



# Annual Water Operating Plan

2021 | 2022

# 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 Public Annual Water Operating Plan is a new report that provides increased transparency around the water operations of the Snowy Scheme. It includes a look back at Snowy Hydro's compliance with release requirements for the previous water year, and outlines the release obligations for the upcoming water year.

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)

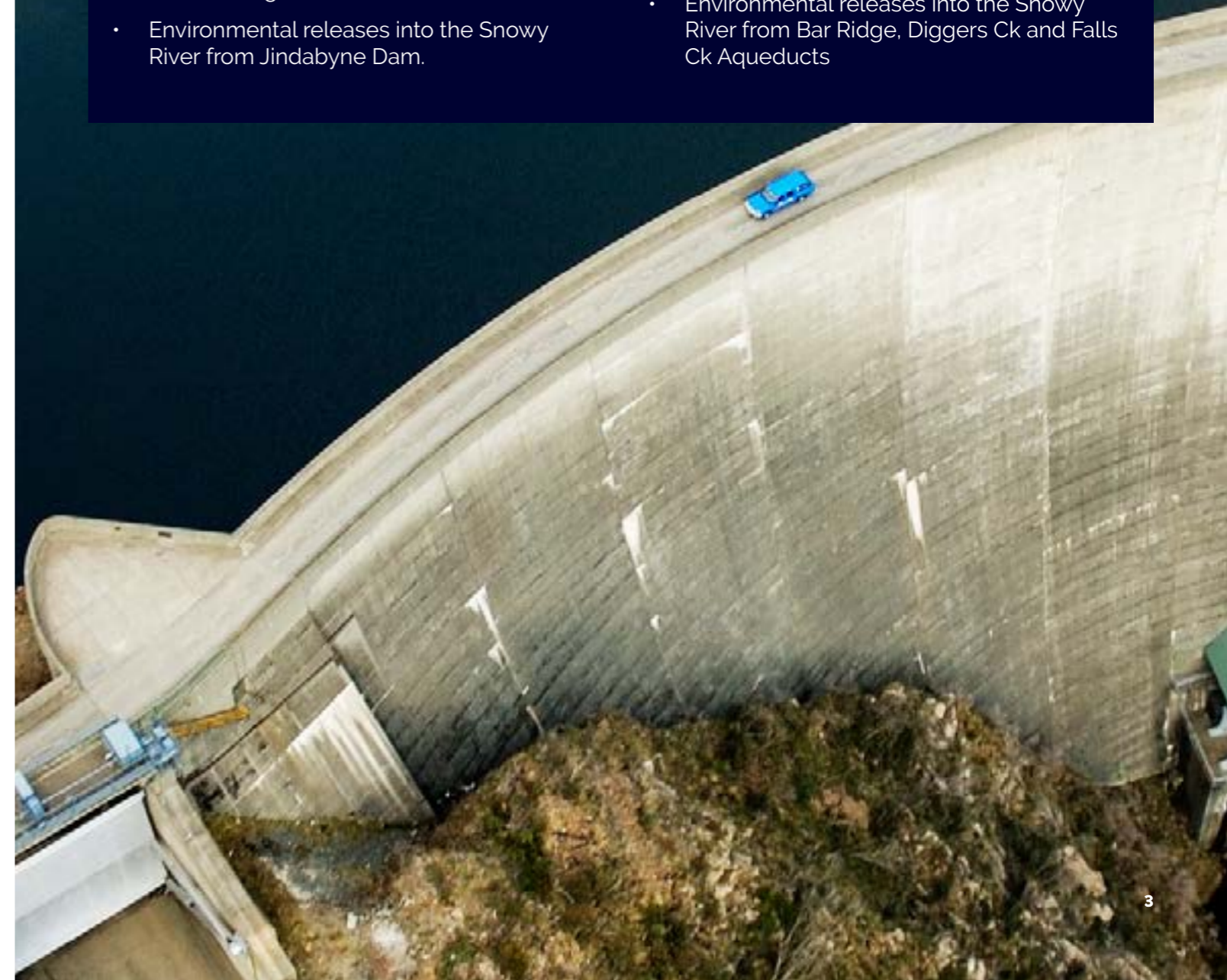
# 2020-21 Compliance report

## What water went out

Snowy Hydro complied with all of the requirements imposed upon the company under the Snowy Water Licence during the 2020–2021 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

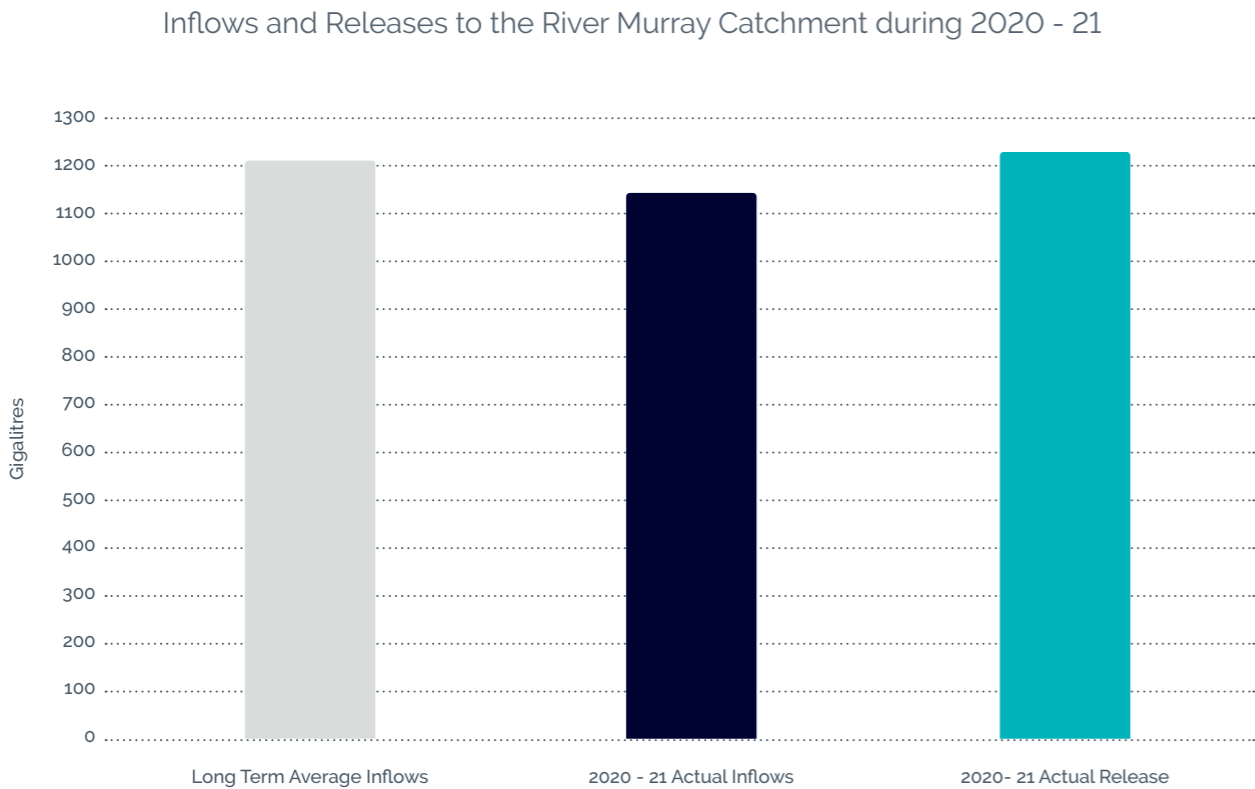
## River Murray catchment

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 2020–21 water year.

The total accounted release volume was 1,232 GL. This was made up of:

- 881 GL being the 2020–21 RAR calculated under the Snowy Water Licence; plus
- 301 GL of pre-release of the 2021–22 RAR; plus
- 50 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 14 GL of montane environmental flow releases provided to the Geehi and Swampy Plains River which did not flow through the Scheme's power stations.



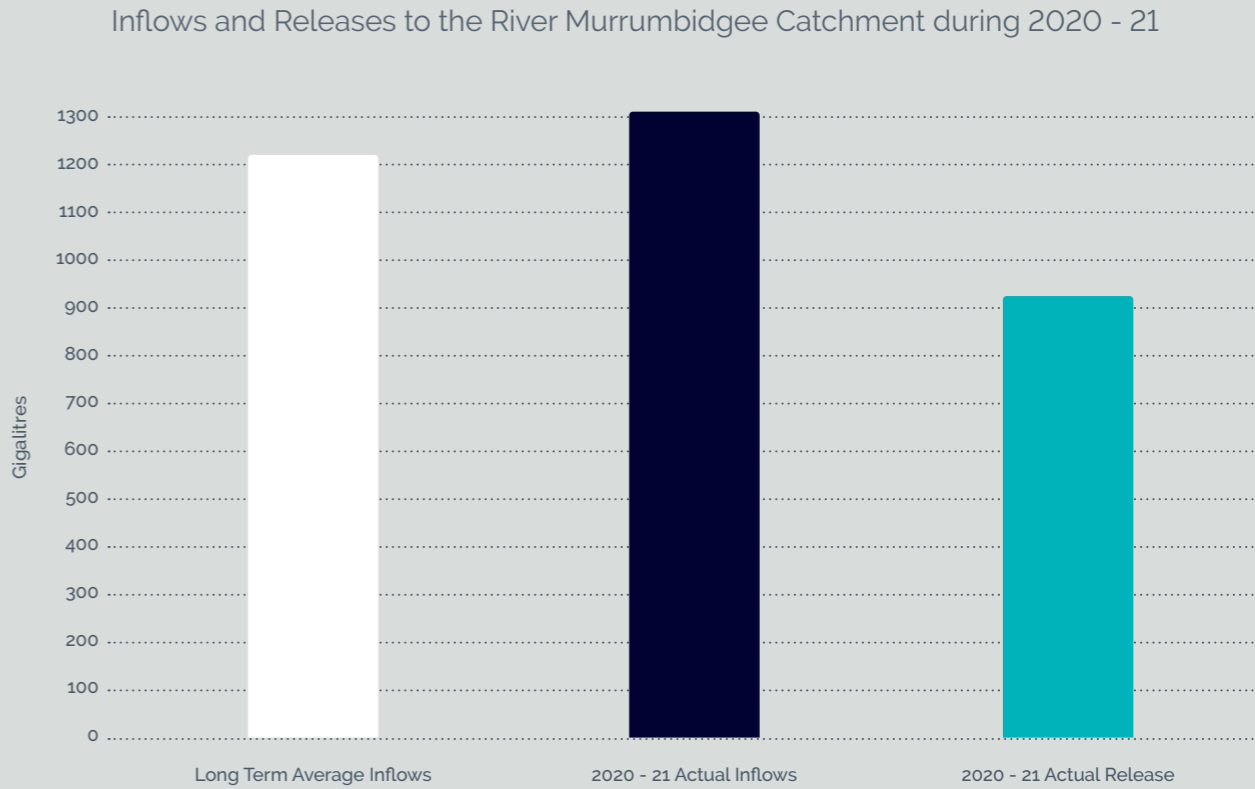
## Murrumbidgee River catchment

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 2020–21 water year.

The total accounted release volume was 924 GL. This was made up of:

- 612 GL being the 2020–21 RAR calculated under the Snowy Water Licence; plus
- 200 GL of pre-release of the 2021–22 RAR; plus
- 112 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 10 GL of montane environmental flow releases provided to the Murrumbidgee and Goodradigbee Rivers which did not flow through the Scheme's power stations.



# Environmental releases

## Snowy River increased flows

Snowy Hydro complied with its obligation to target releases from Jindabyne Dam for environmental purposes during the 2020–21 water year.

The volume of Snowy River Increased Flows (SRIF) released from Jindabyne Dam during the 2020–21 water year was 82.7 GL, which was 0.4 GL below the target volume of 83.1 GL. That deficit is well within the +/-10% annual tolerance around the target volumes allowed under the Snowy Water Licence. The 2021–22 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 were within the +/-20% monthly tolerance allowed under the Snowy Water Licence. There were three consecutive days where the daily releases were outside the daily target by more than 20%. This was reported to NSW DPIE Water. All other releases were within the +/-20% daily tolerance allowed under the Snowy Water Licence.

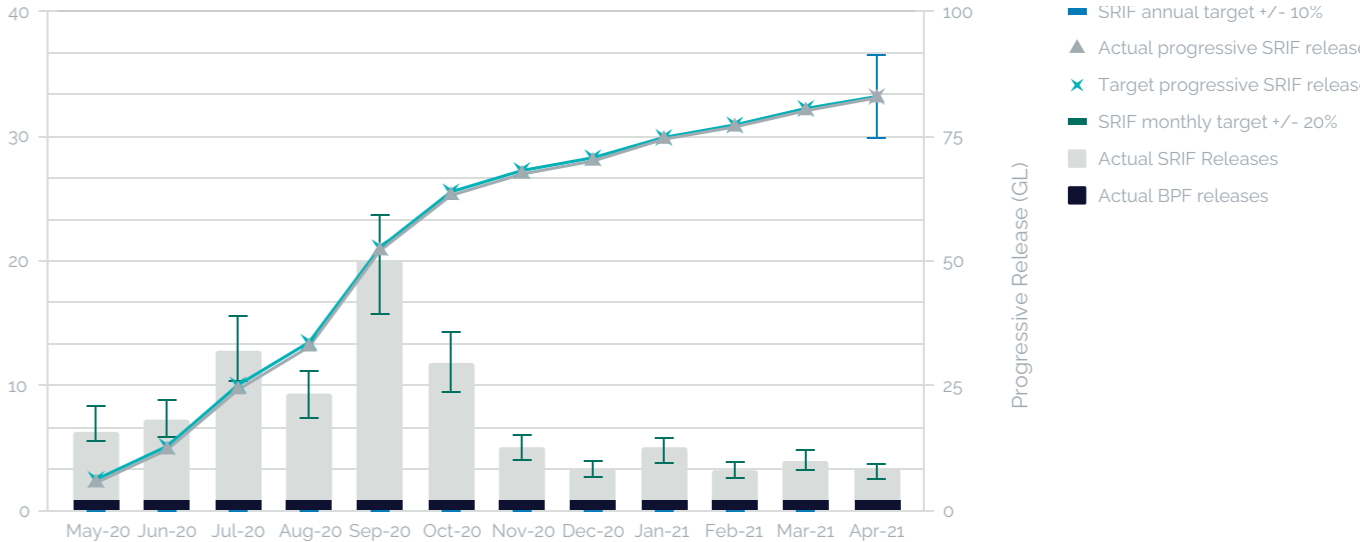
In any year when allocations exceed 100GL, Snowy Hydro can be instructed by NSW DPIE Water to deliver a flushing flow to the Snowy River. A flushing flow is defined as a day when the release target exceeds the 5GL capacity of the other release infrastructure at Jindabyne Dam, meaning that the spillway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

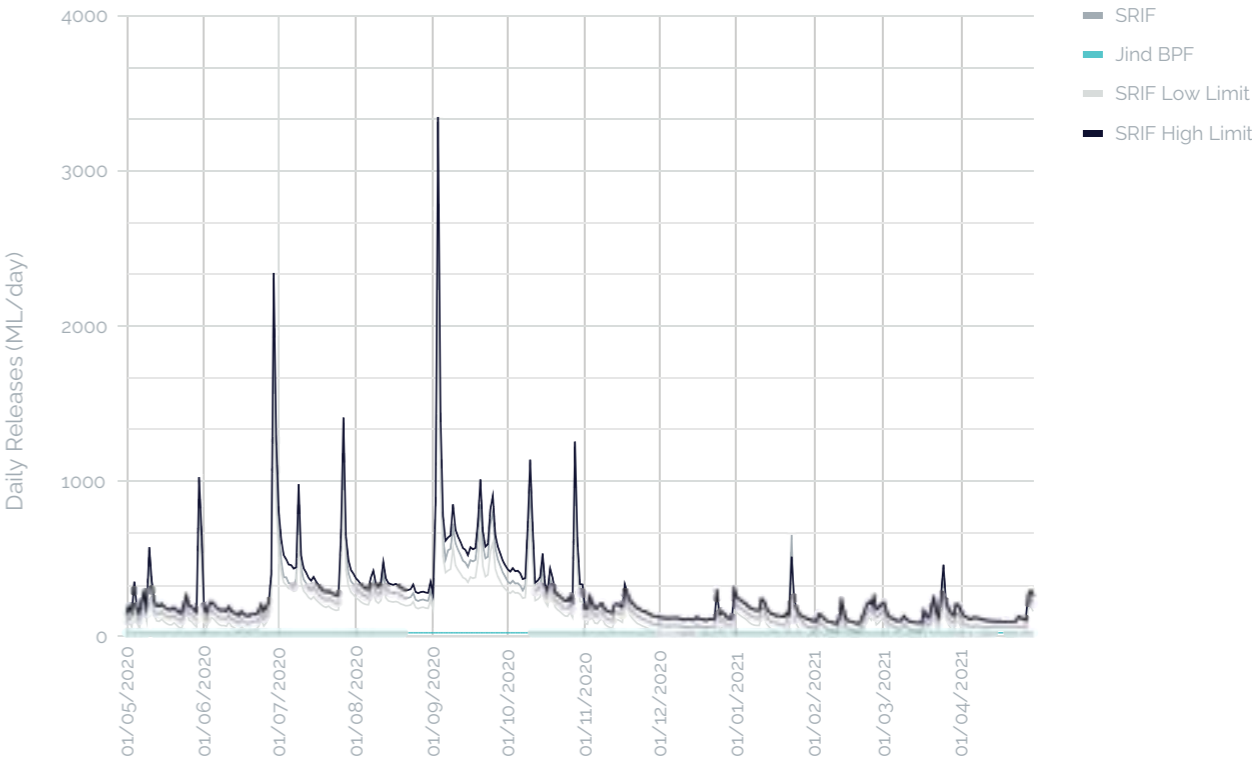
As allocations for the 2020–21 water year did not exceed 100GL, a flushing flow was not scheduled for the Snowy River.

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 including Mowamba riparian releases



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



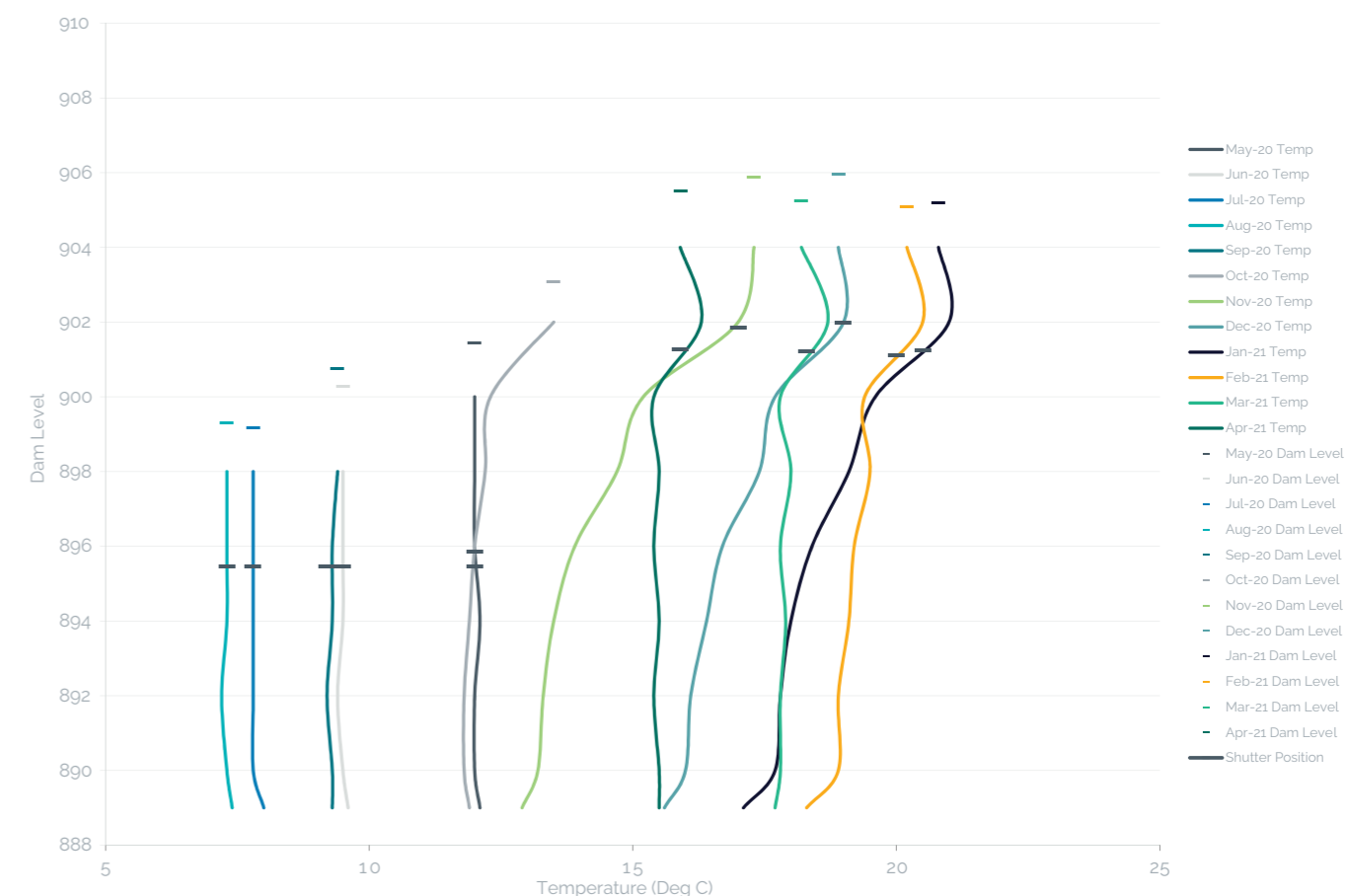
## The temperature of releases from Lake Jindabyne

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 2020–21 water year.

During the 2020–21 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),
- Diggers Creek Aqueduct Diggers Creek, (a tributary of the Snowy River), and
- Falls Creek to the Snowy River below Guthega Dam.

The target volume for SMRIF totalled 39.1 GL, with 3.1 GL from Tantangara Dam, 7.0 GL from Goodradigbee Aqueduct, 16.2 GL from Middle Creek and Strzelecki Ck, 9.4GL from Diggers Creek and 3.4GL from Falls Creek, all to be targeted over the whole water year.

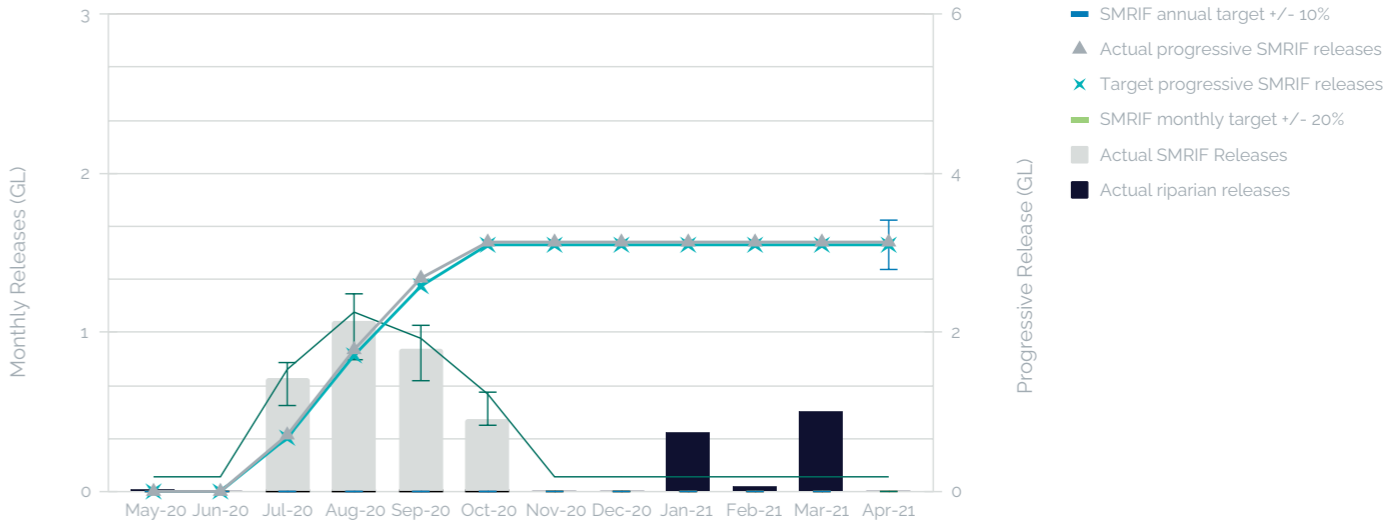
The total actual montane release volume was 38.8 GL. This was made up of 3.1 GL from Tantangara Dam, 7.1 GL from Goodradigbee Aqueduct, 13.6 GL from Middle Creek Aqueduct and Strzelecki Ck combined, 11.9 GL from Diggers Creek Aqueduct and 3.1 GL from Falls Creek, released over the whole water year.

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.

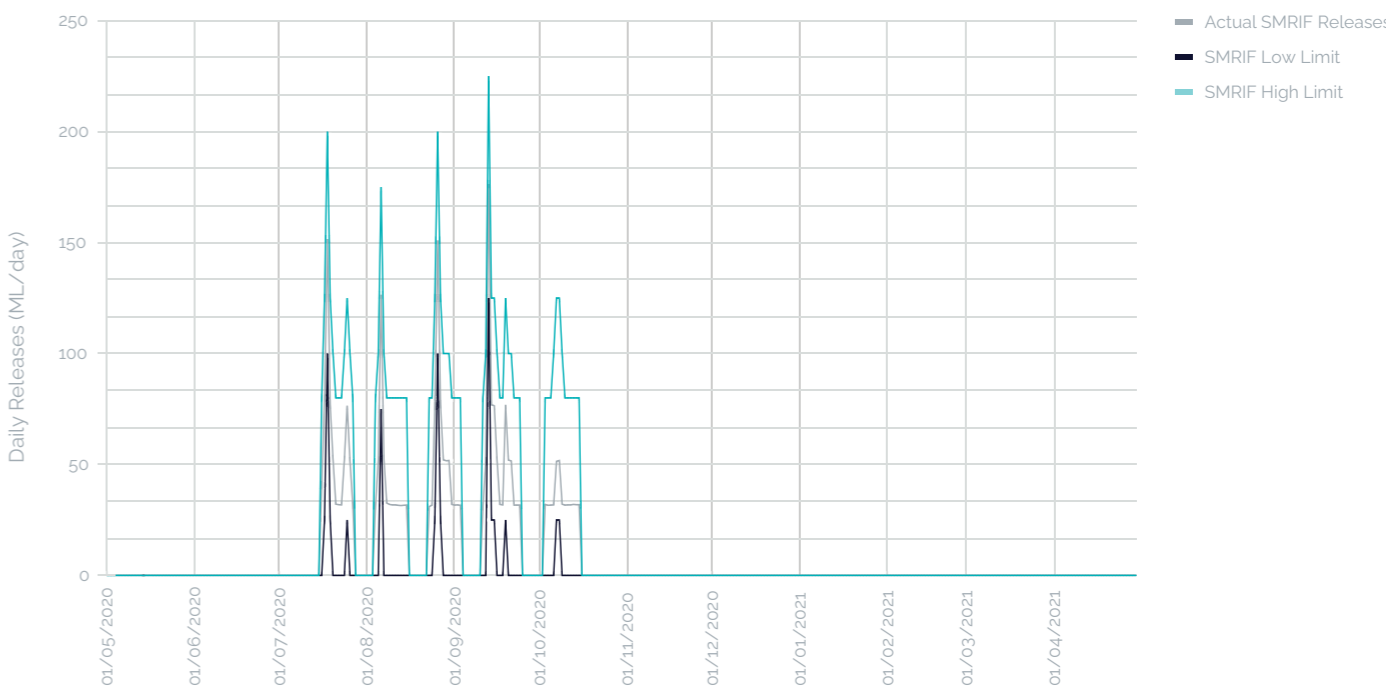
Monthly releases from Goodradigbee, Middle Creek, Strzelecki Creek, Diggers Creek and falls Creek are also provided on the following pages. As these releases are made from small catchments and the inflows (and therefore releases) cannot be predicted or controlled, there are no annual compliance targets for these releases. The above/below target delivery of water in these catchments in 2020-2021 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.

Due to the low allocations to the Snowy Montane Release Program in 2020-21, releases were not made from Bar Ridge Aqueduct.

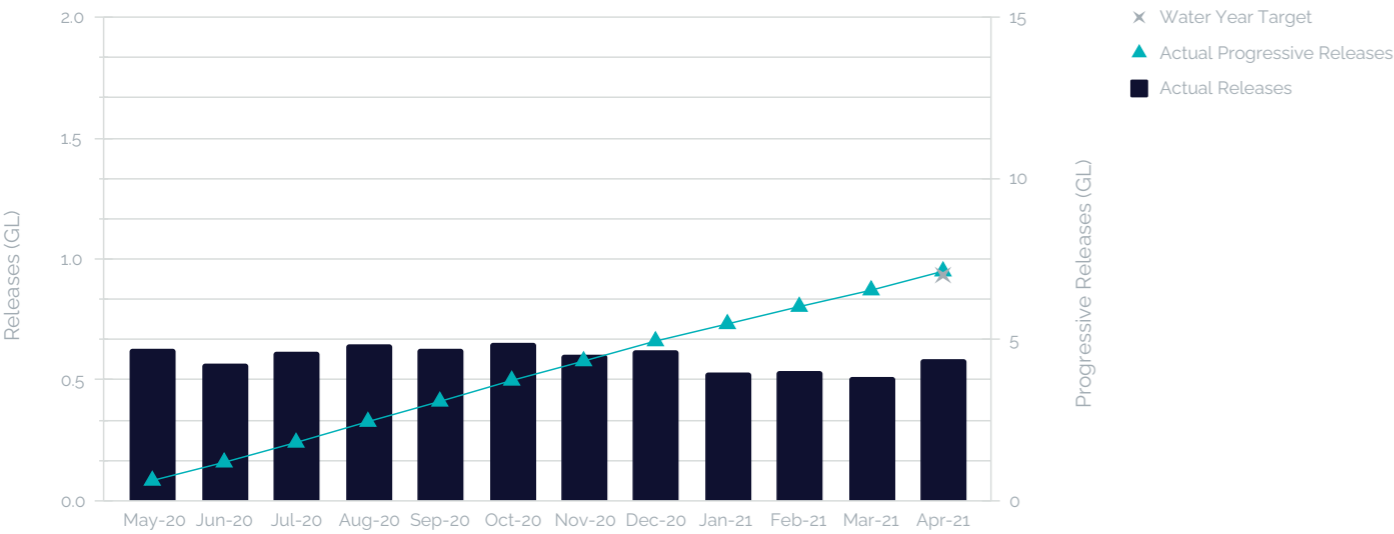
Snowy Montane Rivers Increased Flows (SMRIF) and Riparian Release from Tantangara Dam



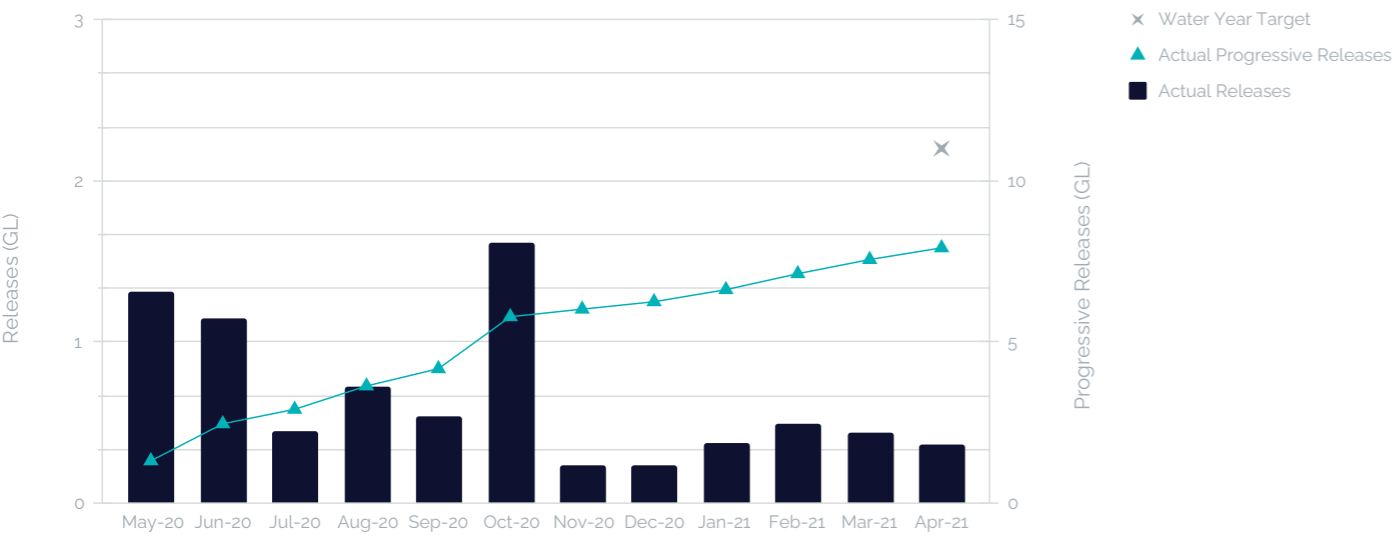
Snowy Montane Rivers Increased Flows (SMRIF) from Tantangara Dam and daily limits



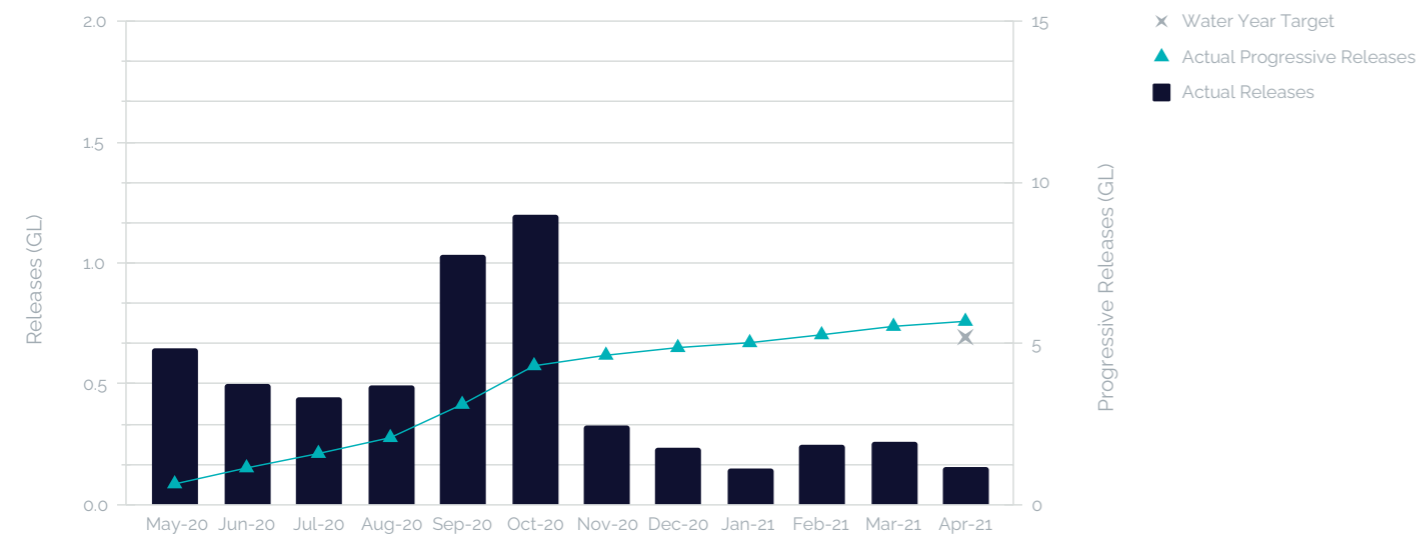
Snowy Montane Rivers Increased Flows (SMRIF) from Goodradigbee Weir



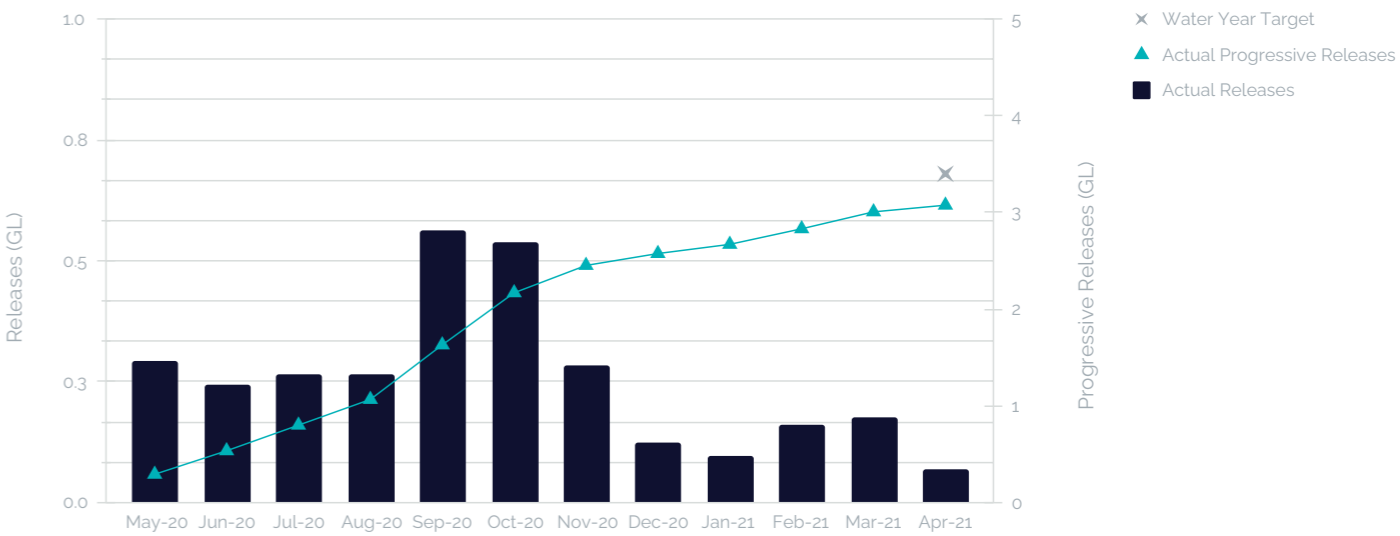
Snowy Montane Rivers Increased Flows (SMRIF) from Middle Creek Aqueduct



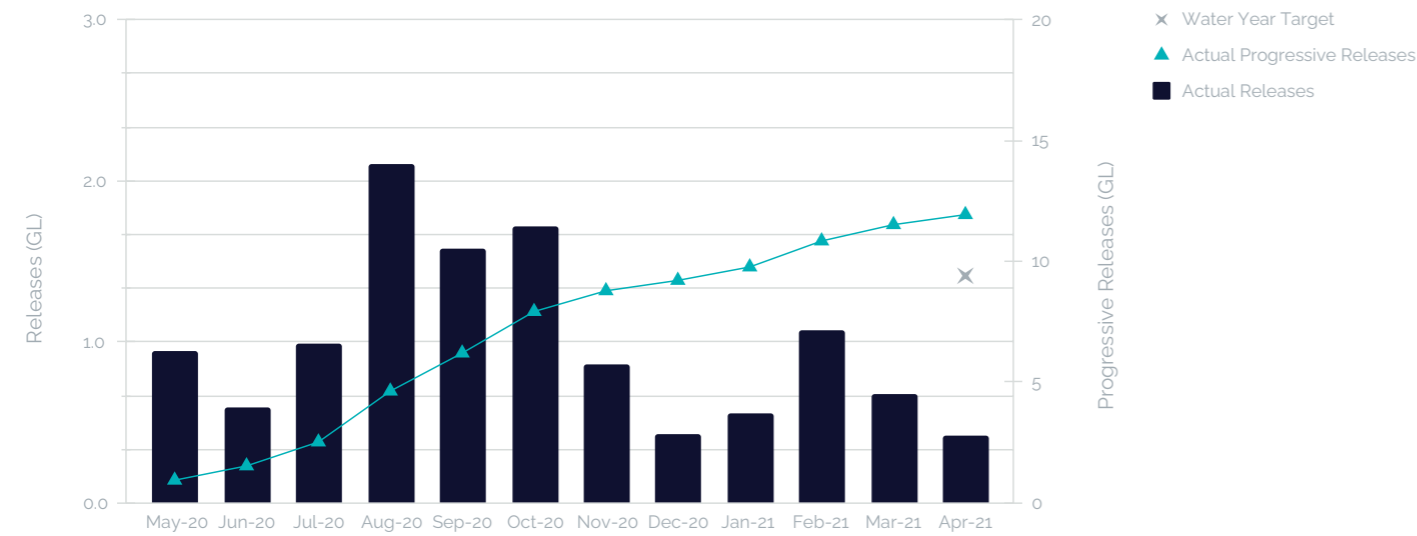
Snowy Montane Rivers Increased Flows (SMRIF) from Strzelecki Creek Aqueduct



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



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



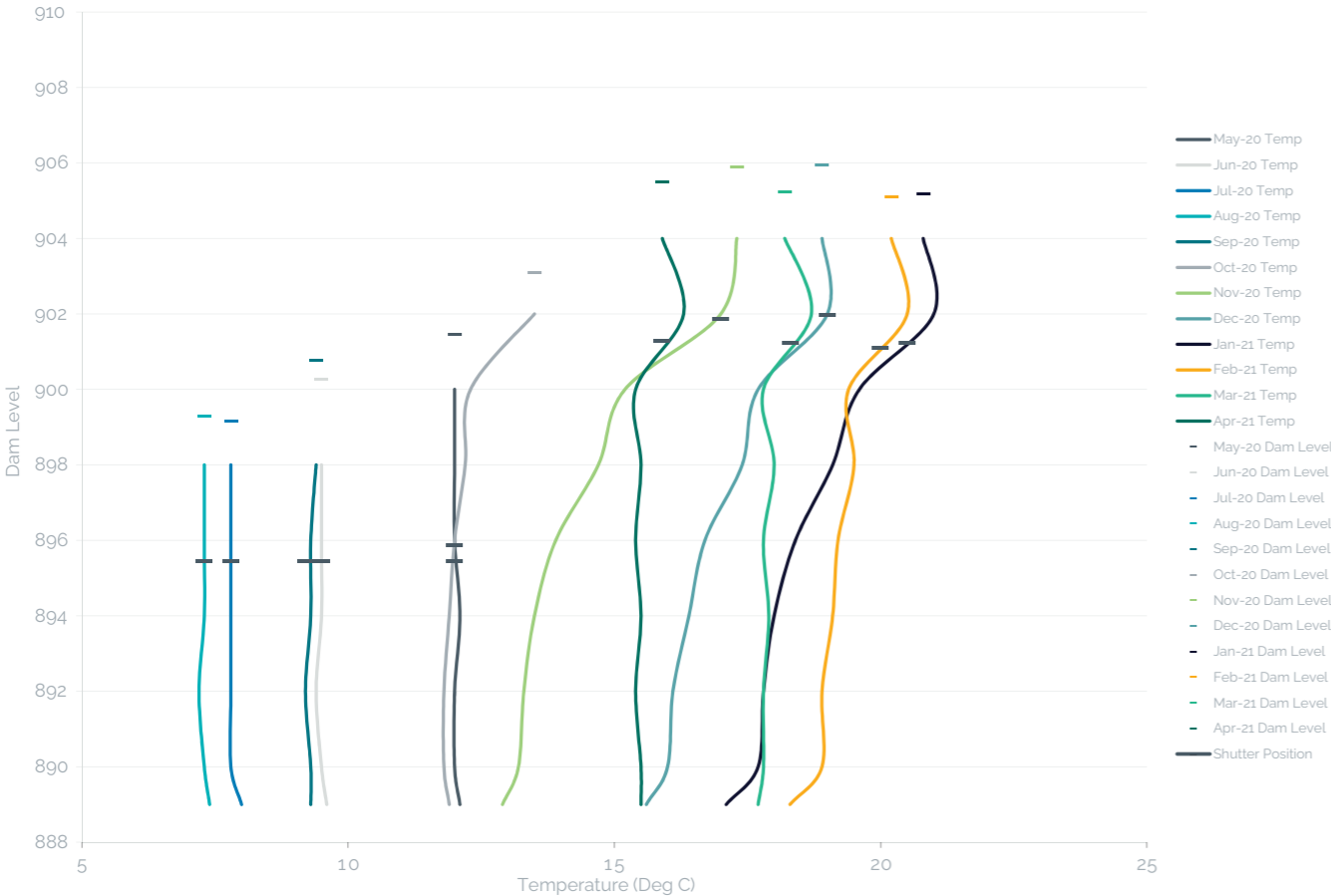
# The temperature of releases from Tintangara Reservoir

The Snowy Water Licence requires the outlet works at Tintangara 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 Tintangara 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, all releases were made from above the thermocline.

Tintangara Dam Intake Water Temperatures and Level



# 2021-22 Operating Plan

## Summary of obligations

Snowy Hydro will operate the Snowy Scheme to target the requirements imposed upon the company under the Snowy Water Licence during the 2021-22 water year, including each water release target relating to:

- The Guaranteed Minimum Water Release to the River Murray and Murrumbidgee River catchments
- The expected Required Annual Release to the River Murray and Murrumbidgee River catchments
- 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

Where relevant, this section of the report will also contain:

- Any agreements by the Water Consultation and Liaison Committee regarding matters relevant to the Annual Water Operating Plan; and
- Other information with respect to water releases and diversions Snowy Hydro and/or the Ministerial Corporation see fit.

# Western river releases

## River Murray catchment

Snowy Hydro will guarantee a minimum water release from the Snowy-Murray Development to the River Murray of 418 GL, on the basis of pre-release volumes, water available in storage at the start of the water year and minimum inflows throughout the year.

The expected Required Annual Release is 654 GL. This volume can increase or decrease through the year based on numerous factors set out in the Snowy Water Licence, particularly the Dry Inflow Sequence Volume under dry conditions and Relaxation Volumes under wet conditions. The Required Annual Release is expected to include 23 GL of montane environmental flow releases provided to the Geehi and Swampy Plains River without flowing through the Scheme's power stations.

Snowy Hydro will closely monitor inflows and will provide monthly advice to water authorities regarding the Dry Inflow Sequence Volume and the extent of the possible reduction in the Required Annual Release.

## Murrumbidgee River catchment

Snowy Hydro will guarantee a minimum water release from the Snowy-Tumut Development to the Murrumbidgee River of 635 GL, on the basis of pre-release volumes, water available in storage at the start of the water year and minimum inflows throughout the year.

The expected Required Annual Release is 661 GL. This volume can increase or decrease through the year based on numerous factors set out in the Snowy Water Licence. The Required Annual Release is expected to include 44 GL of montane environmental flow releases provided to the Murrumbidgee and Goodradigbee Rivers without flowing through the Scheme's power stations.

Snowy Hydro will closely monitor inflows and will provide monthly advice to water authorities regarding the Dry Inflow Sequence Volume and the extent of the possible reduction in the Required Annual Release.

# Environmental releases

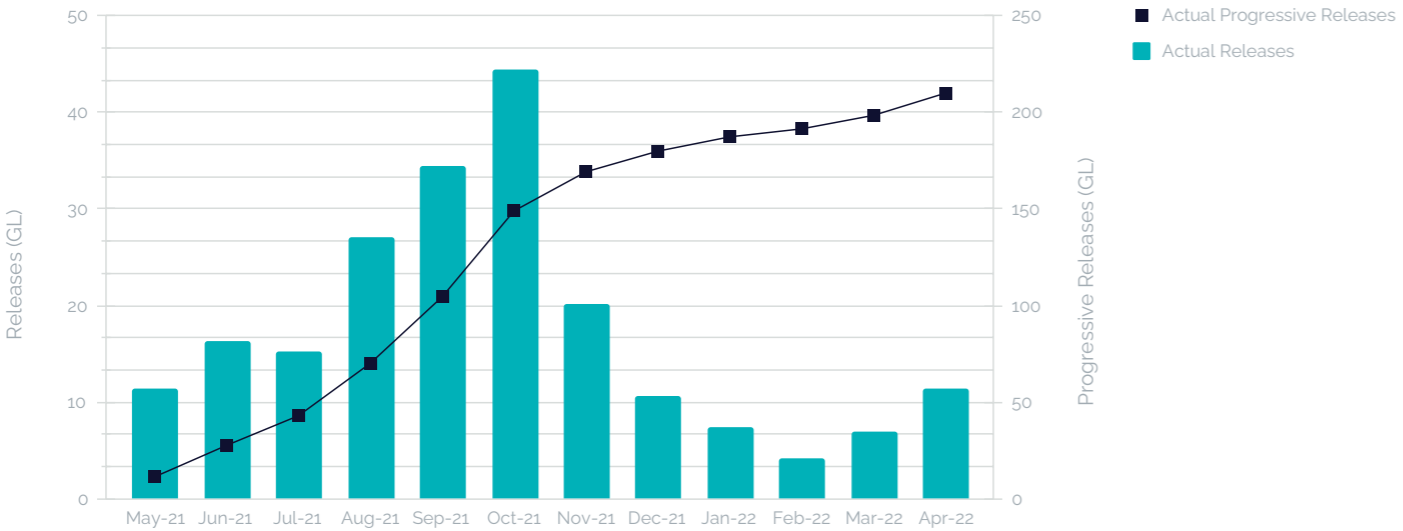
## Snowy River increased flows

Snowy Hydro will target the daily, monthly and annual release targets from Jindabyne Dam, as developed and prescribed by NSW DPIE Water. The volume of Snowy River Increased Flows (SRIF) apportioned to be released from Jindabyne Dam of 201.1 GL was increased by the under release from last Water Year of 0.4 GL to ensure the Snowy River does not receive more or less than allocated by NSW DPIE Water in the long term. In addition to the environmental releases, 8.5GL Base Passing Flow (BPF) will be released from Jindabyne Dam and 0.5GL riparian flow from the Mowamba Weir. Total releases from Jindabyne Dam will therefore be  $201.1 + 0.4 + 8.5 = 209.9$  GL

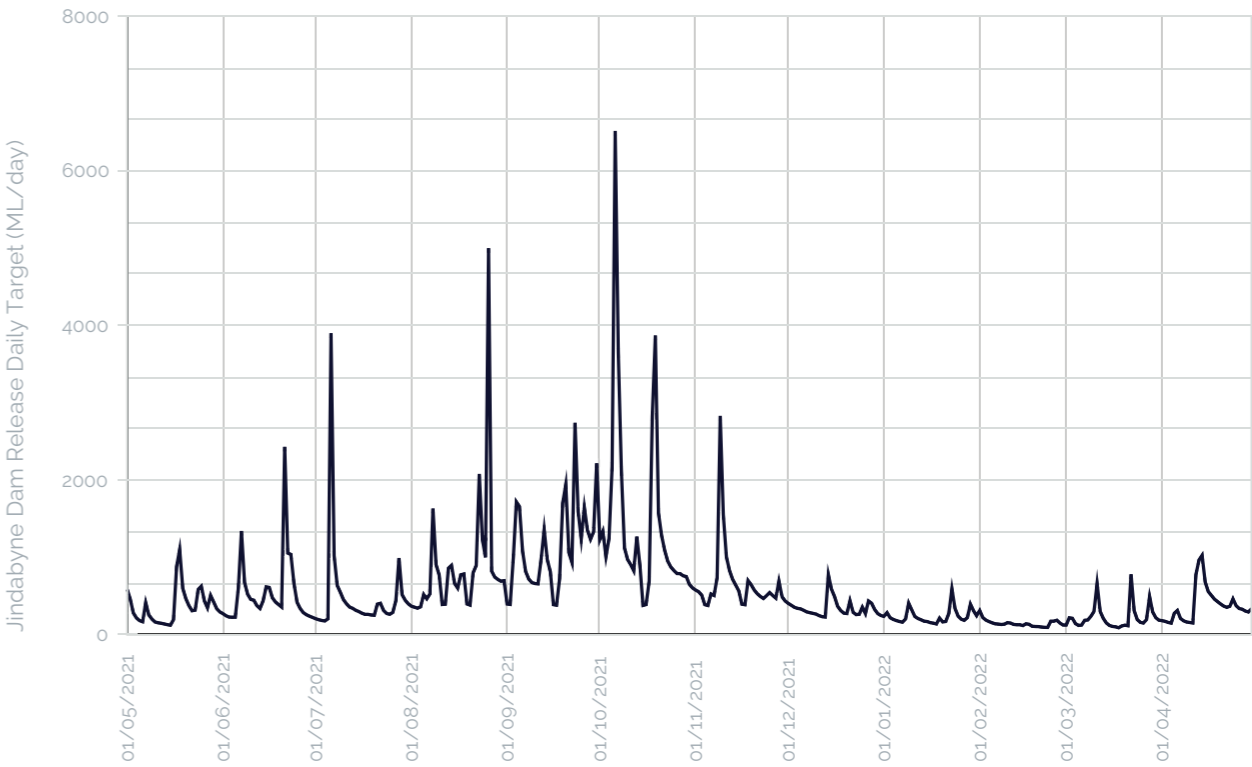
As allocations for the 2021–22 water year exceeded 100GL, a flushing flow was scheduled for the Snowy River. Snowy Hydro will operate Jindabyne Reservoir to target a peak flow rate of 10,362 ML/day for 8 hours in October 2021. The NSW DPIE Water, working with representatives across local, state and Commonwealth Government agencies, will be responsible for the advice to downstream landholders and other stakeholders that would be impacted by the increased Snowy River levels.

The annual, monthly and daily release targets for the Snowy River Increased Flow releases are shown in the following table and charts.

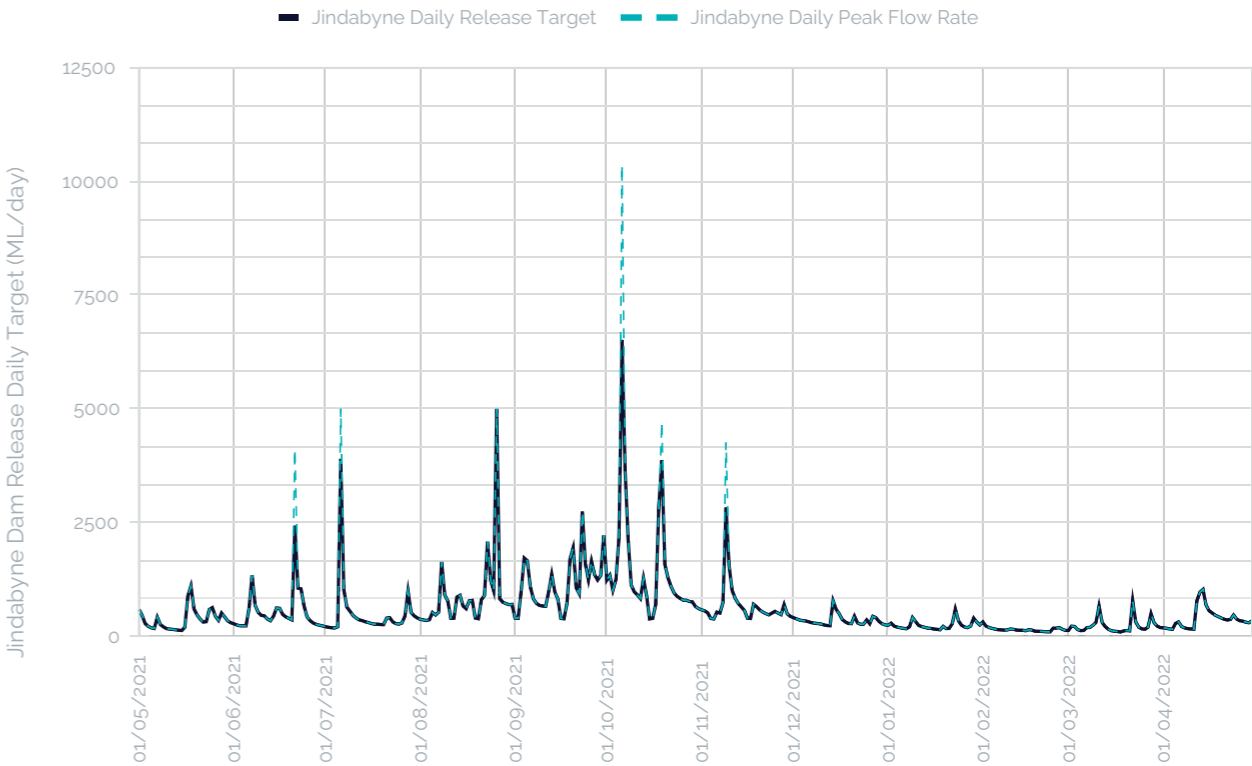
Jindabyne Dam Monthly Release Targets



Jindabyne Dam Daily Release Targets



Jindabyne Dam Daily Release Targets

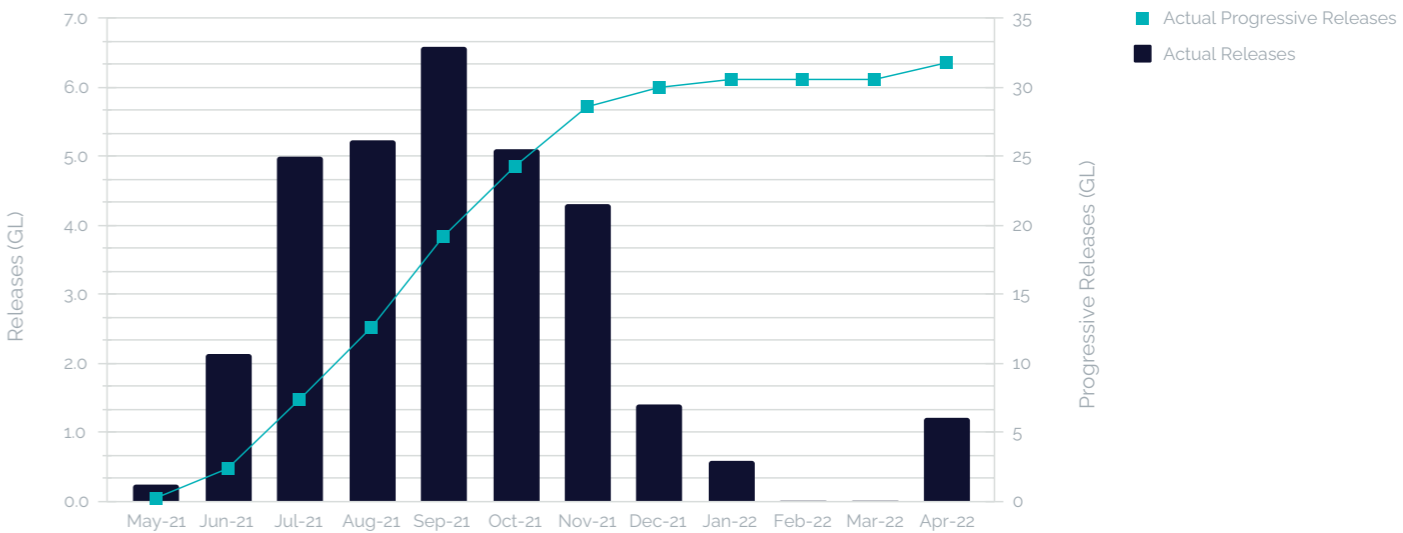


### Snowy Montane Rivers increased flows

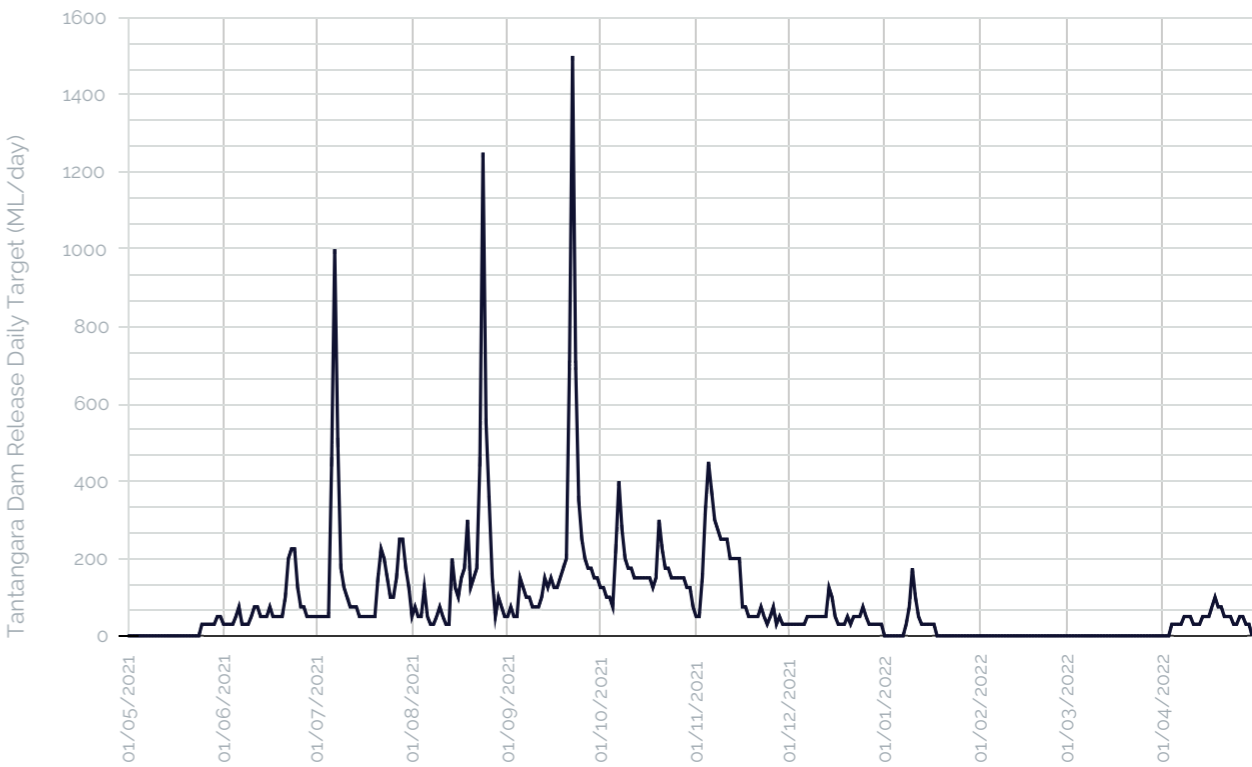
Snowy Hydro will target the daily, monthly and annual release targets from Tantangara Dam, and the annual targets for Goodradigdee, Middle Creek, Strzelecki Creek, Bar Ridge, Diggers Creek and Falls Creek Aqueducts, as developed and prescribed by NSW DPIE Water for the 2021-22 water year.

The target volume for SMRIF totalled 88.8 GL, with 31.8 GL from Tantangara Dam, 12.0 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.

Monthly Release Targets for Snowy Montane Rivers Increased Flows (SMRIF) from Tantangara Dam



Daily Release targets for Snowy Montane Rivers Increased Flows (SMRIF) from Tantangara Dam



**snowy**hydro