Te Awarua-o-Porirua Whaitua Committee

Water allocation – further information on alternative options for minimum flow and allocation limit for 26.10.2107 workshop

Background

We presented an approach to setting minimum flows and allocation limits to you at the 14 September Committee workshop. This approach incorporated a minimum flow of 90% of mean annual low flow (MALF)[1] and an allocation limit of 30% of MALF (we'll call this the 90+30 approach). A theme that emerged from that conversation was that stream flows naturally vary from year to year and you sought more information to understand this natural variability. You also expressed a degree of comfort with a minimum flow of 90% of MALF but wanted to explore alternative options for both the minimum flow and the allocation limits before coming to a consensus decision.

Natural variability in stream flow and the effect of a water allocation regime

Streams and their native fish inhabitants naturally experience stress during periods of low flow, and the intensity and duration of this stress varies between years. The intensity of flow related stress is often expressed in terms of how much habitat space is available at different flows, often as certain percentages of MALF (e.g. 100% of MALF, 90% of MALF). The duration and intensity of stress naturally fluctuates, in wetter years there is less stress, in drier years there is more intense stress (lower flow) for longer periods.

Two hydrographs of flows in the Pauatahanui Stream show this natural variation in flow over the summer season for a moderate year (2014) and a drier than average year (1981). You can roughly equate a stream flow to the amount of water in the stream, so when the hydrograph peaks are higher, there is more water in the stream.

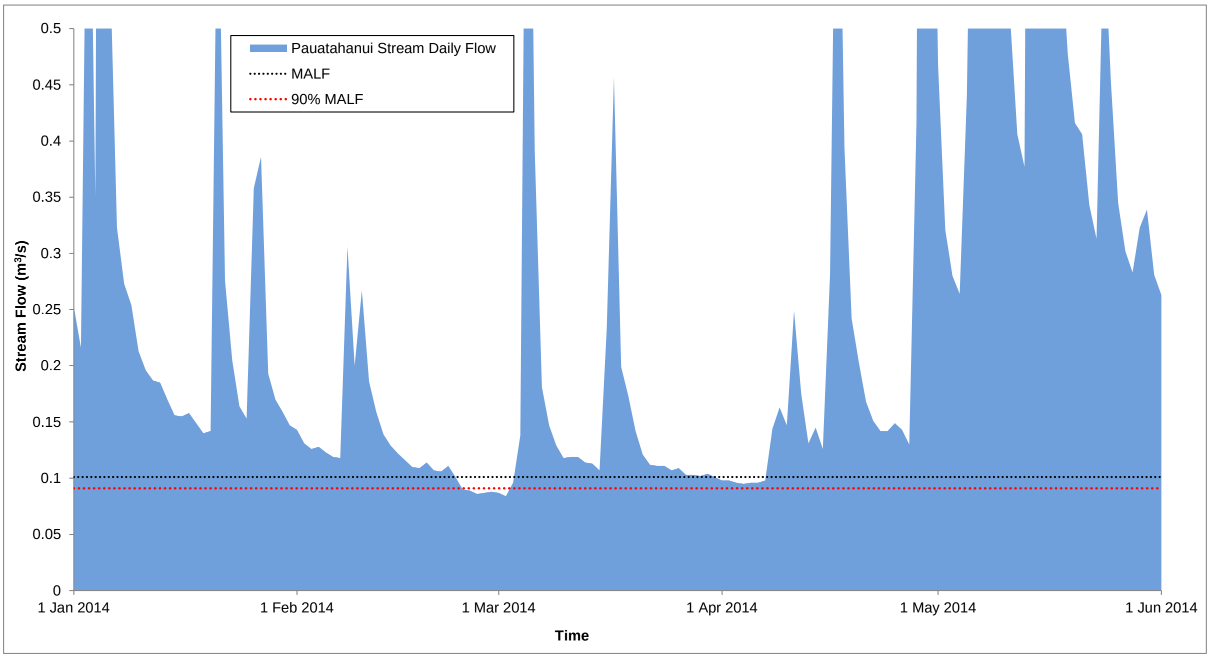

Figure 1. Hydrograph for the Pauatahanui Stream in a moderate year (2014)

[1] MALF is a statistic used in river flow monitoring to indicate the typical low flow that occurs in an average year.

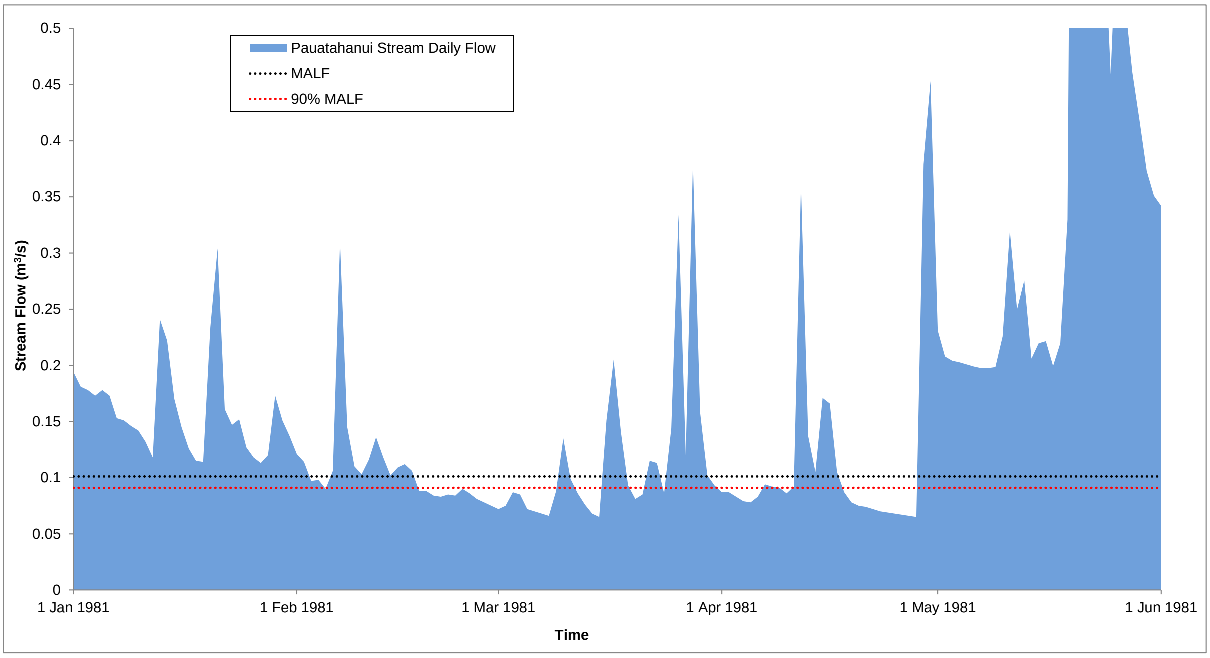

Figure 2. Hydrograph for the Pauatahanui Stream in a drier than average year (1981)

A water allocation regime is commonly built around managing the way people contribute to the two elements of stress in a stream:

- a minimum flow controls the additional <u>intensity</u> of stress that water abstraction might induce
- an allocation limit controls the additional <u>duration</u> of stress that water abstraction might induce.

Setting the minimum flow means that we stop abstraction at that point and can stop the human contribution from making the intensity of stress greater. However even when taking has stopped, the stream flow can naturally continue to decrease below the 'minimum flow' in drier years, as shown in the natural hydrographs above.

Allocating water for abstraction means the stream flows are reduced and we are likely to reach the nominated 'minimum flow' sooner than might naturally occur. Implementing an allocation limit means that we can manage how much sooner we might reach the nominated 'minimum flow'. The size of that allocation limit will determine the period a stream is at or below the nominated minimum flow. Larger allocation limits mean a stream to reach the minimum flow sooner and spend longer at or below that flow than smaller allocation limits.

These ideas are illustrated in the following graph. The blue part of the graph shows the 'natural' stream flow. The dashed blue line shows the 'residual' stream flow – the flow left if people took the full amount of water allowed under an allocation regime. For this example, we've used the 90% MALF minimum flow and 30% MALF allocation limit option. This illustrates three key points:

1. When water is taken out the stream for people to use, the minimum flow is reached earlier than would naturally be the case. The stream flow is therefore at or below the minimum flow for a longer period than is naturally the case.

2. When abstraction is stopped at the minimum flow, people stop contributing to any stress on fish at that time.

3. Even with abstraction having stopped, at times the flow naturally drops lower than the minimum flow. Any fish in the stream will experience an increasing intensity of stress until it rains and higher flows return.

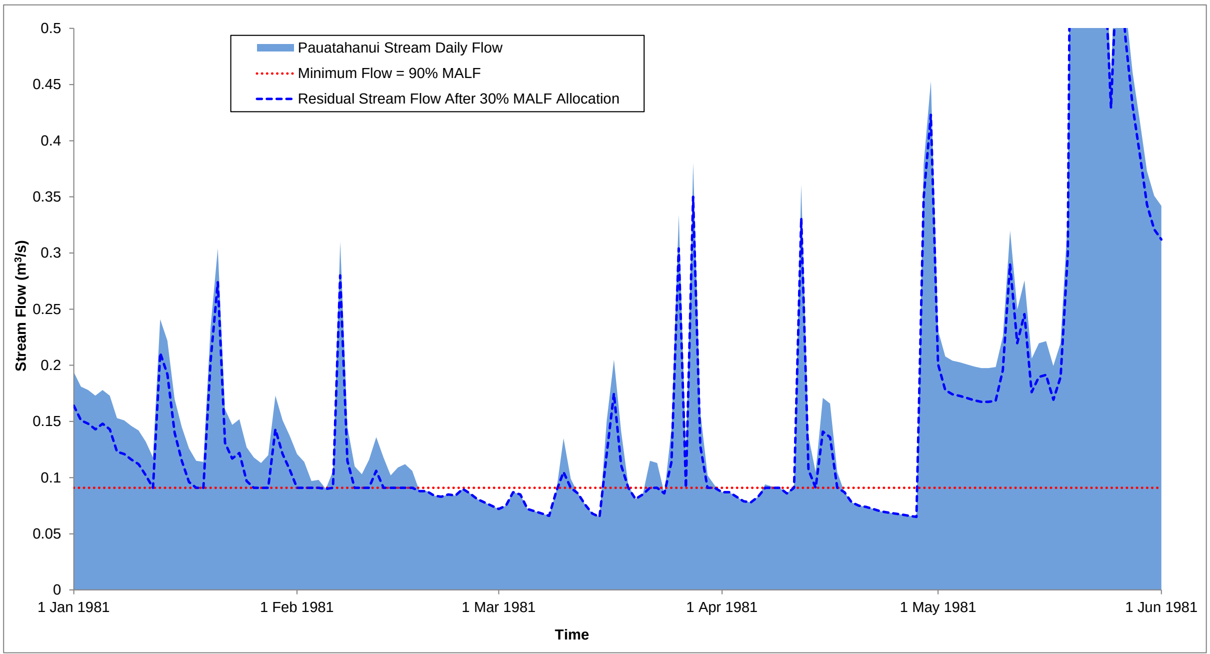

Figure 3. Hydrograph of Pauatahanui Stream showing the natural and residual flows

Information on alternative minimum flow and allocation limits

The 90+30 approach discussed at the 14 September 2017 workshop was assessed as providing good levels of habitat protection (between 90% and 98% habitat protection for native fish species at minimum flow) and modest reliability of supply for water users. You expressed a degree of comfort with the minimum flow level of 90% of MALF, though asked for more information on alternative options for minimum flow (higher) and allocation limits (both higher and lower) in order to help further your decision. The options assessed were:

- Minimum flows of 90% and 100% of MALF, and
- Allocation limits of 20%, 25%, 30% and 40% of MALF

An assessment of these options has been done using flow records from the Pauatahanui Stream, shown in Table 1 (over page) and summarised below. Options were assessed against attributes of ecosystem health and mahinga kai and economic use values. We also looked into the impact of wetter or drier years would have for these options. While the results are for the Pauatahanui Stream, the patterns between the options and the wetter and drier years are likely to be similar for other streams in the Whaitua, thought absolute numbers may differ.

Intensity of 'human induced' stress on native fish

There is a relatively small difference in stress levels for most native fish species between the two minimum flow options examined. The 100% MALF minimum flow provides between 10% and 2% more habitat than for the 90% MALF minimum flow depending on the fish species we looked at. Both minimum flow options represent low levels of stress for native fish species.

Additional days at minimum flow

In general, a larger allocation limit causes the stream to be close to or below the minimum flow for longer periods than a smaller allocation limit. In an average year and with no water being taken, the Pauatahanui Stream is expected to spend about 3 weeks below flows of 90% of MALF. With an allocation limit of 20% of MALF being taken from the stream, there would be an additional 2 weeks at flows close to or below 90% of MALF; with a 30% of MALF allocation limit an additional 3 weeks and with a 40% of MALF allocation limit an additional 4 weeks.

The time naturally spent below minimum flows is less in a wet year and longer in drier years. There is no consistent pattern in the duration that water abstraction extends this period by between wetter or drier years.

Time with full access to allocation amount

When allocation limits are smaller, users of water are provided longer periods where stream flows are high enough to sustain access to their allocation (i.e. you don't reduce flow as quickly towards the minimum flow level). However, this also means that smaller amounts of water are available to take so this greater reliability is enjoyed by fewer or smaller users.

For Pauatahanui Stream, the 20% of MALF allocation limits provides about 2 more weeks' full access than the 40% of MALF allocation limit.

Time on total restrictions

The period of time that users are restricted from accessing water from streams is largely determined by the minimum flow. In an average year, people taking water from the Pauatahanui Stream would experience about 3 weeks of total restriction with a 90% of MALF minimum flow. There would likely be no restrictions in a wetter year and around 5 weeks of restrictions in a drier year. For a 100% of MALF minimum flow, people taking water would see slightly longer periods on restrictions, with about 4 weeks of restriction in an average year and either 0 or 7 weeks in a wetter or drier year respectively.

The comparisons of all these effects of alternative options for the Pauatahanui Stream are presented in the table below, in comparison with the effects of the 90+30 approach.

Table 1. Alternative minimum flow and allocation amounts compared to 90+30 approach for the Pauatahanui Stream

Value	Attribute	Effect	Alternative minimum flow and allocation amounts compared to 90+30							
			100+20	90+20	100+25	90+25	100+30	90+30	100+40	90+40
Ecosystem health and mahinga kai	Habitat protection	Intensity of 'human induced' stress	Better	Same	Better	Same	Better	Good protection	Better	Same
		Additional days of stress at or below minimum flow	Better	Better	Better	Slightly better	Same		Worse	Worse
Economic use of water	Supply reliability	Time with full access to allocation amount	Same	Better	Slightly worse	Slightly better	Worse	Moderate reliability	Worse	Worse
		Time on total restrictions	Worse	Same	Worse	Same	Worse		Worse	Same
	Availability of water for economic use	Amount of water that can be taken from a stream	Less ← → More							

Recommendation

The default 90% of MALF minimum flow and 30% of MALF allocation limit are still assessed as providing good levels of habitat protection and modest reliability of supply for water users.

A higher minimum flow of 100% of MALF with lower allocation limit of either 20 or 25% of MALF would provide slightly higher levels of habitat protection and this comes with the trade-off of slight reductions in reliability of supply due to more time on total restrictions and less total water available for use.

It is recommended that the Whaitua Committee consider the information and make an interim value judgement decision between the options presented.