the recent Hawkes Bay work[9]. The default provision used widely throughout NZ is high flow allocation at no more than 10% of the median flow as a default limit in the absence of river specific detail.

This threshold will be appropriate until either a larger scale proposal is made and defended with appropriate flow modelling and assessment or if Council further develops flow management regimes that provide for flow harvesting above specified flows or until the cumulative allocation reaches the 10%.

The main alternative (in the absence of specific modelling) is flow sharing approach however the percentage above median flow allocation provides a more definitive number that reduces uncertainty to applicants and consent planners and enables more effective compliance monitoring.

5. Management Options

5.1 Allocation Limits

Different allocation scenarios were presented in the technical report[10]. The groundwater/river flow model assessed the impact of alternative irrigation options that abstracted water across different areas and at different allocation limits. The model provided information about impact on river flows (including impact on the WCO requirements), groundwater levels and drawdown effects and security of supply for water users.

The scenarios modelled are summarised in the following Table 1. None of the scenarios modelled the proposed new allocation limit precisely, but give the possible upper boundary.

[9] Hay J, Kitson 2013 (ibid)

[10] Water Allocation Limits for the Upper Motueka Catchment Landcare Research Report LC1631: Fenemor A and Thomas J 2013.

Table 1: Allocation Scenarios Modelled

Scenario (Options)	Allocation limit (l/sec)		Area irrigated (ha)	Comments	Costs	Benefits
	Upper Tapawera	Lower Tapawera				
	(Plan Allocation limit 515)					
1. Status quo (based on actual metered water use)	314	210	737ha as modelled (model based on actual use so it would be 1038ha if fully irrigated at 300m^3/wk)	Metered use has generally been about 30 – 40% of the total allocated. Unlikely to ever get 100% use of allocated water, but could get higher rate of actual use following permit renewal and bona fide assessment. This may lead to re-allocation to new users. There may also be changes in land use systems that increase total use. A soil and crop based[11] allocation regime will contribute to a higher rate of actual versus allocated water use.	The opportunity of the significant economic benefits provided by additional irrigation is lost. A crop and soil based allocation regime ensures a more efficient allocation regime, but decreases land owner flexibility to change crops.	Plan change costs are avoided. River and groundwater system protected at current levels. There is scope for increased water use within current limits through consent review to ensure water is allocated and used more efficiently and resulting re-allocation to new users especially if crop type is also accounted for.
1A. Status quo based on maximum allocated water use						
3. All irrigable land in Tapawera Plains Zone irrigated at rates equivalent to actual metered use			2759	High use prediction at maximum allocation for irrigable land.	Has significant impact on river flows and will adversely affect the instream uses and values. Greater effect on water quality through increased nutrient losses also possible	
4. Irrigable land in lower part of Tapawera Plains irrigated at rates equivalent to metered use.	314	475	1270	Model prediction for increase use within existing minimum flow and security of supply constraints		
4A. (Not modelled)	314	300	917ha (Or 1237ha at 300m^3/wk)	This was not specifically modelled but allows for some precaution given lack of precision in modelling residual river flow, upper catchment land use change and risk of reduced security of supply for water users.		

[11] The Plan does not currently allocate on the basis of crop type except in the over-allocated zones (Waimea and the Moutere Surface zones).

Option 4A: Recommended

Divide existing Tapawera Plains Zone into two zones named the Tapawera Zone and the Glen Rae Zone with allocation limits of 314 l/sec and 300 l/sec respectively.

This provides for sustainable water allocation that results in economic and social benefits to the community while still protecting the values of the Motueka River.

The benefits of increasing the area of irrigated land include:

- private benefit as a result of increased production and profitability.
- public benefit in relation to social and economic well-being of the community through increased employment opportunity and greater spending in the local and regional areas.
- more productive use of the limited areas of high quality irrigable land in Tasman District

The costs of allowing for an increase in the abstracted water relate mainly to managing uncertainty and ensuring the appropriate triggers for rationing are used.

There are uncertainties in relation to future patterns of water use and level of investment into new irrigation within the allocation limit.

The model used to calculate whether additional water can be abstracted without adversely affecting river values or existing water users' security of supply predicts up to 265 l/sec could be abstracted. The amount being proposed by Council is a precautionary 90 l/sec.

New permits to take water enabled by this proposed Plan Change will be subject to the more stringent requirements for irrigation management and nutrient recording that were introduced to the Plan with Changes 45-48.

5.2 Motueka River Rationing

Options

1. Status quo - only using the 7000 l/sec Motueka River flow at Woodstock.

2. A new water flow trigger for step 1 rationing above the Wangapeka River confluence of 1400 l/sec to manage effects of water takes occurring in the Tapawera Plains Zone.

   The Council could install a new water gauging site above the one currently maintained at Woodstock however, it is recommended that because of the difficulties of maintaining a site in a mobile gravel bed and the costs involved in doing so, a suitable alternative is regular gauging when Motueka River flows fall below the trigger for consultation at Woodstock. This trigger is currently 7500 l/sec. Council already routinely gauges this part of the river to maintain accurate flow data.

Option 3: Recommended

Adopt a revised rationing regime (including specific new policy) that includes a new trigger of 1400 l/sec above the Wangapeka confluence plus enabling decisions about rationing to take into account river flow contributions from Motueka River tributaries, pattern of water use, time of season, weather patterns consistent with the regime adopted for the Waimea Plains.

Reason

This provides a comprehensive and responsive approach to rationing that provides certainty for users as well as reflecting the actual patterns of water use and availability that may exist from time to time.

This approach is consistent with successful drought management approaches elsewhere in the District.

5.3 Motupiko and Rainy Zone Allocation Limits

Options

1. Status quo - continue with the combined allocation limit for both rivers.

Option 2: Recommended

Divide the current Motupiko Zone into the Rainy Zone and Motupiko Zone with allocation limits of 25lsec and 85 l/sec respectively.

Reason

Ensures an appropriate limit for abstraction is set for the Rainy River that reflects its own uses and values in the Motupiko which it contributes flow to.

5.4 Motupiko and Rainy Zones Rationing Trigger

Options

1. Status quo - no trigger specifically for the Motupiko Zone (continue to rely on trigger at Woodstock) and continue with 239 l/sec) at Christies as the trigger for rationing of the Rainy takes.

Option 2: Recommended

Adopt trigger for rationing for both Motupiko and Rainy Zones of

Trigger for consultation	400 l/sec at Christies
Step 1	250 l/sec at Christies,
Step 2	200 l/sec
Step 3	180 l/sec

Adopt a cease take flow for the Rainy Zone of 203 l/sec.

Reasons

It is both more transparent and consistent as well as providing clarity and certainty for water users and the community to provide an explicit trigger for the Motupiko River in the Plan rather than water management being through ad hoc consent conditions.

A single trigger for both connected water bodies is more logical and consistent.

A trigger specific for these water bodies enables a more targeted approach that enables localised variations in river flows to be accounted for.

The cease take flow reflects the consent condition requirements for the Rainy Zone takes.

5.5 Buffering Effects of Water Takes on Instantaneous River Flow

Options

1. Status quo - continue to rely on existing policy.

Option 2: Recommended

Require new takes in the relevant zones to be set back from specified river banks as follows:

Glen Rae Zone	New takes to be setback at least: - 100m from the Motueka River and - 50m from the Hinetai Stream

Tapawera Zone	New takes to be set back at least 100m from the Motueka River
Motupiko and Rainy Zones	New takes to be set back at least 50m from the Motupiko and Rainy Rivers respectively

Reason

Gives effect to existing policy and reduces effects of water takes on river flow while allowing advantage to be taken of groundwater storage.

5.6 Takes at Time of High Flow for Storage

Options

1. Status quo. Rely on existing policy to help guide decision making. This approach is uncertain, lacks clarity and can result in perverse outcomes in relation to storage and harvesting.

Option 2: Recommended

Amend the existing policy to provide more clarity about the concepts of storage and harvesting at high flows and the relationship of these to established allocation limits.

Reason

Provides additional policy guidance and interpretation of terms.