

Revised strategy for the Snowy River Increased Flows 2014-15

Introduction

This factsheet outlines the details of the revised release strategy for the Snowy River Increased Flows (SRIFs) for 2014-15. It includes adjustments to the daily flow targets following an experimental water release from the Mowamba River during May-June 2014.

The annual target for releases from Jindabyne has steadily risen from 38GL in 2002-03 to 181.6 GL in 2013-14 (Figure 1). A total of 155.308 GL is available for release in 2014-15. The water available for the Snowy River Increased Flows is dependent on the climatic conditions in the Western Rivers, and will vary from year to year. The 155.308 GL target includes an allocation of 146.3 GL from Snowy River Increased Flows (SRIF) plus a base passing flow of 9GL, with 0.5 and 8.5 GL from delivered from the Mowamba Weir and Jindabyne Dam respectively.

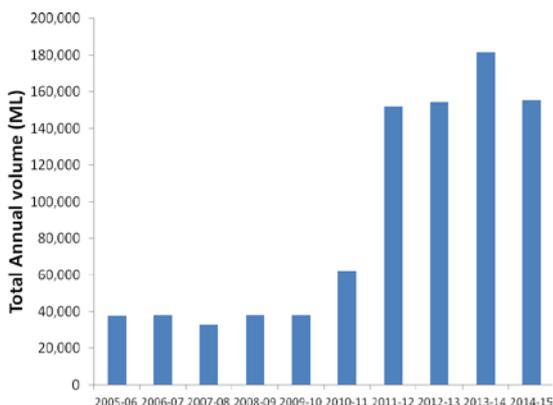


Figure 1. Total annual water targets for the Snowy River Increased Flows 2005-06 to 2014-15.

In 2013-14 the “natural flow scaling” methodology formed the basis of the release strategy to the Snowy River (Reinfelds *et al.* 2013; Williams and Reinfelds 2013). The premise of the method is to deliver

environmental water to mimic the natural hydrological cues of a Snowy Montane River. Details of the preliminary outcomes of the 2013 spring releases are described by Coleman and Williams (2014). The flow scaling approach is again the basis for the flow targets in 2014-15.

Aims

The aims of this fact sheet are to present:

1. the mean daily, peak hourly and monthly total hydrographs for the proposed 2014-15 environmental flow regime for the Snowy River below Jindabyne Dam,
2. the likely environmental outcomes from the 2014-15 release strategy, and
3. the experimental release from the Mowamba River.

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 of more than 5,000 MLd⁻¹ can be delivered via spillway gates, but require more careful management of lake levels (including a major shift in dam operations by Snowy Hydro). It was not until the 2013-14 water year that 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 were implemented to their full potential.

The 2014-15 release strategy will further trial this new approach to deliver more frequent small flood pulse events with flow peaks of up to 5,000 MLd⁻¹ using the cone valves and one event of more than 5,000 MLd⁻¹ via the spillway to better replicate natural events.

Discussions between SHL dam operators and the NSW Office of Water has indicated that the new flow approach can be implemented at Jindabyne Dam, including the five 8 hour peak flow releases during the spring of 2014.

Key hydrological aspects of the 2014-15 recommendations

The annual targeted volume of 155.3 GL from Jindabyne Dam is the third largest since the program began in 2002. The 2014-15 daily flow release strategy (Figure 2) has a number of key components and they are briefly described below.

The 'flow scaling' approach for 2014-15 will deliver 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 in September and October. This provides a small sustained 'press disturbance' to the Snowy River and its estuary, which is a characteristic of the pre-regulation period.
- Low flow periods in late summer, with a minimum release rate of 85 ML/day that are punctuated by frequent small flow pulses reflective of natural summertime rain storms.
- Median daily flows for the year are 318 MLd⁻¹.
- An annual flood with a primary 8 hour peak of 119.14 m³ per second (i.e. equivalent to 10,294 ML/day), and a total daily target volume of 6,773 ML to be delivered via the Jindabyne Dam spillway.
- Four additional smaller flood pulse releases (1,2,3 and 5), with an hourly release strategy to specifically increase the peak flow rate over an eight hour period. These four events will have peak flow rates sustained over eight hour durations ranging from 2,419 – 3,841 MLd⁻¹

(27.9 – 44.4 m³/second). These releases will require a higher level of active management by Snowy Hydro Limited to generate the eight hour peaks and to obtain the overall daily target.

- Substantially increased flow variability between days, i.e. the river discharge is different from one day to the next.
- Complex multi peak hydrographs that are typical of the Snowy Mountain rivers.
- The flow sequence differs from the previous year and introduces variability between years, especially around the timing and magnitude of flood events.

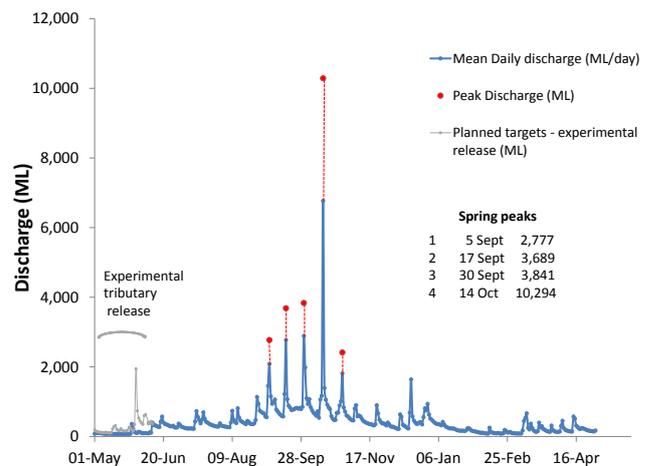


Figure 2. Revised Snowy River below Jindabyne mean daily discharge pattern for 2014-15 (blue), with one primary (4) and four secondary (1,2,3,5) hourly flow peaks (red dotted lines).

Note: daily flow targets have been revised to account for adjustments following experimental flow release in May-June 2014.

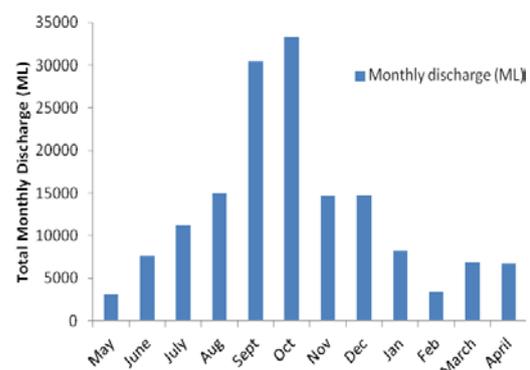


Figure 3. Snowy River below Jindabyne Dam revised total monthly discharge pattern for 2014-15.

Key environmental objectives for the 2014-15 SRIF strategy.

Objective- Overall long term rehabilitation

The long-term 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 decadal to century long time scales, environmental water releases that mimic the flows of a smaller un-regulated snow-melt river will allow the Snowy River to slowly develop a size, shape and perhaps condition, similar to that of a Snowy montane river, such as the Thredbo.

This long-term 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.
- the in-stream habitat needs to be substantially improved in-order for major secondary and tertiary ecological responses to be observed, and forms the primary focus of the strategy in the early stages of the river recovery.



Figure 4. Introducing a high flow regime in the Snowy River below Jindabyne is critical to improving habitat condition and the in-stream ecology (source: S. Williams).

Objective- Morphological change

The regulation of the Snowy River, coupled with land degradation and bush fires, has resulted in the in-stream habitat becoming smothered with fine sediment. This poor in-stream habitat has been identified as a key constraint to river recovery and higher flows (above the original post scheme 25 ML/day base passing flows) are required to scour the bed of the river to improve the in-stream habitat. Modelling and Monitoring in the Snowy River has shown that fine sediment and sand is picked up from

the bed at discharge rates of >1,000 ML/day. Previous monitoring of high releases has indicated that most of the fine sediment is moved in the first day of the event. This indicates that the magnitude of the flow peak is more important than the duration and allows for some optimisation of the available water for release by delivering high flow events of short duration (<1 day).

The 2014-15 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 (i.e. less fine silt on the substrate, and a more defined channel), 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

Riffles are the shallow flowing rocky parts of rivers in between deeper pools. Riffle maintenance is the scour of fine sediment and periphyton (i.e. attached algae) from these locations. This process occurs in the reaches below Jindabyne at a flow rate of 2,000 ML/day. Based on the 2014-15 release strategy, a flow rate of >2,000 ML/day will be achieved on five occasions during the year. In the longer term, the improved riffle habitat condition will facilitate the change in the composition of aquatic macroinvertebrates, with greater abundances of mayflies, caddis flies and stone flies.

Objective- Primary productivity

Regular high flow pulses of water down the Snowy River have been demonstrated to inundate the lower in-channel benches and provide carbon (i.e. leaves and other debris) to the water column. Carbon is a basic component of the aquatic food web. 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- Aquatic vegetation

The increased daily flow variability is designed to frequently wet the lower benches and the lower margins of the riparian zone and maintain moisture in the soil profile of the riverbank. It is expected that the increased daily flow variability will favour the development of aquatic and riparian vegetation within a band just above the low water level of the Snowy River. Additionally, the daily flow variability will limit the ingress of terrestrial vegetation into the river channel.

Objective- Thermal regime

All releases from Lake Jindabyne to the Snowy River occur through infrastructure designed to draw water from the near surface of the lake, meaning that the Snowy River is not affected by cold water pollution. However, at times of the year the water is warmer than the surrounding rivers in the Snowy Mountains. Making additional changes to 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.

Objective- Large scale fish passage

Large scale fish passage is not an objective being targeted at this stage of the SRIF program. It is unlikely that fish would be able to traverse the large natural barriers, including Snowy Falls, at the flows available for release. It's possible that large natural floods, beyond those considered 'safe' for a regulated release, 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 2014-15 water year.

Objective- Estuary health / Salinity dynamics

The 2014-15 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 like a flood. The press disturbance will be delivered over winter/spring 2014. Given that the Snowy River estuary is a very complex system, with varying mixing rates between the river stem, lakes and wetlands, it is envisaged that a press disturbance will:

- allow for a greater period of freshwater mixing in these estuarine habitats. The salinity regime in the estuary appears to be unsuitable for Australian Bass recruitment.
- assist with the maintenance of the estuary entrance condition. The natural floods from tributaries will be a more significant factor for the entrance condition than the releases.

Overall, the releases will need to continue over many decades in-order to meet the longer term environmental objectives. This trial using the hydrosaling 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.

Experimental releases from Mowamba Weir.

Part of the 2014-15 strategy is to increase our understanding of the Snowy River, in terms of how it functions and how it responds to environmental water. An experimental release from the Mowamba Weir occurred over a six week period from the beginning of May 2014 to mid June 2014. This experiment involved making minimal releases from Jindabyne dam while the full flow of the Mowamba River will be delivered to the Snowy River. As a result, flows in the Snowy River during this period are likely to be lower than expected for this time of year. This resulted in the need to adjust the daily flow targets upwards for the period August 2014 to April 2015.



Figure 5. Experimental releases to the Snowy River occurred from the Mowamba River for six weeks during May and June 2014 (source: S. Williams).

This release is part of a research project assessing the role of carbon supply from tributaries and its influence on the primary productivity in the Snowy River. This project is attempting to better understand the function of the base of the aquatic food chain.

Acknowledgments

The document should be cited as Williams, S. (2014). Revised strategy for the Snowy River Increased Flows, 2014-15. Snowy Flow Response Modelling and Modelling program, NSW Office of Water, Sydney.

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