

Memo

Date	1 September 2017
To	OTOP Zone Committee
CC	
From	Shirley Hayward

Updated flow statistics and ecological minimum flow options

PURPOSE:

The purpose of this paper is to:

- a. Provide the zone committee with updated flow statistics following the review of the consents inventory.
- b. Provide justification for the initial ecological flow assessment approach

INRODUCTION

The memo by Hayward and Meredith (13 July 2017) provided a summary of ecological flow recommendations based largely on the draft national environmental standard for ecological flows (NES). Since this memo was completed, a review and update of the consents inventory has been completed, which has resulted in a recalculation of naturalised flow statistics on which ecological flow recommendations were based. This memo provides an updated set of flow statistics and ecological flow recommendations (Appendix 1).

The updated naturalised flow statistics resulted in minor changes to the naturalised MALF and NES default ecological minimum flows (Appendix 1). The review of the consents inventory allowed updated calculations of current allocation volumes and comparison of these with the NES default recommendations. These are summarised in Appendix 1 for completeness but are discussed in more detail in the separate memo by Dan Clark (1 September 2017).

For the South Branch, naturalised flow statistics for the South Opuha at the Monument Bridge minimum flow were originally not available and the flow statistics for the upstream site at Stoneleigh were used. Flow statistics for the Monument Bridge minimum flow site have since been calculated. Because there is a loss of flow (at base flows) between the upstream flow monitoring site at Stoneleigh and the downstream site at Monument Bridge, and most abstraction occurs between these sites, it is therefore preferable that the downstream flow recorder site remains as the minimum flow site. Appendix 1 has been updated to reflect minimum flow recommendations for the Monument Bridge site.

Comparison of draft NES default minimum flow limits with IFIM (measured and modelled instream habitat) based assessments

The zone committee has requested further justification for the reliance on flow statistics for determining the ecological flow recommendations of Hayward and Meredith (2017). The approach taken by Hayward and Meredith (2017) was to primarily draw on the draft National Environmental Standard (NES) for ecological flows default minimum flow recommendations of 80 - 90% of MALF. They also considered other aspects such as water quality and temperature data, ecological health indicators (macroinvertebrates and periphyton), and instream habitat assessments where available.

Flow assessments in Canterbury have used a variety of methods for determining ecological flow needs ranging from full instream habitat assessment and modelling, to use of expert panels, and reliance on maintaining an acceptable percentage of naturalised flow statistics. A review of minimum flow assessments using a variety of methods in the Te Waihora/Lake Ellesmere catchment showed that habitat modelling methods typically resulted in ecological flow recommendations in the order of 90% of MALF (Figure 1).

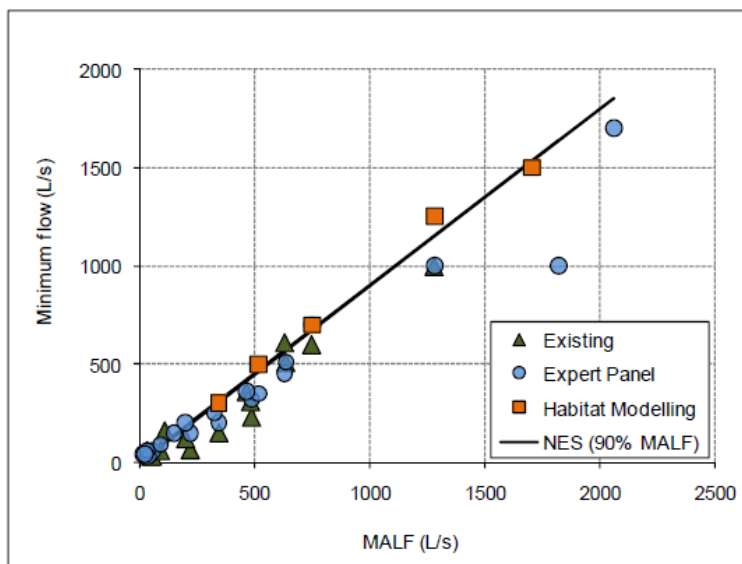


Figure 1 Relationship between 7DMALF and existing minimum flows and minimum flow recommendations calculated using different methods at various sites in the Selwyn/Te Waihora catchment (Golders 2011)

Ecological flow assessments in the Pareora and Orari rivers that include habitat modelling resulted in flow recommendations in the order of 70% to 100% of MALF (Table 1). In the Pareora River, the ecological flow assessment identified locally important brown trout fishery and moderate native fish diversity as key ecological values. Instream habitat assessments determined that maximum habitat availability for brown trout (adult and spawning life stages) occurred at flows above MALF, and a moderate diversity of native fish habitat was provided at MALF. Therefore, the assessment recommended MALF as the minimum flow that best provided for instream ecological values (Golders 2008). Similar findings for the Orari River resulted in a recommendation ranging from ~70% of MALF to provide for native fish species, salmonid spawning and trout rearing, to 100% of MALF to maximise adult brown trout habitat (Golders 2013).

Table 1 Comparison of ecological flow recommendations for other OTOP catchments based on habitat modelling compared to the default NES ecological flow recommendations

Catchments	Naturalised MALF	Default NES minimum flow	Recommended ecological flow based on habitat modelling and other ecological assessments	Minimum flow in relevant plans
Pareora				Pareora River Regional Plan
Pareora R at Huts	660 L/s	594 L/s	660 L/s	400 L/s (5yrs after plan operative)
Orari				LWRP Section 14
Orari R upstream of Ohapi confl.	1,496 L/s	1,346 L/s	900 -1,350 L/s	500 L/s (3yrs after plan operative) 900 L/s (by 2040)

Overall, ecological flow assessments show that in shallow, hill-fed rivers habitat availability for adult brown trout and large fish species (e.g. adult eels) is typically maximised at or above MALF, and that native fish habitat varies for species; but providing adequate habitat for the maximum number species occurs in the range of 70 -100 % of MALF. Additionally, shallow rivers are prone to potential issues with high water temperatures, nuisance algal growths and other negative water quality interactions with increasing duration and degree of low flows. These common findings should give confidence that by providing a high proportion of MALF (70 – 90%) as a minimum flow, adequate protection for instream ecological values is provided.

However, there remains benefits in undertaking more detailed instream habitat assessments at specific sites. This will add support to flow and allocation limits and assess vulnerable parts of the catchments (eg flow losing reaches) in relation to minimum flow sites, particularly where there is currently significant deviation from ecological and cultural flow recommendations.

Summary of current ecological flow assessments

The initial approach taken by Hayward and Meredith (2017) and updated in this memo aimed to provide an initial evaluation of default ecological minimum flow recommendations alongside an assessment of current minimum flows and the current health of waterways. This has shown that for reaches/tributaries where minimum flows are close to the default NES recommendations, they also generally maintain good ecological health and water quality such as in the North and South Opuha rivers. In other reaches, where combined effects of abstractive pressures (allocations), low minimum flows and cumulative effects of land uses on water quality result in variable (and sometimes poor) overall ecological health, showing their vulnerability to current abstractive and land use pressures.

The current flow provisions (minimum flow and allocations) of the main tributaries can be broadly grouped according to their degree of deviation from the default NES recommendations and current ecological health as follows:

- 1. Current minimum flows and allocations close to ecological flow limit recommendations and rivers generally maintain good ecological health**
 - North Opuha River
 - South Opuha River

- 2. Current minimum flows and allocations deviate from ecological flow limit recommendations; rivers generally exhibit good ecological health but are showing vulnerability to low flow and water quality pressures**
 - Upper Opihi River (Rockwood)
 - Te Ana a Wai
 - Lower Opihi River
 - Opuha River (Skiptons) (does not maintain good ecological health because of effects of dam and loss of bed moving floods, and affected by Didymo proliferations)

- 3. Current minimum flows and allocations deviate significantly from ecological flow limit recommendations and rivers exhibit poor ecological health**
 - Temuka River and the lower reaches of its tributaries (Waihi, Hae Hae Te Moana, Kakahu)

Key decision areas

The following key decision areas complement the water allocation options paper. When considering flow regimes, the combination of allocation and minimum flows impact on both reliability of supply and instream values.

Setting minimum flow regimes for catchments and tributaries:

- **Option one: Set minimum flows at current consented minimum flows**

- **Option two: Apply allocation methodology from draft NES**

- **Option three: Cultural allocation preferences**

References

Golder Associates, 2008: Pareora River aquatic ecology and minimum flow requirements. Report prepared for Environment Canterbury by Golder Associates.

Golder Associates, 2011: Te Waihora/Lake Ellesmere catchment flow review: ecological values and flow requirements. Report prepared for Environment Canterbury by Golder Associates. R11/124.

Golder Associates, 2013: Orari River catchment: Ecological values and flow requirements. Report prepared for Environment Canterbury by Golder Associates.

Hayward, S. Meredith, A. 2017: Opihi River - ecological flow review. Environment Canterbury memorandum dated 13 July 2107.

Attachments: Appendix 1

Appendix 1 - updated flow statistics and ecological flow recommendations for the Opihi catchment

Surface water allocation zone	Minimum flow site location and site No.	Naturalised 7dMALF (L/s)	Common consent min. flows (L/s)	ORRP minimum flow (L/s)	NES default minimum flow (L/s)	Ecological minimum flow recommendation (L/s)	Cultural minimum flow preferences (L/s)	NES default allocation (L/s)	Current allocation (L/s)
North Opuha	Clayton Rd (69615)	826 847	850 Oct - Apr 1,000 Apr - Sep	Recommended min. flows be established for these tributaries	743	740 - 850 (Oct - Apr)		248	A - 609 B - 393
South Opuha	Monument bridge (69616)	666	500 Sep - Apr 800 Apr - Aug		599	520 - 600 (Oct - Apr)		200	A - 159 B - 957 no block - 57
Opuha River	Skiptons Bidge (69614)	2,399			1,919	2,000	2,000	1,200	A - 29 B - 1,500
Upper Opihi -Rockwood	Rockwood (69618)	1,367 1,296	790 Nov - Mar 1,280 Apr - Oct		1,325	1,000 Nov - Mar 1,200 - 1,500 Apr - Oct	1,500	684	A - 144 B - 896 no block - 46
Te Ana a Wai River (Tengawai River)	Te Ana a Wai R at Picnic grounds (69635)	616 634	400 Oct-Apr 600 May-Aug 500 Sep		554	550 (Oct - Apr) 1,200 (May - Sept)	1,200	185	A - 467 B - 856 no block - 87
Lower Opihi River catchment (unmodified flow)	Opihi R at SH1 bridge (69607)	2,685	2,500	2,500	2,148	2,500	2,600	1,343	A - 5,431 B - 1,460 no block - 392
Temuka	Temuka R at Manse Bridge (69602)	1,664 1800		700 Oct - Mar	1,335	1,400 Oct - Apr	1,500	832	A - 2,511 B - 650 no block - 215
				1,000 Apr - Sep					