snowyhydro

Annual Water Operating Report

2022 | 2023

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 and Environment at industry.nsw.gov.au/water/basins-catchments/ snowy-river

2021-22 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 2021–2022 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

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 2021–22 water year.

The total accounted release volume was 1,036 GL. This was made up of:

- 515 GL being the 2021–22 RAR calculated under the Snowy Water Licence; plus
- 228 GL of pre-release of the 2022–23 RAR; plus
- 293 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 33 GL of montane environmental flow releases provided to the Geehi and Swampy Plains River which did not flow through the Scheme's power stations.



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 2021–22 water year. The total accounted release volume was 933 GL. This was made up of:

- 485 GL being the 2021–22 RAR calculated under the Snowy Water Licence; plus
- 200 GL of pre-release of the 2022–23 RAR; plus
- Snowy Hydro is able to release at its discretion).

This total accounted release volume includes 44 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 River Murray Catchment during 2021-22

• 248 GL of Discretionary Above Target Water release (water not required for RAR releases that

Inflows and Releases to the Murrumbidgee Catchment during 2021-22



Environmental releases

SNOWY RIVER INCREASED FLOWS

environmental purposes during the 2021–22 water year.

The volume of Snowy River Increased Flows (SRIF) released from Jindabyne Dam during the 2021-22 water year was 200.2 GL, which was 1.3 GL below the target volume of 201.4 GL. That deficit

There were two days of releases that were below the daily target by more than 20%. This was reported to NSW Department of Planning and Environment - Water (DPE Water). All other daily and monthly releases were within the +/-20% tolerance allowed under the Snowy Water Licence. As allocations for the 2021–22 water year exceeded 100 GL, a flushing flow was scheduled for the

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

	Spill & Storage Management Pre-release
	Actual SRIF Releases
	Actual BPF Releases
-	SRIF monthly target +20%
-	SRIF monthly target - 20%
×-	Target progressive SRIF releases
-	Actual progressive SRIF releases
-	SRIF annual target + 10%
-	SRIF annual target - 10%

Spill & Storage Management Pre-rele

- Jind BPF
- SRIF Low Limit
- SRIF High Limit

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

In any year when allocations exceed 100 GL, Snowy Hydro can be instructed by NSW DPE Water to deliver a flushing flow to the Snowy River. A flushing flow is defined as a day when the release target exceeds the 5 GL 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.

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

JINDABYNE SPILL

Delivery of the flushing flow led to a reservoir level in Jindabyne significantly higher than was necessary to deliver the monthly targets as equal daily volumes. Very wet inflow conditions from November 2021 through to February 2022 on top of the high storage levels led to Jindabyne Dam spilling on 20 and 21 December 2021. 4.8 GL was spilled and another 79.8 GL pre-released to the end of April 2022 to avoid further spill and manage public safety, both around and downstream of Lake Jindabyne. Following the deterministic requirements of the Snowy Water Licence, 18.7 GL of the spill volume will be treated as a borrow of the 2022-2023 Snowy River Increased Flows.



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 (May 2021 to April 2022)



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

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 Agueduct to Middle Creek and Strzelecki Creek Intake (on the Geehi River Aqueduct) to Strzelecki Creek (tributaries of the Geehi River),
- Diggers Creek Aqueduct to Diggers Creek and Bar Ridge Aqueduct to Tolbar Creek (tributaries of the Snowy River below Island Bend Dam),
- Falls Creek to the Snowy River below Guthega Dam.

The target volume for SMRIF totalled 88.8 GL, with 31.7 GL from Tantangara Dam, 12.0 GL from Goodradigbee Aqueduct, 22.7 GL from Middle Creek and Strzelecki Ck, 9.4GL from Diggers Creek and 9.5GL from Bar Ridge Aqueduct and 3.4GL from Falls Creek, all to be targeted over the whole water year.

The total actual montane release volume was 110.0 GL. This was made up of 31.8 GL from Tantangara Dam, 12.6 GL from Goodradigbee Aqueduct, 32.6 GL from Middle Creek Aqueduct and Strzelecki Ck combined, 16.3 GL from Diggers Creek Aqueduct and 13.4 GL from Bar Ridge Aqueduct and 3.3 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 2021-2022 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.







	Actual Riparian Releases
	Actual SMRIF Release
	SMRIF monthly target - 20%
	SMRIF monthly target + 20%
<u> </u>	Actual Progressive SMRIF Release
	Target Progressive SMRIF Release
	SMRIF annual target - 10%
	SMRIF annual target + 10%



Snowy Montane Rivers Increased Flows from Diggers Creek Aqueduct

Snowy Montane Rivers Increased Flows from Falls Creek Aqueduct







Snowy Montane Rivers Increased Flows from Goodradigbee Weir



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



Note: There are no monthly or annual compliance targets for Middle Creek.

Actual Releases (GL) → Actual Progressive Releases (GL) × Water Year Target (GL)

2.0 1.8 1.6 1.4 1.2 1.0 0.8 0.6 0.4 0.2

May-21 Jun-21 Jul-21 Aug-21 Sep-21 Oct-21 Nov-21 Dec-21 Jan-22 Feb-22 Mar-22 Apr-22

Note: There are no monthly or annual compliance targets for Strzelecki Creek.



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

Estimated Release (ML) ▲ Estimated Progressive Release (GL)

× Water Year Target (GL)

Snowy Montane Rivers Increased Flows from Strzelecki 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, all releases were made from above the thermocline.



Tantangara Dam Intake Water Temperatures and Level

2022-23 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 2022–23 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

This 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 inisterial Corporation see fit.



Western river catchments

RIVER MURRAY CATCHMENT

Snowy Hydro will guarantee a minimum water release from the Snowy-Murray Development to the River Murray of 676 GL, on the basis of pre-release volumes, water available in storage at the start of the water year and the maximum relaxation volume occurring throughout the year.

The expected Required Annual Release is 711 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 642 GL, on the basis of pre-release volumes, water available in storage at the start of the water year and the maximum relaxation volume occurring throughout the year.

The expected Required Annual Release is 668 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 48 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 apportioned to be released from Jindabyne Dam of 193.3 GL was reduced by the 18.7 GL borrow during the 2021-2022 spill event and increased by the under release from last Water Year of 1.3 the long term. In addition to the environmental releases, 8.5 GL Base Passing Flow (BPF) will be released from Jindabyne Dam and 0.5 GL riparian flow from the Mowamba Weir. Total releases from Jindabyne Dam will therefore be 193.3+1.3+8.5 = 203.1 GL

As allocations for the 2022–23 water year exceeded 100 GL, a flushing flow was possible, but was not scheduled by NSW DPE Water for the Snowy River. NSW DPE Water, working with 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 Release Targets including 8-hour Peak Flow Targets



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



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

SNOWY MONTANE RIVERS INCREASED FLOWS

Snowy Hydro will target the daily, monthly and annual release targets from Tantangara Dam, and the annual targets for Goodragidgee, Middle Creek, Strzelecki Creek, Bar Ridge, Diggers Creek and Falls Creek Aqueducts, as developed and prescribed by NSW DPE Water for the 2022-23 water year.

The apportionment volume for SMRIF totalled 92.8 GL, with 35.8 GL from Tantangara Dam, 12.0 GL from Goodradigbee Aqueduct, 22.7 GL from Middle Creek and Strzelecki Ck, 18.9 GL from Bar Ridge and Diggers Creek Aqueducts and 3.4 GL from Falls Creek, all to be targeted over the whole water year. The adjusted annual target volume for releases from Tantangara Dam is 35.7 GL after being reduced by 0.1 GL of over release from last Water Year.





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