Department of Primary Industries
Office of Water

SNOWY RIVER RECOVERY | SNOWY FLOW RESPONSE MONITORING AND MODELLING

Proposed flow release strategy for the Snowy River Increased Flows: 2013/14

August 2013

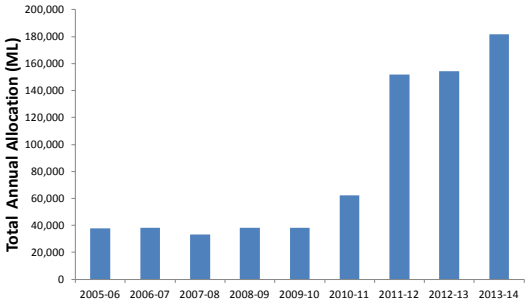
Introduction

Under the Snowy Water Inquiry Outcomes Implementation Deed (SWIOID, 2002), the NSW Office of Water is required to develop and submit a draft Annual Water Operating Plan to the Water Consultation and Liaison Committee in February each year as part of the implementation of the Snowy River Increased Flows (SRIFs).

This factsheet outlines the details of proposed release strategy that has been agreed for the Snowy River Increased Flows for 2013/14.

The annual volumetric allocation for Snowy River Increased Flows (SRIF) has steadily risen from 38GL in 2002 to 181.6 GL in 2013/14 (Figure 1). Additionally, a base passing flow of 9GL will be delivered to the Snowy River, with 0.5 and 8.5 GL from the Mowamba Weir and Jindabyne Dam respectively.

Figure 1. Total annual water allocation to the Snowy River Increased Flows 2005/06 to 2013/14.



Maximising ecosystem benefits of limited water allocations to environmental flows is a greatly debated issue in the scientific literature and amongst environmental water managers. As a part of its adaptive management approach, the NSW Office of Water undertook a detailed review of the past four years (i.e. 2009/12) of environmental flow recommendations and release patterns for the Snowy River below Jindabyne Dam (Reinfelds *et al*., 2013). This review found that the 'building blocks' environmental flow methodology as applied to the Snowy River over four years from 2009/10 to 2012/13 resulted in a flow regime that was out-of-scale with available water volumes. Most notably, the spring flood pulses released in 2011/12 and 2012/13:

- consumed approximately 51 per cent of the annual water allocation, whereas equivalent natural events accounted for only 10 to12 per cent of annual volumes
- maintained peak flow rates for 1 to 2 days longer than equivalent natural events
- were a simplification of complex, multi-peak hydrographs characteristic of the spring to early summer snowmelt signal of the Snowy River at Jindabyne prior to the Snowy Mountains Scheme.

Additionally, the review found that the allocation of water to a single event compromised the ability to meet other hydro-ecological cues in the remainder of the year. In this regard, patterns of daily flow variability resulting from the 'building blocks' methodology was heavily suppressed and uncharacteristic of rivers in the Snowy Mountains.

As a part of this review, the NSW Office of Water also undertook a detailed assessment of the potential for 'flow scaling' to deliver a 'more natural' flow regime to the Snowy River, as well as a flow regime in closer agreement with the recommendations of the independent expert panel (Pendlebury *et al*., 1996) and management objectives detailed in the SWIOID and the new objectives put forward by Williams and Wolfenden (in prep). While both the 'flow scaling' and 'building blocks' methods provide alternative options to implement the intent of the Snowy Water Inquiry (SWIOID, 2002) and the expert panel work of Pendelbury *et al.* (1996), in all aspects the 'flow scaling' approach was found to be either superior or equivalent to the 'building blocks' method. In response to this, commencing in 2013/14, the NSW Office of Water is trialling the 'natural flow scaling' release strategy for the Snowy River below Jindabyne Dam.

Aims

The aims of this discussion paper are to:

1. briefly discuss mean daily, peak hourly and monthly total hydrographs for the proposed 2013/14 environmental flow regime for the Snowy River below Jindabyne Dam
2. provide further details as to the 'natural scaling' methodology used to develop the 2013/14 flow sequence for the Snowy River below Jindabyne Dam
3. discuss the likely environmental outcomes from the 2013/14 release strategy.

Methods

The engineering works at Jindabyne Dam provide a unique opportunity to deliver some world class outcomes for environmental water delivery to the Snowy River. There are two key components to the engineering works that allow large flexibility in the operational delivery of environmental water, these being: (i) flows up to 5,000 MLd^{-1} can be easily programmed into a daily flow sequence to introduce a high degree of natural flow variability; and (ii) within channel flood flows can be delivered via radial gates, but require more careful management of lake levels. To date these capabilities of generating flow sequences reflecting natural patterns of daily flow variability together with peak flow rates with frequencies and durations reflective of natural flood events have not been trialled or implemented to their full potential. The 2013/14 release strategy will trial this new approach to deliver more frequent small flood pulse events up to 5,000 MLd^{-1} to better replicate natural events.

Key aspects of the 2013-14 recommendations

The annual volume at 190.6 GL is the largest since the program began, but an allocation of 212 GL still only represents 21 per cent of the pre Snowy Mountains Scheme average annual discharge of the Snowy River at Jindabyne. The 2013/14 daily flow release strategy (Figure 2) has a number of key components and they are briefly described below.

The 'flow scaling' approach for 2013/14 delivers an enhanced seasonal signal in the monthly flow pattern (Figure 3) that is typical of a mixed snowmelt rainfall river system characteristic of the Snowy Mountains, including:

- Sustained higher flow rates over winter and spring months, with seven consecutive months discharging in excess of 10,000 ML per month with total discharges greater than 20,000 ML per month for three of these months. This provides a sustained 'press disturbance' to the Snowy River and its estuary characteristic of the pre-regulation period.
- Low flow periods in late summer, with a minimum release rate of 101 ML/day that are punctuated by frequent small flow pulses reflective of natural summertime rain storms.
- An annual flood with a primary 8 hour peak of 111.49 m^3s^{-1}, and a total daily volume of 6,337 ML. This will require delivery via the Jindabyne Dam spillway.
- Four additional smaller flood pulse releases (A,B, C and D), with an hourly release strategy to specifically increase the peak flow rate up to the maximum capacity of cone valves over an eight hour period. These four events will have peak flow rates sustained over eight hour durations ranging from 2,815 – 5,000 MLd^{-1} (23.15 – 57.87 m^3s^{-1}). For the initial trial, these releases will also require active management by Snowy Hydro to generate the eight hour peaks and to obtain the overall mean daily target.
- Substantially increased flow variability between days, i.e. the river discharge is not maintained at the one level for a week at a time.
- Complex multi peak hydrographs that are typical of the Snowy Mountain rivers.

Figure 2. Snowy River below Jindabyne mean daily discharge pattern for 2013/14 (blue), with one primary (X) and four secondary (A,B,C,D) hourly flow peaks (dotted lines) compared with 2012/13 mean daily flow pattern (red).

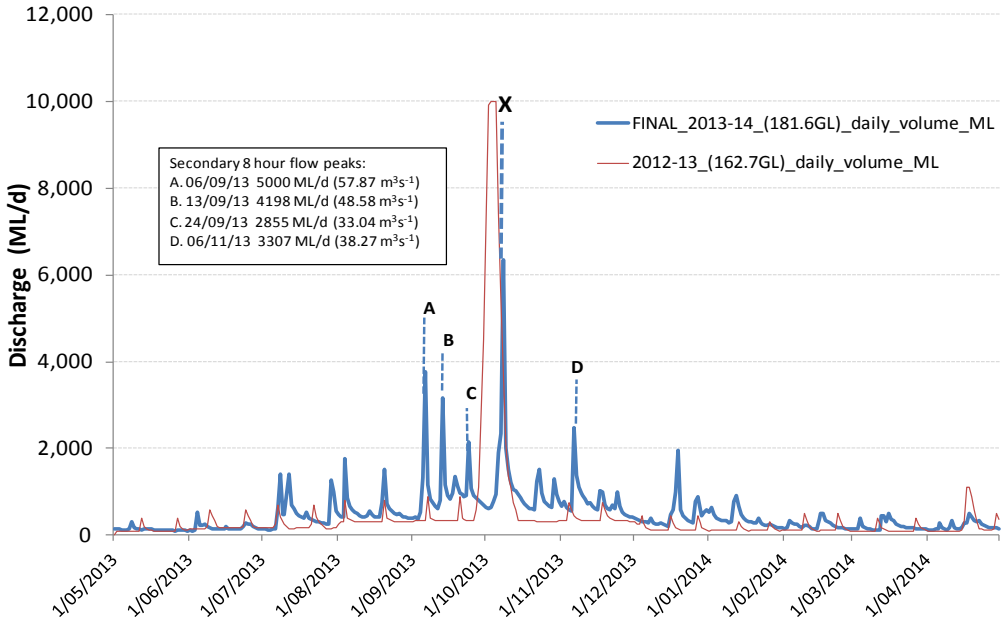
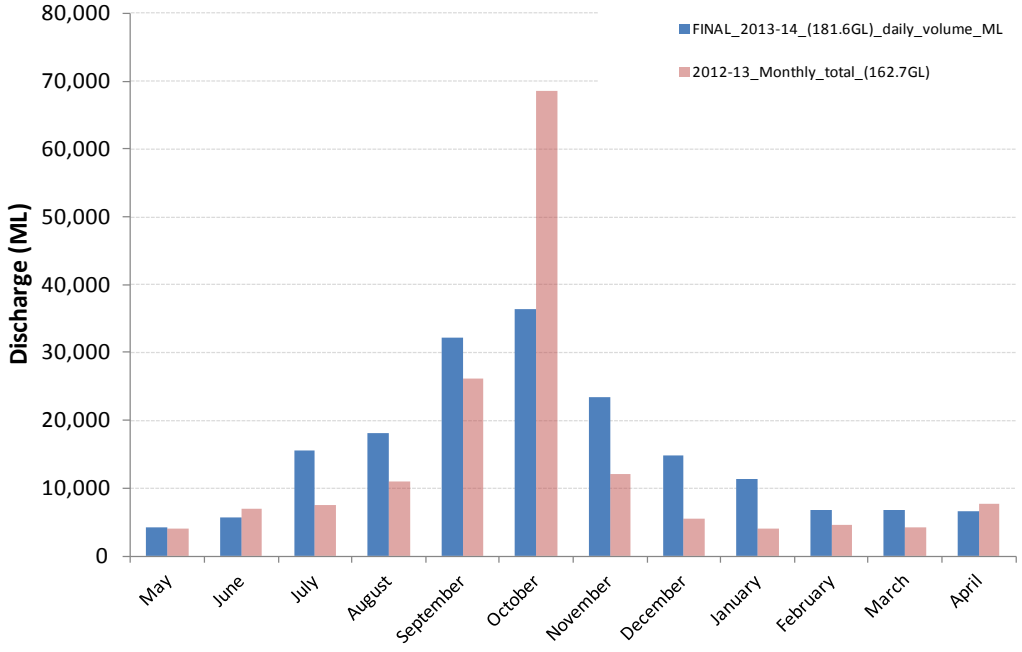


Figure 3. Snowy River below Jindabyne Dam total monthly discharge pattern for 2013/14 (blue) compared with 2012/13 (red).



Key environmental outcomes to be achieved from the 2013/14 flow strategy

The overarching objective for an environmental flow regime based on natural daily and hourly flow sequences in the Thredbo River is 'to facilitate the rehabilitation and evolution of the Snowy River below Jindabyne Dam into a smaller but healthy river.' Over decadel to century long time scales, environmental water releases scaled to the Thredbo River flows will allow the Snowy River to slowly develop a size, shape and perhaps condition, similar to that of the Thredbo River. This overarching objective implicitly recognises that it is not possible to restore or

maintain the Snowy River to its former size with one fifth of its former flow volume.

Objective- River bed scour

The regulation of the Snowy River has resulted in the in-stream habitat in filling with fine sediment. The poor in-stream habitat has been identified as a key constraint to river recovery and higher flows (above the post scheme 24 ML/day base passing flows) are required to scour the bed of the river to improve the physical condition.

Fine sediment and sand is known to move at discharge rates of >1,000 ML/day in the Snowy River. Previous results indicated that most of the fine sediment is moved in the first day of the releases and allows for some optimisation of the available water for release.

The 2013/14 release strategy with the (i) increased daily flow variability and the (ii) peaking 8 hourly discharges for five events will allow for regular disturbance of the substrate and improve its condition. Once the bed of the river has improved in condition, then it is expected that there will be an increased chance of target species, such as River Blackfish, being able to maintain a viable population in the main stem of the Snowy River.

Objective- Riffle maintenance

Riffle maintenance in the reaches below Jindabyne occurs at a flow rate of 2,000 ML/day. Riffle maintenance is the scour of fine sediment and periphyton (i.e. attached algae).

Based on the 2013/14 release strategy, a flow rate of >2,000 ML/day will be achieved on five occasions during the year.

Objective- Primary productivity

Regular pulses of water down the Snowy River have been demonstrated to inundate the lower in-channel benches and provide carbon to the water column. Many of the lower benches in the upper reaches are inundated at flow rates of about 1,500 ML/day.

It is anticipated that multiple small to moderate peaks will provide carbon from these lower benches to the river and stimulate primary productivity and the aquatic food chain.

Objective- Thermal regime

Changing the thermal regime via releases from Jindabyne Dam, are not seen as a highly practical outcome at present. However, the higher base flows punctuated by regular events may limit excessive heating of some of the shallower habitats during summer. Further studies are being undertaken to determine these flow thresholds, but it is not a key consideration for the 2013/14 water year.

Objective- Large scale fish passage

Large scale fish passage is not an objective being targeted at this stage of the SRIF program. The large natural barriers, including Snowy Falls may only ‘drown out’ at flows outside the volume available for release. It’s entirely possible that large natural floods would be required to achieve large scale fish passage along the Snowy River. Further modelling is being undertaken to determine these flow thresholds, but it is not a key consideration for the 2013/14 water year.

Objective- Estuary health

The 2013/14 release strategy will provide a freshwater ‘Press disturbance” (i.e. sustained disturbance) to the upper reaches of the estuary rather than as a large pulse disturbance. During September to December over 20,000 ML a month will be delivered to the estuary as a press disturbance.

Given that the Snowy River estuary is a very complex system, with varying mixing rates between the river stem, lakes and wetlands, it is envisage that a press disturbance will allow for a greater period of freshwater mixing in these estuarine habitats. This will partly reinstate some of the prior inundation and mixing hydrological cues in these low lying estuarine habitats.

Overall releases will need to continue over many decades in-order to meet the longer term environmental objectives. This trial using the hydroscaling approach will allow for (i) the introduction of a flow regime that is similar to a snow melt river, within the available annual allocation, and (ii) allow the engineering capabilities at Jindabyne Dam to be fully tested.

References

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Acknowledgments

The document should be cited as

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