

An aerial photograph of a large reservoir with several islands. The water is a deep blue, and the sky is filled with white clouds. A faint rainbow is visible in the distance. The foreground shows a green, hilly landscape with some brown patches.

# WATER OPERATIONS REPORT

2019 - 2020 Water Year

**snowy**hydro  
renewable energy



# ABOUT THIS REPORT

Since the Snowy Scheme's completion in 1974, Snowy Hydro Limited has carefully managed the water that flows through the Scheme's dams, tunnels, aqueducts and power stations in accordance with our water licence. This report outlines how we are managing the water that flows through the Scheme.

Snowy Hydro operates a complex hydro-electric scheme utilising the water captured by the Scheme to generate energy to meet the market's needs, while also moving water from east to west to support irrigation districts.

Each year, we have to reach certain targets for downstream and environmental water releases. Snowy Hydro has operational flexibility day-to-day to strategically manage our generation and water releases, while at the same time providing long-term security to the downstream users around annual water releases. In the Snowy Scheme, water releases and electricity generation are inseparably linked.

Snowy Hydro operates under the Snowy Water Licence, issued by the NSW Government. The licence has many legally-binding and enforceable obligations on the company.

Snowy Hydro is obligated under the Snowy Water Licence to:

- ◆ Target water releases to the River Murray and Murrumbidgee River catchments, the annual volumes of which are determined according to highly-prescriptive formulae set out in the Snowy Water Licence;
- ◆ Target water releases from Jindabyne Dam into the Snowy River for environmental purposes (Snowy River Increased Flows); and
- ◆ Facilitate additional natural flows to nominated rivers for environmental purposes (Snowy Montane Rivers Increased Flows).

This report is an important channel to educate and inform our stakeholders about the water operations of the Scheme. While we generate energy from the water that moves through the Scheme, we don't own a drop of it; nor do we sell the water, or charge people to access it.

Snowy Hydro must operate the Snowy Scheme to first meet its water release obligations and then to maximise electricity market opportunities within the constraints imposed by the Snowy Water Licence.

The Snowy Water Licence recognises the difficulties inherent in achieving precise release volumes at each release point, so any shortfall or excess is accounted for and generally dealt with by an 'unders' and 'overs' approach, whereby the shortfall or excess is added or subtracted to the following year's target – i.e. there is no way that Snowy Hydro can consistently 'under-deliver' water to any aspect of the release program.

For more information about the Snowy Water Licence we encourage people to visit the NSW Department of Planning, Industry and Environment at [industry.nsw.gov.au/water/basins-catchments/snowy-river](https://industry.nsw.gov.au/water/basins-catchments/snowy-river)

# COMPLYING WITH OUR LICENCE – WHAT WATER WENT OUT

Snowy Hydro complied with all of the requirements imposed upon the company under the Snowy Water Licence during the 2019–20 water year, including each water release target relating to:

- ◆ The Required Annual Release to the River Murray catchment.
- ◆ The Required Annual Release to the Murrumbidgee River catchment.
- ◆ Environmental releases into the Snowy River from Jindabyne Dam.
- ◆ Environmental releases into the Murrumbidgee River from Tantangara Dam.
- ◆ Environmental releases into the Goodradigbee River from Goodradigbee Aqueduct.
- ◆ Environmental releases into the Geehi River from Middle Creek and Strzelecki Creek Aqueducts.
- ◆ Environmental releases into the Snowy River from Bar Ridge, Diggers Ck and Falls Ck Aqueducts

# WESTERN RIVER RELEASES

## RIVER MURRAY CATCHMENT

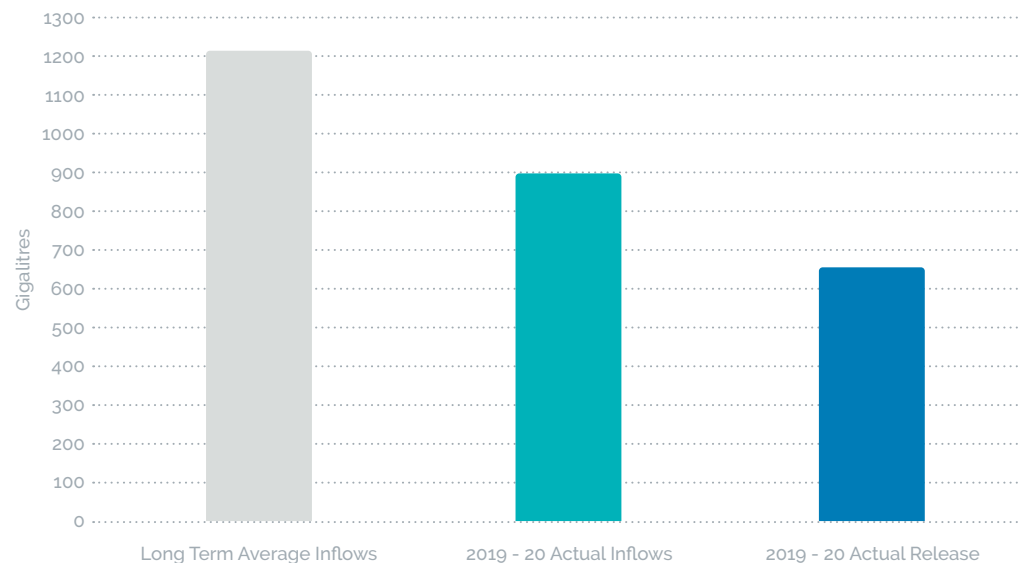
Snowy Hydro complied with its obligation to target the Required Annual Release (RAR) from the Snowy-Murray Development to the River Murray catchment during the 2019–20 water year.

The total accounted release volume was 654 GL. This was made up of:

- 💧 781 GL being the 2019–20 RAR calculated under the Snowy Water Licence; less
- 💧 254 GL of Net Dry Inflow Sequence Volume (DISV) Increase; plus
- 💧 127 GL of pre-release of the 2020–21 RAR; plus
- 💧 0 GL of Discretionary Above Target Water Releases (water not required for RAR releases that Snowy Hydro is able to release at its discretion)

This total accounted release volume includes 20 GL of montane environmental flow releases provided to the Geehi and Swampy Plains River which did not flow through the Scheme's power stations.

Inflows and Releases to the River Murray Catchment during 2019 - 20



## MURRUMBIDGEE RIVER CATCHMENT

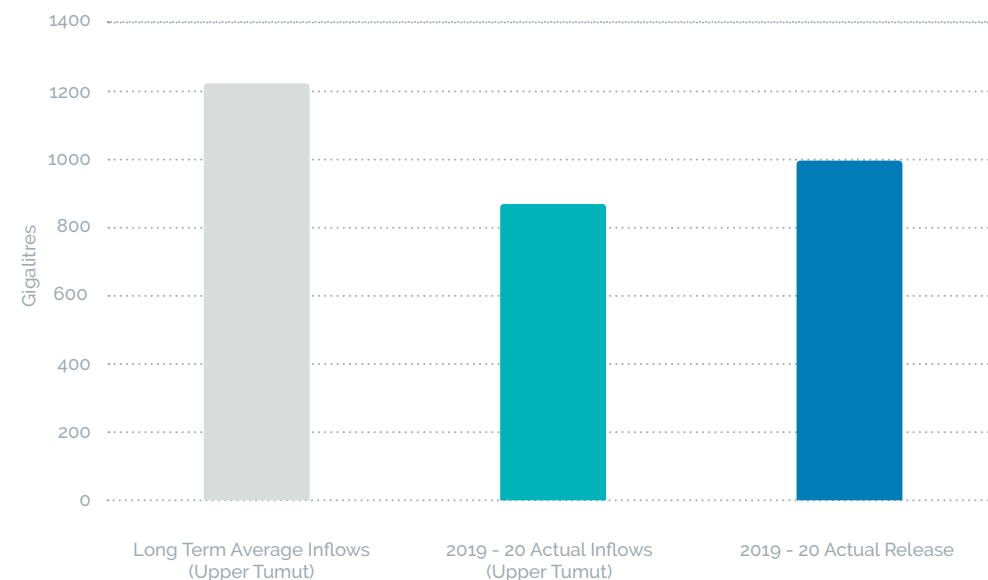
Snowy Hydro complied with its obligation to target the Required Annual Release (RAR) from the Snowy-Tumut Development to the Murrumbidgee River catchment during the 2019–20 water year.

The total accounted release volume was 997 GL. This was made up of:

- 💧 880 GL being the 2019–20 RAR calculated under the Snowy Water Licence; plus
- 💧 117 GL of pre-release of the 2019–20 RAR; plus
- 💧 0 GL of Discretionary Above Target Water release (water not required for RAR releases that Snowy Hydro is able to release at its discretion).

This total accounted release volume includes 8 GL of montane environmental flow releases provided to the Murrumbidgee and Goodradigbee Rivers which did not flow through the Scheme's power stations.

Inflows and Releases to the Murrumbidgee Catchment during 2019 - 20



# ENVIRONMENTAL RELEASES

## SNOWY RIVER INCREASED FLOWS

Snowy Hydro complied with its obligation to target releases from Jindabyne Dam for environmental purposes during the 2019–20 water year.

The volume of Snowy River Increased Flows (SRIF) released from Jindabyne Dam during the 2019–20 water year was 109.3 GL, which was 0.0 GL below the target volume of 109.4 GL (note 0.1 GL rounding error). That deficit is well within the  $\pm 10\%$  annual tolerance around the target volumes allowed under the Snowy Water Licence. The 2020–21 target has been adjusted up to account for this release deficit.

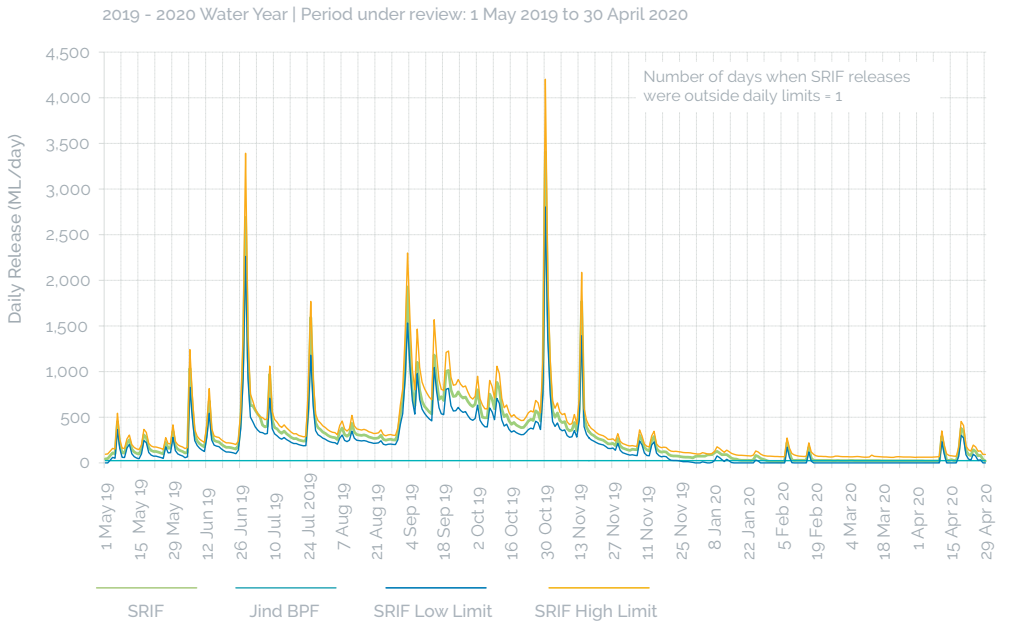
In addition to the environmental releases, 8.5GL Base Passing Flow (BPF) was also released from Jindabyne Dam and 0.5GL riparian flow was released from the Mowamba Weir.

All monthly releases except March 2020 were within the  $\pm 20\%$  monthly tolerance allowed under the Snowy Water Licence. There was one day where the daily releases was outside the daily target by more than 20%. This was reported to NSW DPIE Water. All other releases were within the  $\pm 20\%$  daily tolerance allowed under the Snowy Water Licence.

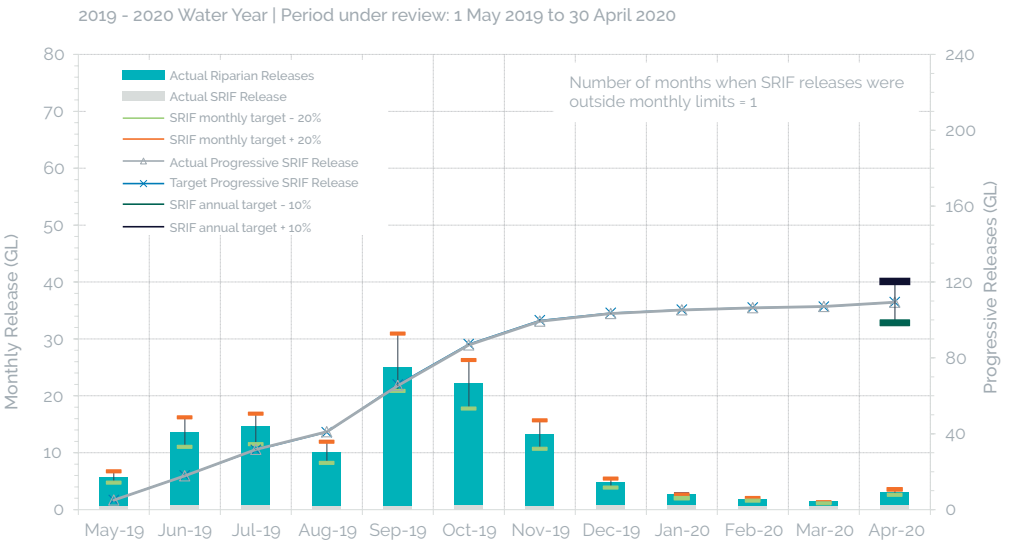
As allocations for the 2019–20 water year once again exceeded 100GL, a flushing flow was scheduled for the Snowy River, as set out on page 5.

The comparison of the annual, monthly and daily release targets for the Snowy River Increased Flow releases against the actual releases is shown in the following charts.

## Snowy River Increased Flows (SRIF) and Jindabyne Base Passing Flow (BPF) Releases and Daily Limits



## Snowy River Increased Flows (SRIF) and Jindabyne Base Passing Flow (BPF) Releases including Mowamba Riparian Releases



## DELIVERING 'FLUSHING FLOWS' OUT OF JINDABYNE DAM INTO THE SNOWY RIVER

In any year when allocations exceed 100GL, Snowy Hydro can be instructed by NSW DPIE Water to deliver a flushing flow to the Snowy River. A flushing flow is defined as a day when the release target exceeds the 5GL capacity of the other release infrastructure at Jindabyne Dam, meaning that the spillway gates must be opened to achieve the flow target.

The intent of flushing flows is to mimic the effect of the spring snow melt in the Snowy River. These high flows are intended to scour the bed of the channel and remove fine sediment to improve the habitat of the river for fish and macro invertebrates.

In October 2019 Snowy Hydro delivered a flushing flow, following the release pattern set by the NSW DPIE Water, with releases peaking at 5.0 GL per day and discharged through the spillway gates, as well as the cone valves.

The NSW DPIE Water, working with representatives across local, state and Commonwealth Government agencies, was responsible for the advice to downstream landholders and other stakeholders that would be impacted by the increased Snowy River levels.

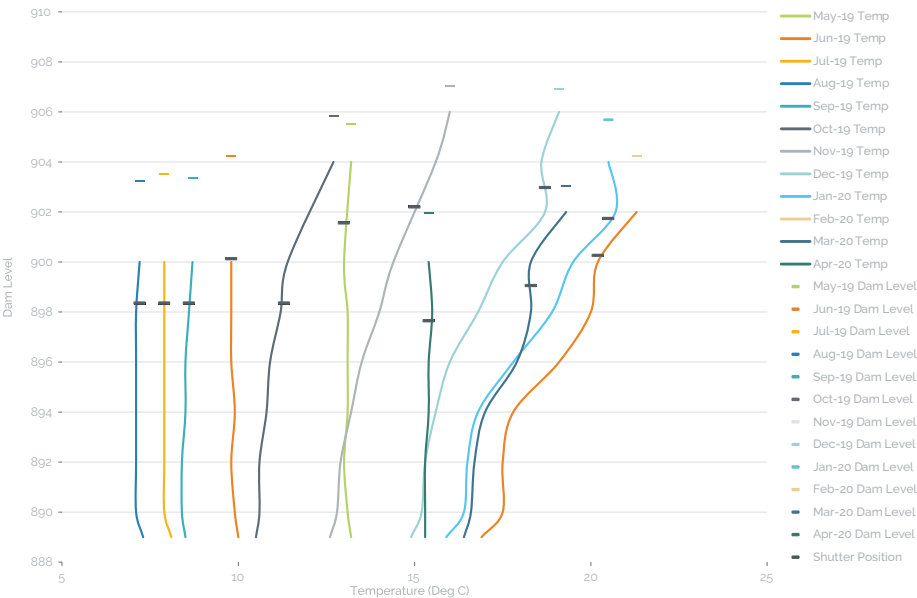
## THE TEMPERATURE OF RELEASES FROM LAKE JINDABYNE

The Snowy Water Licence requires the outlet works at Jindabyne Dam to be capable of releasing water from above any thermocline in the reservoir. The thermocline is a thin, but distinct, layer in a large body of water in which water temperature changes more rapidly with depth than it does in the layers above or below. Typically, as the summer progresses, the surface waters warm and the deeper waters remain cold. This causes a lack of mixing between the upper and lower layers, which can result in the lower layer having reduced oxygen levels. For these reasons, the deeper waters within reservoirs are generally viewed as having undesirable water quality characteristics for releases, hence the requirement for the outlet works to be able to draw water from above the thermocline.

The intake works at Jindabyne are located at the end of a channel excavated into the bank of Lake Jindabyne. In addition to the variable level shutters in the intake tower, the level of the base of the channel means that the deeper waters of the reservoir are inaccessible. This means that the thermocline is only likely to be above the levels of the intake channel when the lake is at much higher levels.

Snowy Hydro undertakes temperature monitoring at the intake tower to detect the presence of a thermocline and adjusts shutter height as necessary. As can be seen in the chart below, all releases were made from above the thermocline.

Jindabyne Dam Intake Water Temperatures and Level



SNOWY MONTANE RIVERS INCREASED FLOWS

Snowy Hydro complied with its obligation to target Snowy Montane Rivers releases for environmental purposes during the 2019–20 water year.

During the 2019–20 water year, Snowy Hydro was directed to make Snowy Montane Rivers Increased Flows (SMRIF) from the following locations:

- Tantangara Dam to the Murrumbidgee River,
- Goodradigbee Aqueduct to the Goodradigbee River (a tributary of the Murrumbidgee River),
- Middle Creek Aqueduct to Middle Creek and Strzelecki Creek Intake (on the Geehi River Aqueduct) to Strzelecki Creek (tributaries of the Geehi River), and
- Bar Ridge and Diggers Creek Aqueducts to Tolbar Creek and Diggers Creek, respectively (tributaries of the Snowy River)
- Falls Creek to the Snowy River below Guthega Dam.

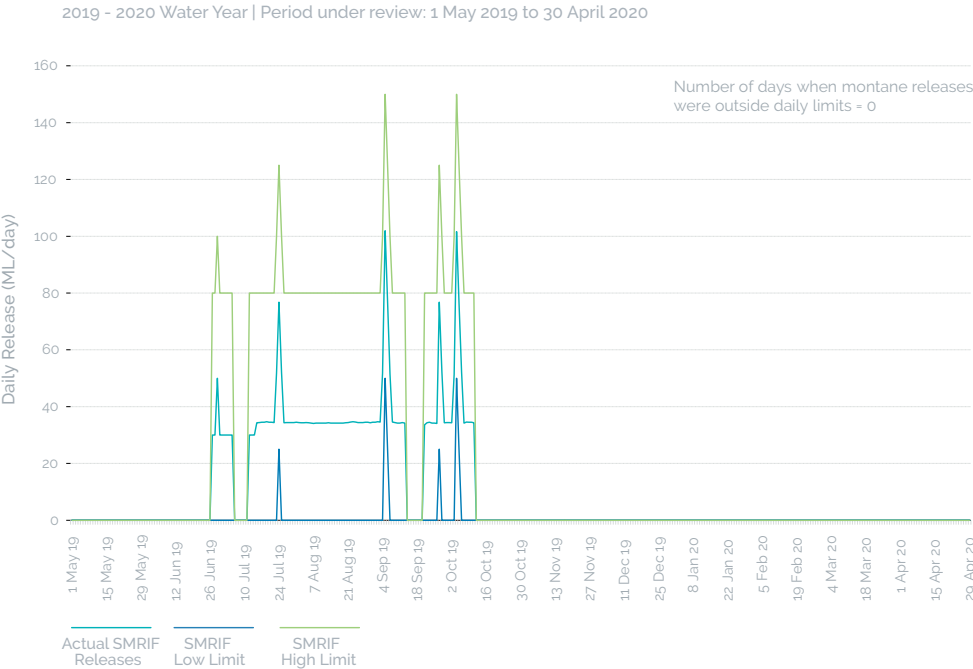
The target volume for SRIF totalled 55.3 GL, with 3.3 GL from Tantangara Dam, 7.0 GL from Goodradigbee Aqueduct, 22.7GL from Middle Creek and Strzelecki Ck, 18.9GL from Bar Ridge and Diggers Creek Aqueducts and 3.4GL from Falls Creek, all to be targeted over the whole water year.

The total actual montane release volume was 42.9GL. This was made up of 3.6 GL from Tantangara Dam, 4.5GL from Goodradigbee Aqueduct, 19.9 GL from Middle Creek Aqueduct and Strzelecki Ck combined, 12.2 GL from Bar Ridge and Diggers Creek Aqueducts combined and 2.7 GL from Falls Creek, released over the whole water year. The Bar Ridge montane release was delivered via Burrungubugge River in the 2019 - 20 water year.

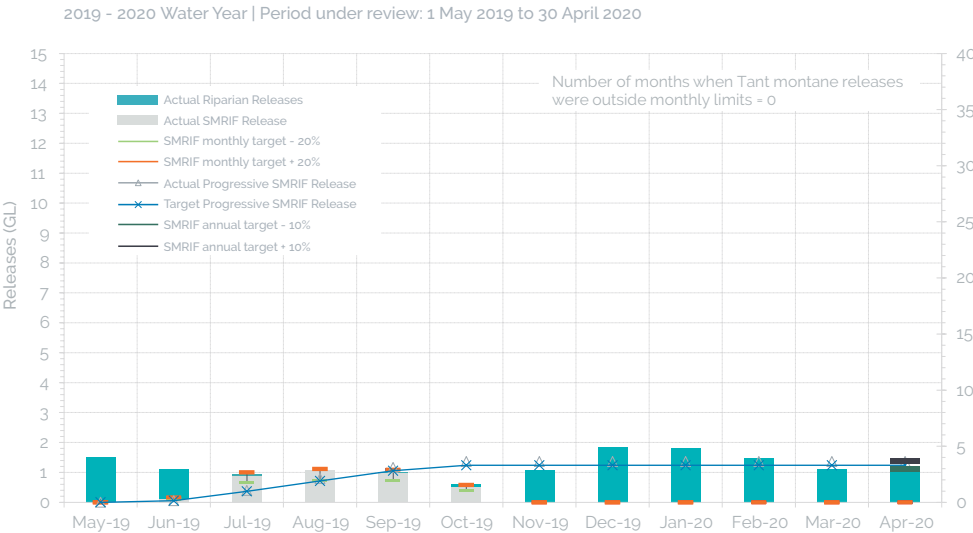
The comparison of the annual, monthly and daily release targets for the SMRIF against the actual release from Tantangara Dam is set out in the graphs opposite. All daily, monthly and annual release targets were within the compliance limits.

Monthly releases from Goodradigbee, Middle Creek, Strzelecki Creek, Bar Ridge and Diggers Creek are also provided on the following pages. As these releases are made from small catchments and the inflows (and therefore releases) cannot be predicted or controlled, there are no annual compliance targets for these releases. The above/below target delivery of water in these catchments in 2019-2020 reflects the inflows received in these locations. In years when inflows are above average, above average volumes of water will be delivered to these catchments, and vice versa.

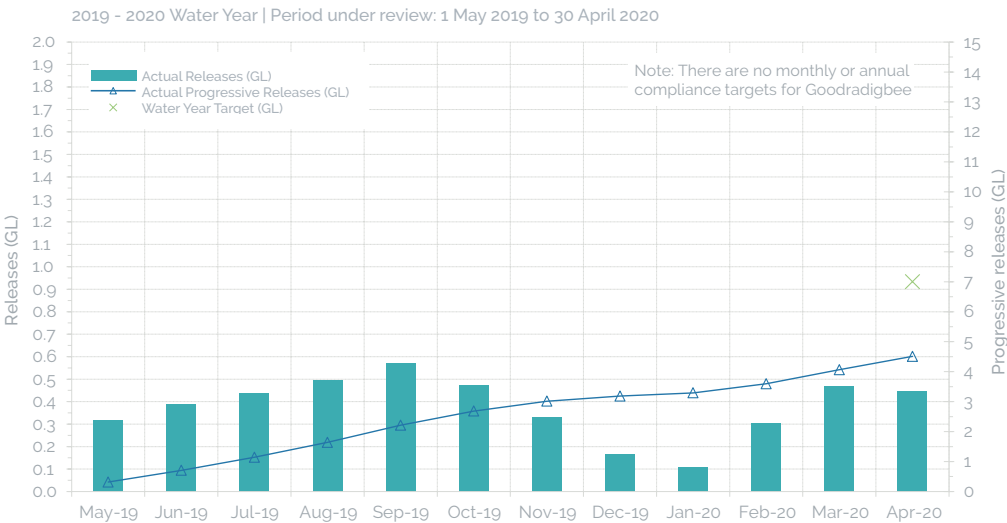
Snowy Montane Rivers Increased Flows (SMRIF) from Tantangara Dam and Daily Limits



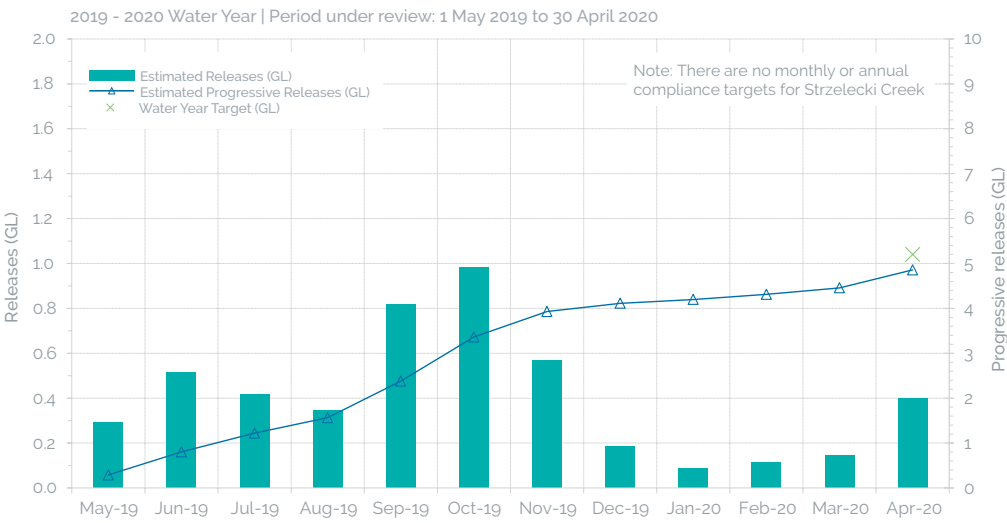
Snowy Montane Rivers Increased Flows (SMRIF) and Riparian Releases from Tantangara Dam



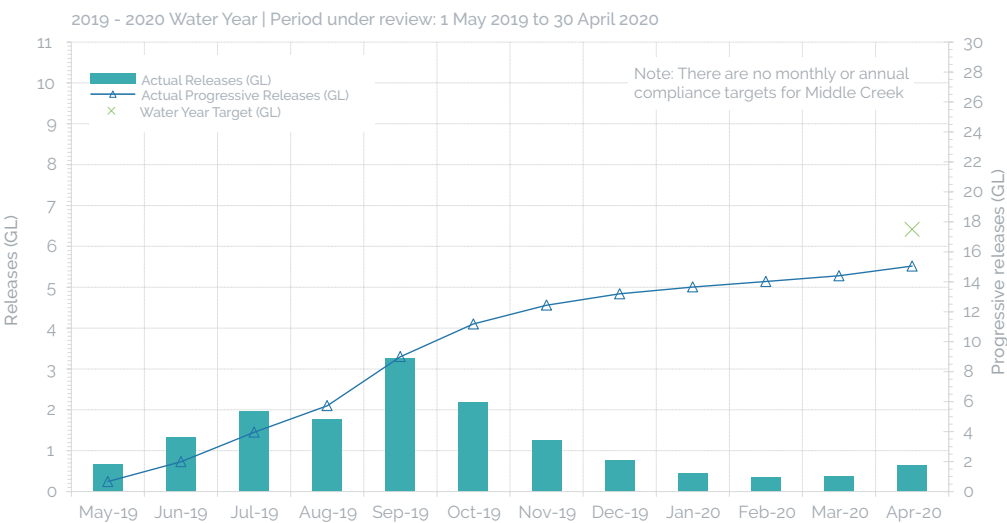
### Snowy Montane Rivers Increased Flows (SMRIF) from Goodradigbee Weir



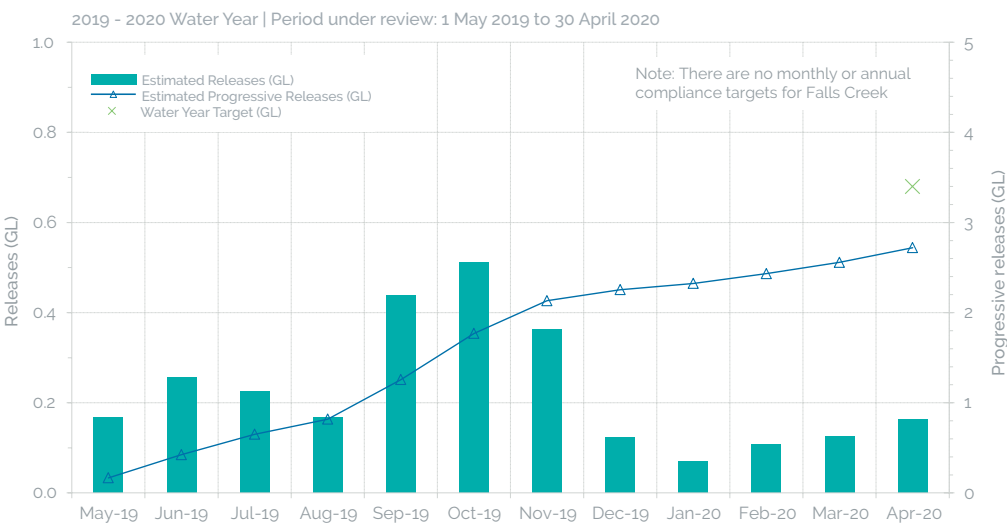
### Snowy Montane Rivers Increased Flows (SMRIF) from Strzelecki Creek Aqueduct



### Snowy Montane Rivers Increased Flows (SMRIF) from Middle Creek Aqueduct

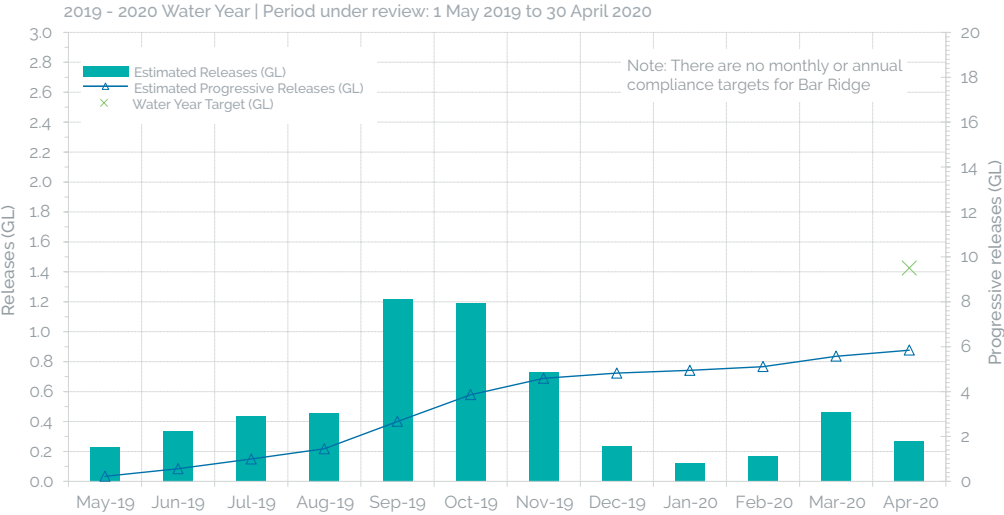


### Snowy Montane Rivers Increased Flows (SMRIF) from Falls Creek Aqueduct

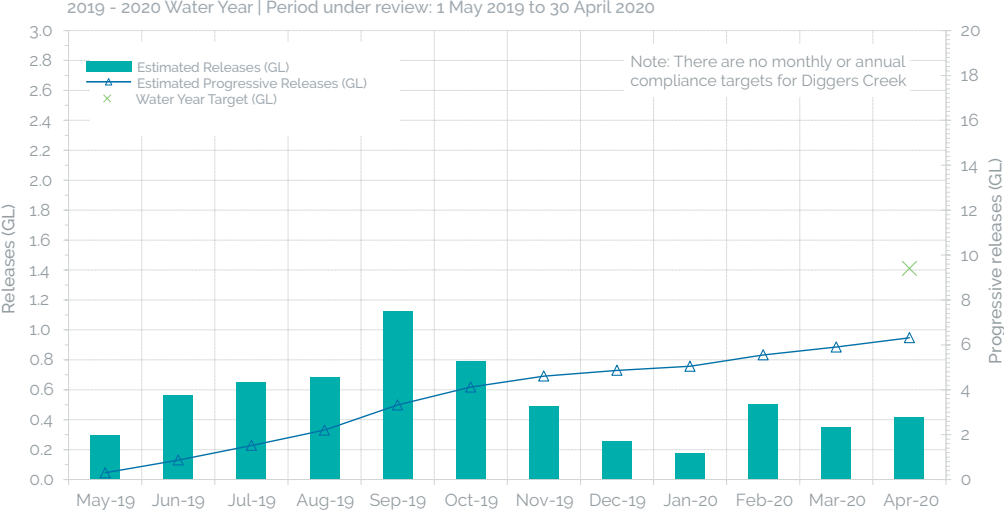




# Snowy Montane Rivers Increased Flows (SMRIF) from Bar Ridge Aqueduct



# Snowy Montane Rivers Increased Flows (SMRIF) from Diggers Creek Aqueduct



# THE TEMPERATURE OF RELEASES FROM TANTANGARA RESERVOIR

The Snowy Water Licence requires the outlet works at Tantangara Dam to be capable of releasing water from above any thermocline in the reservoir. The thermocline is a thin, but distinct, layer in a large body of water in which temperature changes more rapidly with depth than it does in the layers above or below. Typically, as the summer progresses, the surface waters warm and the deeper waters remain cold. This causes a lack of mixing between the upper and lower layers, which often results in the lower layer having reduced oxygen levels. For these reasons, the deeper waters within reservoirs are generally viewed as having undesirable water quality characteristics for releases, hence the requirement for the outlet works to be able to draw water from above the thermocline.

The new intake works at Tantangara Dam are located on the upstream face of the dam wall. They comprise a series of 'telescoping' shutters to create a variable level off-take.

Snowy Hydro undertakes temperature monitoring at the intake tower to detect the presence of a thermocline and adjusts the shutter height as necessary. As can be seen in the chart below, a persistent thermocline was not present during the 2019-20 water year.

# Tantangara Dam Intake Water Temperatures and Level

