WATER REPORT

2013-2014

snowy hydro
renewable energy

FOREWORD

TO OUR LOCAL COMMUNITIES AND STAKEHOLDERS

I am pleased to present this Snowy Hydro Water Report to the community. This report is an important tool through which we are able to improve community, lake user and stakeholder understanding of the water operations of the Snowy Scheme.

Snowy Hydro has produced an annual Water Report for the past six years and in that time there has been a marked improvement in community understanding of the facts relating to the water operations of the Snowy Scheme.

In addition to the water data of this past year, this year we have added our Environment Report.

We hope this combined report will provide even further information of interest and value to the community and our stakeholders.

An interesting topic in this report is how the main catchments of the Snowy Mountains are stored and diverted. This includes simple diagrams of what water is collected and moved from east to west, as well as the new Snowy Montane releases from Middle Creek, Diggers Creek and Bar Ridge.

If you're interested in Snowy Hydro, the operations of the Snowy Scheme and really want to understand the facts, I encourage you to read this Water & Environment Report.

It is also important to keep in mind that all our operations and obligations occur within the context that Snowy Hydro is an energy business. We must earn our own revenue to pay for the maintenance and upgrade of the massive infrastructure that is the Snowy Scheme in order to meet the obligations of the Snowy Water Licence. We can only earn this revenue from energy sales, not water. We don't own the water and don't sell it.

I encourage you to provide us with feedback as we are always looking for opportunities to improve mutual understanding with our communities and stakeholders.

Paul Broad
CEO and Managing Director
Snowy Hydro Limited

Tumut 3 Power Station

Khancoban Dam releases into the Swampy Plain River

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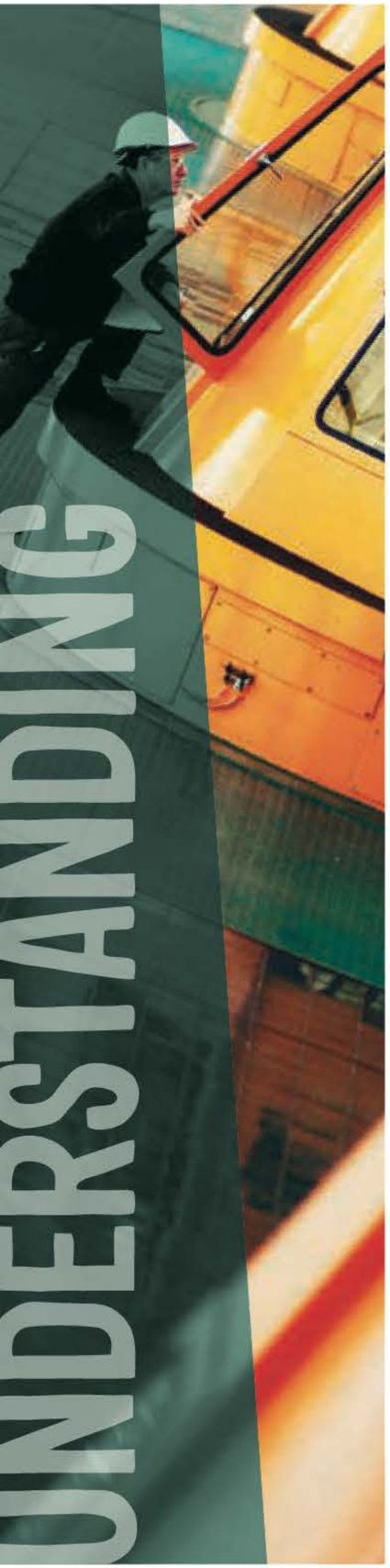


UNDERSTANDING WATER & OUR BUSINESS

The fundamental driver for water operations of the Snowy Scheme is the *Snowy Water Licence*.

The *Snowy Water Licence*, issued by the New South Wales Government, regulates Snowy Hydro in terms of what we can do with the water in the Snowy Scheme. It has many legally binding, enforceable obligations on the company.

The *Snowy Water Licence* states that Snowy Hydro has the right to collect, divert, store and release water. That, in no way, represents any form of ownership of the water. The parties who have an entitlement to releases from the Snowy Scheme own all of the water in the Scheme. This includes the states of New South Wales and Victoria, irrigators from those states, downstream town water supplies and the environment.

The water you see in Lake Jindabyne, Tantangara Reservoir, Lake Eucumbene and all of the other Snowy Hydro storages has already been secured and allocated to the above mentioned parties by the Government.

Snowy Hydro has some flexibility around the short-term timing of releases to meet energy generation needs throughout the year. However, by the end of each water year (which ends in April), Snowy Hydro has to have released a predetermined volume of water out of the Scheme. This is one of the legally binding obligations set out in the *Snowy Water Licence*.

Snowy Hydro is obligated under the *Snowy Water Licence* to:

1. 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*;

2. Targeting water releases from Jindabyne Dam into the Snowy River for environmental purposes (Snowy River Increased Flows); and

3. Facilitating additional natural flows to nominated Rivers for environmental purposes (Snowy Montane Rivers Increased Flows).

To generate electricity Snowy Hydro must release water from the Snowy Scheme, and to release water from the Snowy Scheme, Snowy Hydro must generate electricity. In this way, water releases and electricity generation are inseparably linked.

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*.

Snowy Hydro also has to fund both the debt and operating costs of the Snowy Scheme through its participation in the highly competitive National Electricity Market (NEM). Those electricity revenues pay for the increasing costs of maintaining and operating the Snowy Scheme, including the costs associated with making environmental flows.

Downstream water users (irrigators and environmental entitlements holders) have never been charged for the water regulation services provided to them each year.

In summary, Snowy Hydro has flexibility from day to day in releasing water from the Snowy Scheme as an outcome of generating electricity. Each year, we have to reach certain targets for releases. The short-term flexibility allows us to run our electricity business, while at the same time giving long-term security to the downstream users around annual water releases.

Whilst the *Snowy Water Licence* recognises the difficulties inherent in achieving precise release volumes at each release point, any shortfall or excess is accounted and generally dealt with by an 'unders' and 'overs' approach whereby the shortfall or excess is added or subtracted to the following years 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 and a full copy of the Snowy Water Licence we encourage people to visit **www.water.nsw.gov.au**

WATER YEAR –
THE SNOWY HYDRO WATER YEAR COMMENCES ON 1 MAY AND CONCLUDES ON 30 APRIL EACH CALENDAR YEAR.

1 GIGALITRE (GL) –
EQUAL TO 1,000 MEGALITRES (ML).

1 MEGALITRE (ML) –
EQUAL TO 1 MILLION LITRES (L).

OVERVIEW OF SNOWY HYDRO

Snowy Hydro Limited is an integrated water manager and energy business. Using our portfolio of generation assets including the 4100 megawatt (MW) Snowy Mountains Scheme, the 300MW Valley Power gas-fired power station and the 320MW Laverton North gas-fired power station - both located in Victoria - we provide National Electricity Market (NEM) participants with price risk management products. Snowy Hydro is also the parent company of Red Energy, the successful electricity and gas retailer operating in Victoria, New South Wales and South Australia.

Snowy Hydro operates under a stringent water licence that allows us to capture, store and divert water in order to generate electricity. That water is then released into the River Murray and Murrumbidgee River systems to be used by those who have an entitlement to those releases, such as irrigators, downstream water supplies and the environment.

Snowy Hydro is a producer, supplier, trader and retailer of energy and is also a leading provider of risk management financial hedge contracts in the NEM.

Our energy retailer, Red Energy, is also one of Australia's fastest growing energy retailers offering affordable energy and exceptional customer service to more than 400,000 households and many large commercial and industrial customers.

Electricity generation is not our core business; risk management is. Rather than generating constantly (which there is not enough water for), we have developed our business to capitalise on periods when demand for generation is high. Examples of high demand days are the hot days when everyone turns on their air conditioner. Snowy Hydro is predominantly an insurer for NEM participants. Participants purchase insurance contracts with us that dictate under what market conditions we will switch on our generating units and provide electricity to cover their energy requirements. This provides security of electricity supply and price risk management to NEM participants. Key to our success is our ability to have reliable and available plant ready to meet market needs at all times.

Snowy Hydro aims to become a major energy retailer in the evolving National Electricity Market. We will do this by growing our commercial, industrial and domestic (household) customer base, whilst fulfilling our water licence obligations at all times.

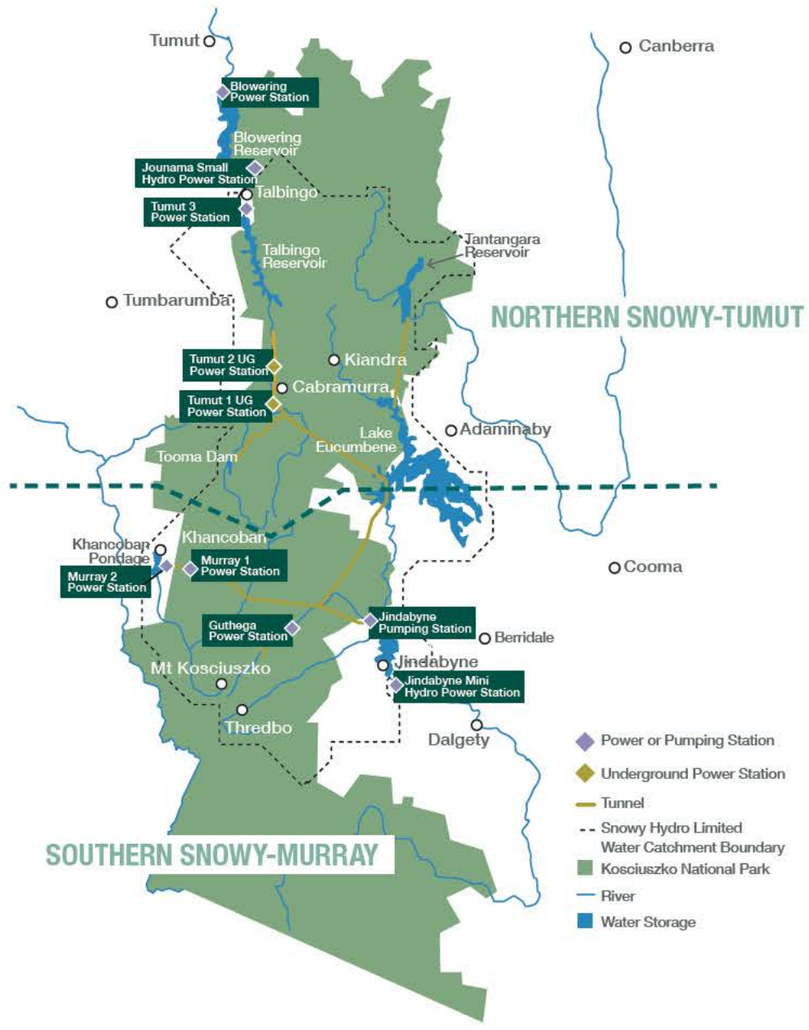
HOW THE SNOWY SCHEME WORKS

The Snowy Scheme was designed to collect and store water, including water that would otherwise flow east down the Snowy River to the coast, diverting it through trans-mountain tunnels and power stations and then releasing it west of the Snowy Mountains into the catchments of the River Murray and the Murrumbidgee River, where it can be used for town water supply, irrigation and environmental uses.

The Snowy Scheme includes:

- Nine power stations – Murray 1, Murray 2, Blowering, Guthega, Tumut 1 (located 366m below ground level), Tumut 2 (located 244m below ground level), Tumut 3, Jounama Small Hydro Power Station and Jindabyne Mini Hydro Power Station;
- One pumping station at Jindabyne and a pump storage facility at Tumut 3 Power Station;
- 16 major dams with a total storage capacity of 7,000GL or almost 12 times the volume of Sydney Harbour;
- 145km of inter-connected tunnels and pipelines and 80km of aqueducts; and
- 33 hydro-electric turbines with a generating capacity of 4,100MW.

The Snowy Scheme comprises two major developments: the Northern Snowy-Tumut Development and the Southern Snowy-Murray Development. The water in Lake Eucumbene, our large long-term storage lake, is split between the two developments based on where the water was collected from.



THE SNOWY-TUMUT DEVELOPMENT

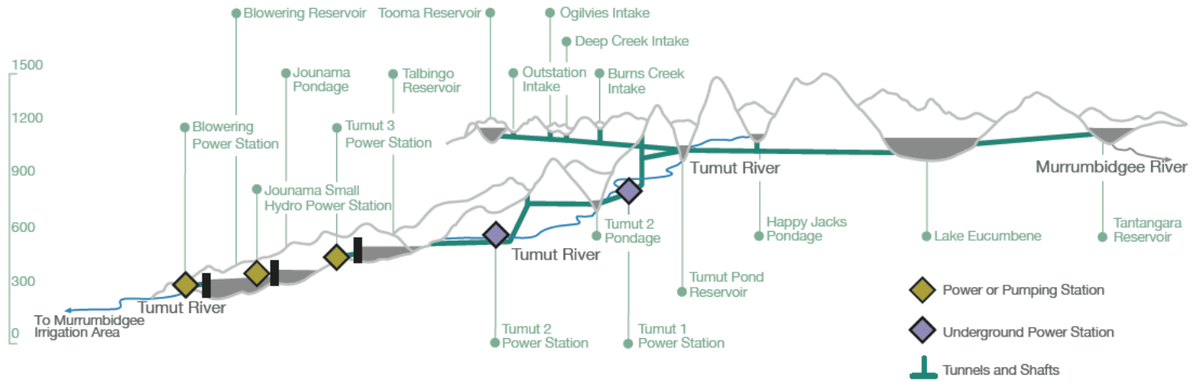
The Snowy-Tumut Development consists of five power stations and 16 generating units. It collects the headwaters of the upper Murrumbidgee, Tooma and Eucumbene Rivers. Those waters are diverted through trans-mountain tunnels to Tumut Pond Dam where they join the waters of the Tumut River and flow through Tumut 1 and Tumut 2 underground power stations, discharging into Talbingo Reservoir. Water stored in Talbingo Reservoir then passes through the Tumut 3 Power Station and into Jounama Pondage.

Three of the six generating units at Tumut 3 Power Station also have large pumps fitted that can be used to pump water from Jounama Pondage back up into Talbingo Reservoir, thereby 'recycling' water. Water cannot be pumped any further uphill than Talbingo Reservoir.

Water is released from Jounama Dam into Blowering Reservoir either through the Jounama Small Hydro Power Station or through the radial release gates at Jounama Dam.

Blowering Power Station is located on Blowering Dam and is leased from NSW State Water Corporation. Water releases from Blowering Dam are controlled by State Water to provide for downstream town water supply, extractive and environmental use requirements.

Blowering Power Station is therefore a 'run of river' plant that operates as State Water releases water from Blowering Dam into the Tumut River, which joins the Murrumbidgee River near Gundagai. On the Murrumbidgee River at Gundagai, the Snowy Scheme contributes around 25% of inflows during average inflow years but can provide up to 60% of the total inflows to this location during drought years.



THE SNOWY-MURRAY DEVELOPMENT

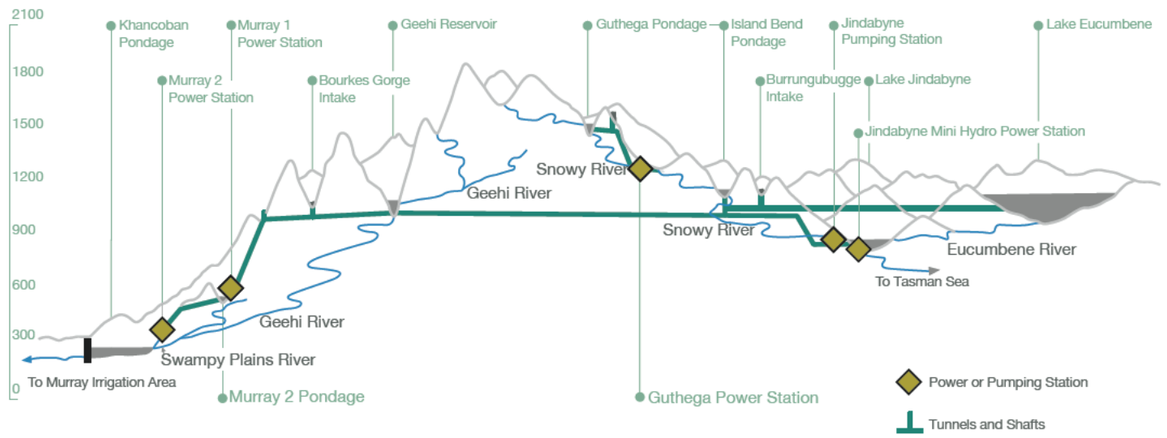
The Snowy-Murray Development consists of four power stations with 17 generating units and one pumping station. Water in the upper Snowy River is diverted at Guthega Dam through Guthega Power Station and back into Island Bend Dam. Inflows into the relatively small Guthega Pondage are seasonal and spills of the reservoir are common, particularly during the spring snowmelt period.

During times of high inflows, water flowing into Island Bend Pondage is diverted to Lake Eucumbene for storage and subsequently transferred to the River Murray catchment at a later time. At times of low inflows, water from Island Bend Pondage is diverted to Geehi Reservoir through a trans-mountain tunnel, together with water transferred back from Lake Eucumbene.

The Jindabyne Pumping Station pumps water from Lake Jindabyne, normally using off-peak power (typically at night and on weekends) into Geehi Reservoir on the western side of the Great Dividing Range. Water from Lake Jindabyne cannot be pumped back to Lake Eucumbene or to Island Bend Dam.

Additionally, the Jindabyne Small-Hydro Power Station allows Snowy Hydro to recover a small amount of electricity from some of the environmental releases made from Jindabyne Dam into the Snowy River.

From Geehi Reservoir, with additional water from the Geehi River, the water from Island Bend and Eucumbene passes through Murray 1 and Murray 2 power stations. Khancoban Dam regulates water released from Murray 2 Power Station down the Swampy Plains River which is a tributary of the upper River Murray. On the River Murray at Hume Dam, the Snowy Scheme contributes inflows of only around 8% during average inflow years but can contribute up to 33% of inflows during drought years.



UNDERSTANDING WATER & THE SCHEME

Snowy Hydro receives many public enquiries about whether the snow melt from a good winter season, a large thunderstorm or week long rain event will fill the lakes.

The total volume of Snowy Scheme storages is massive and it will take a number of consecutive years of above average inflows to return our total storage volumes, particularly Lake Eucumbene, to above average levels. To understand why, we have outlined some of the key operational features of the Scheme.

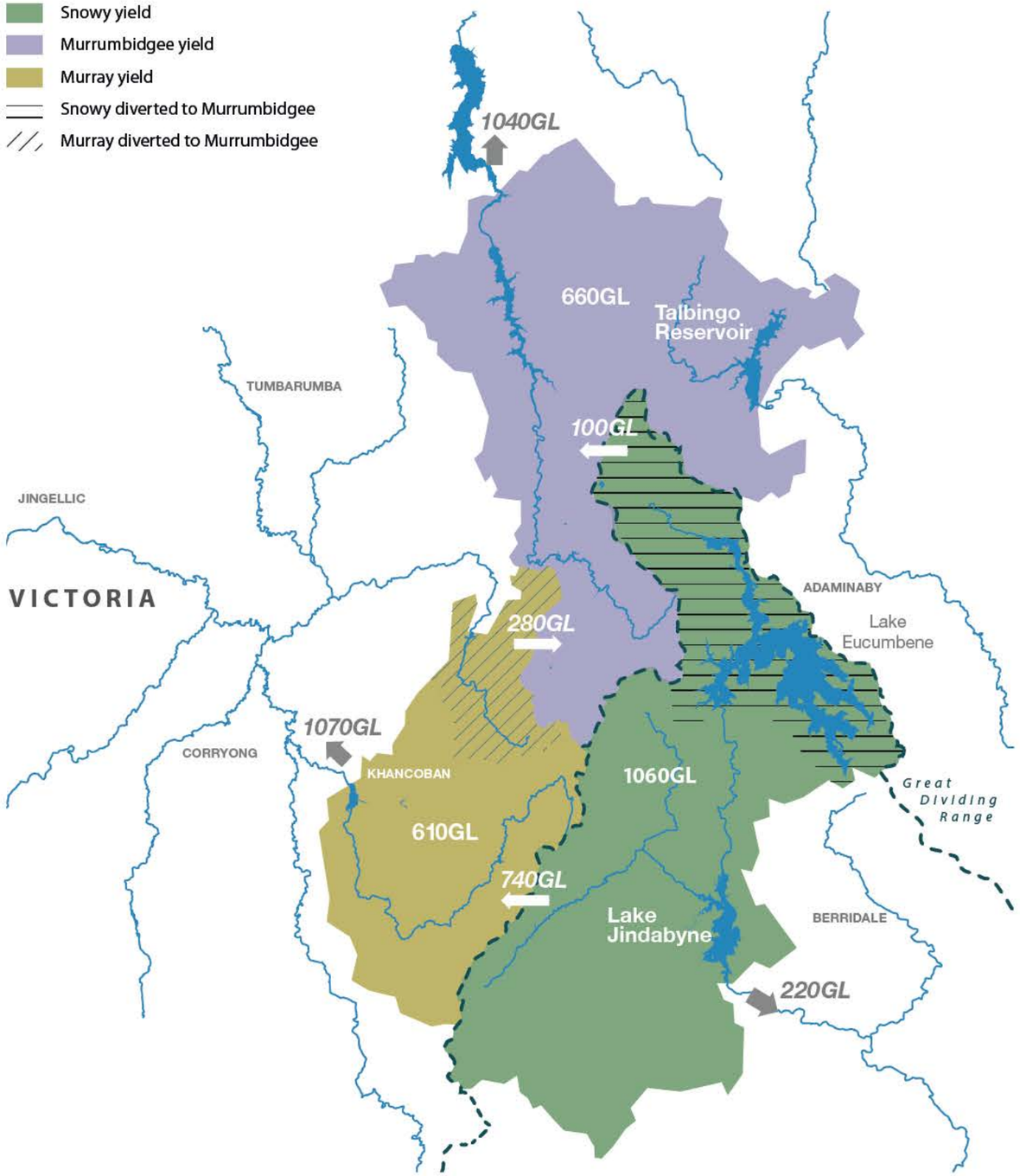
SHARING OF INFLOWS BETWEEN CATCHMENTS

The *Snowy Water Licence* prescribes how each catchment is allocated to either of the two developments of the Snowy Scheme. This principle of catchment based sharing of inflows is one of the original water operating principles that has existed since the inception of the Scheme. It is particularly important given that one of the key functions of the Scheme is to divert flows from rivers of the Eastern side of the Dividing Range to the West.

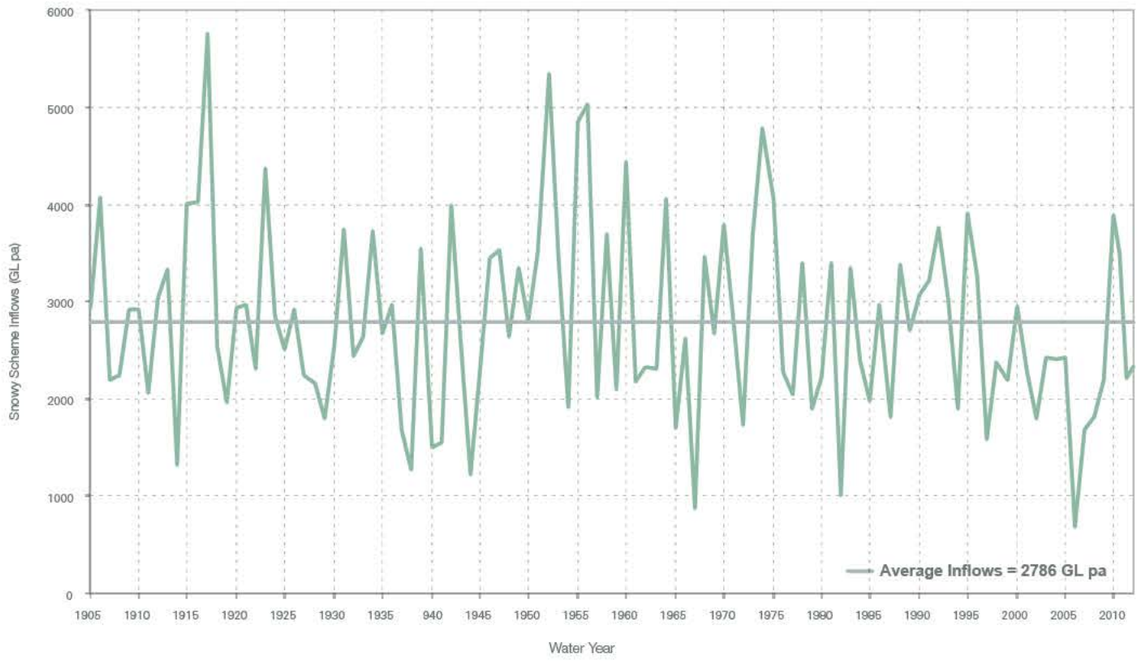
Of all inflows into the Snowy Scheme, each year some water will be lost to evaporation, seepage and occasionally water will be spilt when the inflows are too great for the Scheme to control. This water is subtracted from the total inflow to determine the usable catchment yield. The yield is distributed as per the adjacent diagram and released through the dams and power stations on its way to the Murray, Murrumbidgee and Snowy Rivers. The diagram represents the long term annual average volume of water that is collected by, diverted between and released from, each of the three main river catchments in the Snowy Scheme.

The Snowy Scheme provides 840GL of additional water from the Snowy Catchment on the Eastern side of the Dividing Range, to the natural 1270GL yield of the Western River catchments. On average, the Scheme also provides 230GL of Above Target Water to the Western Rivers that Snowy Hydro is able to release at its discretion in excess of the Required Annual Releases.

These values are based on analysis of long term data to determine the projected distribution of water inflows throughout the Snowy Scheme under current climatic conditions. The analysis has taken into account the increase in environmental flows targeted for release down the Snowy River and the consequent reduction in diversion and releases to the River Murray and Murrumbidgee River.



SNOWY SCHEME INFLOWS FROM MAY 1905 TO APR 2014



EUCUMBENE IS A MASSIVE STORAGE...

It is important to understand that Eucumbene Reservoir is a long-term storage. That is, it is designed to capture and store water over multiple years, even when it is wet.

Broadly, the Scheme is designed to release a similar amount of water down the Tumut and Swampy Plains River each year. In a wet year, the balance of inflows to the top of the Scheme is sent to Eucumbene for storage while in a dry year, the stored water is used to make up the releases. This helps smooth out the dry and the wet years in the areas below the Scheme and increase the security of supply of water to irrigators and other users on the Western Rivers.

The large storage capacity of Lake Eucumbene means that it has never been at Full Supply Level throughout its entire history. The long-term average level of Lake Eucumbene is 59% gross capacity. The highly variable inflows to the Scheme (shown on page 9) also mean that there is no such thing as a 'normal' lake level. It is part of our normal operation for levels in all of our lakes to fluctuate up and down both within and between years.

"THE LONG-TERM AVERAGE LEVEL OF LAKE EUCUMBENE SINCE CONSTRUCTION IS ONLY 59% GROSS CAPACITY"


Tantangara Dam

THE OPERATION OF TANTANGARA…

Water in Tantangara Dam is diverted to Lake Eucumbene via Eucumbene Portal.

Tantangara is a small reservoir being only 1/18 the size of Lake Eucumbene. Usually the reason for consistent diversion to Eucumbene is that Tantangara Reservoir is relatively shallow and in a high wind area. This means that the longer water stays in the storage, the more water is lost to evaporation. Therefore, the sooner water can be transferred to Lake Eucumbene, the less water that is lost to evaporation.

People may have noticed that Tantangara reservoir has been at higher levels in the last few years. This is due to an increase in allocations to the Snowy Montane Rivers Increased Flows Program, an environmental flow program delivered by Snowy Hydro that is specified in the *Snowy Water Licence*.

Most years, Snowy Hydro will be making releases from Tantangara reservoir to the Murrumbidgee River. In order to ensure security of supply for these releases, in future Snowy Hydro will generally hold the lake high enough so that we could still deliver the required releases during two low inflow years in a row. This means that the gross storage level of Tantangara will usually be sitting around 20% full in comparison to the previous average of just over 10%.

WATER CANNOT BE PUMPED FROM JINDABYNE TO EUCUMBENE…

There is still some confusion around the physical limitations around the design of the Snowy Scheme, particularly in relation to the misunderstanding that water can be moved from Lake Jindabyne and Lake Eucumbene. If Lake Eucumbene is at any point above minimum operating level, it is impossible. The following diagrams explain why:

Diagram 1: Cross-section of the Snowy-Murray Development of the Snowy Scheme where you can clearly see the Jindabyne-Island Bend Tunnel and the Eucumbene-Snowy Tunnel. You will see the clear difference in elevation between Lake Eucumbene and Lake Jindabyne.

Diagram 2: With Lake Eucumbene being above minimum operating level, it is beyond the capability of the Jindabyne Pumping Station to pump to this elevation.

The pumps are designed to only pump water from Lake Jindabyne to Geehi Reservoir via the Snowy-Geehi Tunnel only.

Water in Lake Jindabyne can only be pumped to Geehi Reservoir and then released via the Murray 1 and then Murray 2 Power Stations and then into Khancoban Pondage and the Murray catchment.

Jindabyne Pumping Station has the capacity to pump only around 2.4GL of water per day to Geehi Reservoir. Even if you assume zero inflows into Lake Jindabyne, it would take more than a month of non-stop pumping to drop the level of Lake Jindabyne by 2-3 metres. This means that it is impossible to reduce lake levels quickly by pumping alone, especially when inflows are high.

Any water in storages below Tumut Pond Dam on the Snowy-Tumut development, and anything below Island Bend and Geehi Dams on the Snowy-Murray development cannot be transferred back to Eucumbene Dam. Simply, water does not flow uphill and the pump capability at Jindabyne is only sufficient to lift water from Jindabyne to the Snowy-Geehi Tunnel across to Geehi Reservoir. Similarly, the pumps at Tumut 3 also only pump from Jounama Pondage back to Talbingo Reservoir. It is not physically possible to move water uphill from Talbingo Reservoir to higher storages.

Every raindrop or snowflake that falls below Geehi Dam or below Tumut Pond Dam moves straight through the Snowy Scheme. This is particularly relevant during wet years and flood events.

DIAGRAM 1

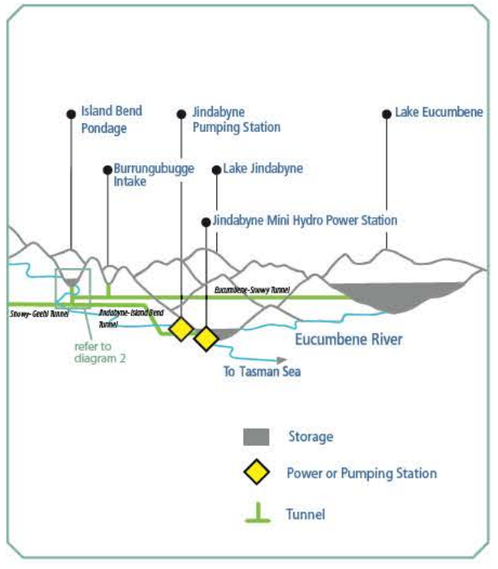
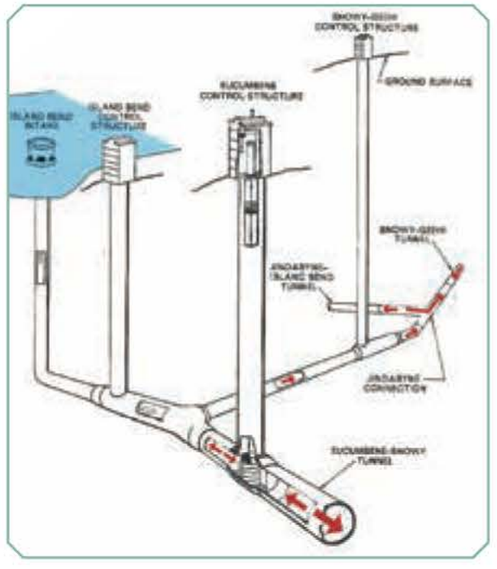


DIAGRAM 2



JINDABYNE LEVELS VS EUCUMBENE LEVELS…

Lake Jindabyne is a much smaller storage than Lake Eucumbene and therefore can fill much faster due to its capacity – Jindabyne is 1/7 the size of Eucumbene.

Snowy Hydro's obligation under the *Snowy Water Licence* to release environmental flows into the Snowy River means that levels in Lake Jindabyne need to be kept significantly higher than historical levels. This is to ensure enough water is available to complete the annual program of environmental releases as well as to deliver flushing flows via the original gated spillway.

Because flushing flows require the use of the spillway, the level of the lake needs to be higher than the base of the spillway gates in order to enable the releases to occur. The bigger the flushing flow, the higher the lake needs to be to deliver the targeted flow. In general, in years when a flushing flow is required, the level of the lake will be 6-7 metres higher than the long-term historical average. Holding the lake higher in winter and spring means that there is also a much greater risk of the Lake reaching full supply level and possibly even spilling in wet years.

Lake Jindabyne

FLOOD OPERATIONS

Flooding occurs when the river channel capacity is exceeded and flows overtop onto the floodplain. When the channel capacity of the rivers downstream of the Snowy Scheme is exceeded, our releases are limited to what the flows would have been had the Scheme not existed. This is known as the calculated 'Pre-SMA' flow.

This means that during a flood we do not release any more water than what would have naturally flowed down the river. As such, we do not in any way exacerbate flooding downstream of the Snowy Scheme.

The Scheme can provide limited storage capacity for high inflows, which in turn can provide some short term assistance. However, water cannot be diverted back to Eucumbene from lower catchments such as Khancoban, Geehi or Talbingo. These are small storages and once they are full, the water must flow downhill.

To pass flood water safely and effectively through the Scheme, Snowy Hydro aims to utilise our series of power stations where possible, rather than operating the spillways at a dam. This means we must generate and will often have to bid that power into the NEM at very low prices (even possibly at $0) to ensure that our plant is dispatched to pass flood flows.

During flood operations, we liaise closely with the BoM, local SES and councils to ensure that the most up to date information is available for landholders and flood response activities.

"DURING A FLOOD WE DO NOT RELEASE ANY MORE WATER THAN WHAT WOULD HAVE NATURALLY FLOWED DOWN THE RIVER"

WATER CONTENT OF SNOW…

Understanding the water content of snow, and what it means for spring inflows into the Snowy Scheme, is really important in understanding water. While it is often said that 1mm of rain equals 1cm of snow, this rule of thumb applies more to the conditions experienced in the colder climates of North America and Japan.

In the Snowy Mountains, the density (or water content) of freshly fallen snow is about 20-25%: 1mm of rain equals about 5mm (0.5cm) of snow. Fresh snow has a relatively low water content, and as the winter season progresses, the average density of snow on the ground tends to increase as it compresses. Throughout the season, the density of snowpack in the Snowy Mountains generally ranges from as little as 25% up to 50%. So, if there is a two metre snowpack, that would be the equivalent of between 50 and 100cm of water sitting on the mountain at that point.

How much of this water makes it into the reservoirs when the snow melts is another matter. Snowmelt is strongly impacted by the weather conditions experienced during late winter and spring, and small changes in the weather can lead to vastly different outcomes for inflows. For example:

- Heavy rain falling on a dense snowpack melts the snow quickly and maximises runoff.
- Hot northerly winds help to melt the snow but when the air is dry, much of the water can evaporate rather than run off into the streams or rivers.

So, an above average snowpack at the start of the season may not provide much water for the storages if spring is dry, but average snowfall during winter can lead to high spring runoff if the ideal rainfall events are received.

Other catchment conditions can also impact runoff yield. For example, bushfires can change the vegetation cover and soil properties and may affect the amount of water absorbed into the ground for many years. The flora that reshoots after a bushfire will also draw more moisture from the ground.

We can expect to receive around 50% of our inflows from snowmelt and rain during spring, so a bad snow season can have a significant impact on the total inflows for the year.

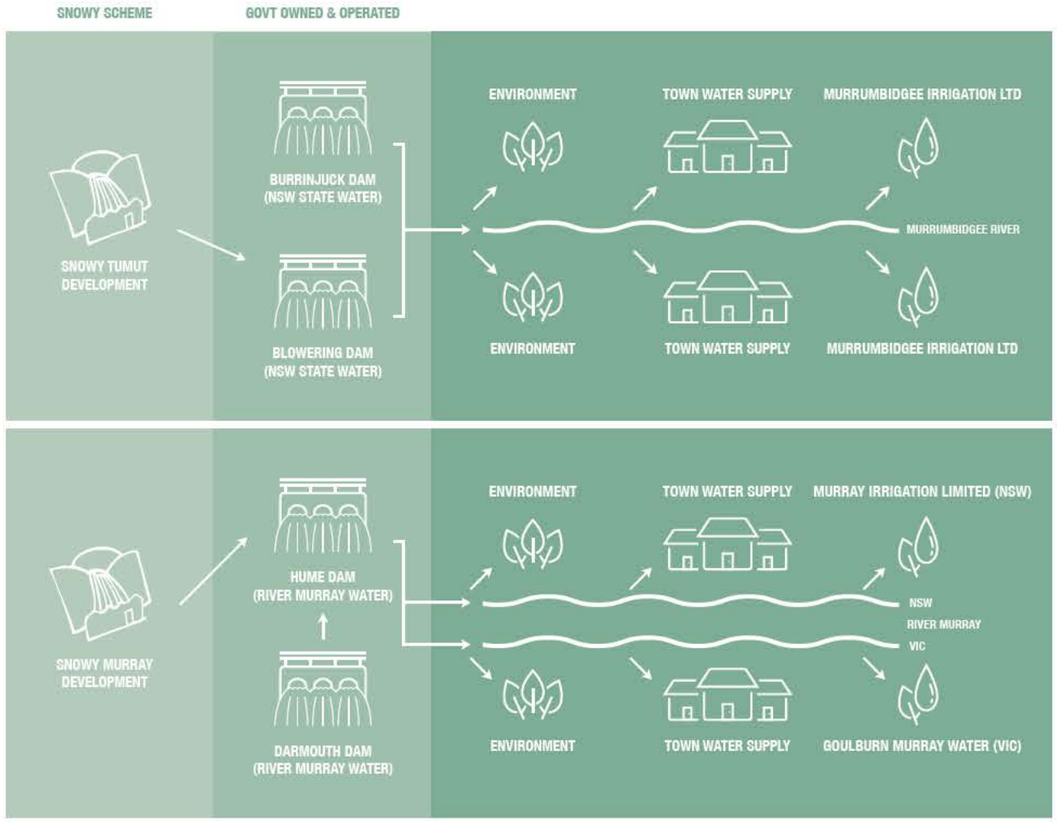
The Snowy Scheme was designed to cope with large variability in inflows. In the last 101 years of data, inflows have ranged from 683GL seen in 2006/07 during the worst drought on record, to 5761GL almost a century ago in 1917. The average is around 2800GL.

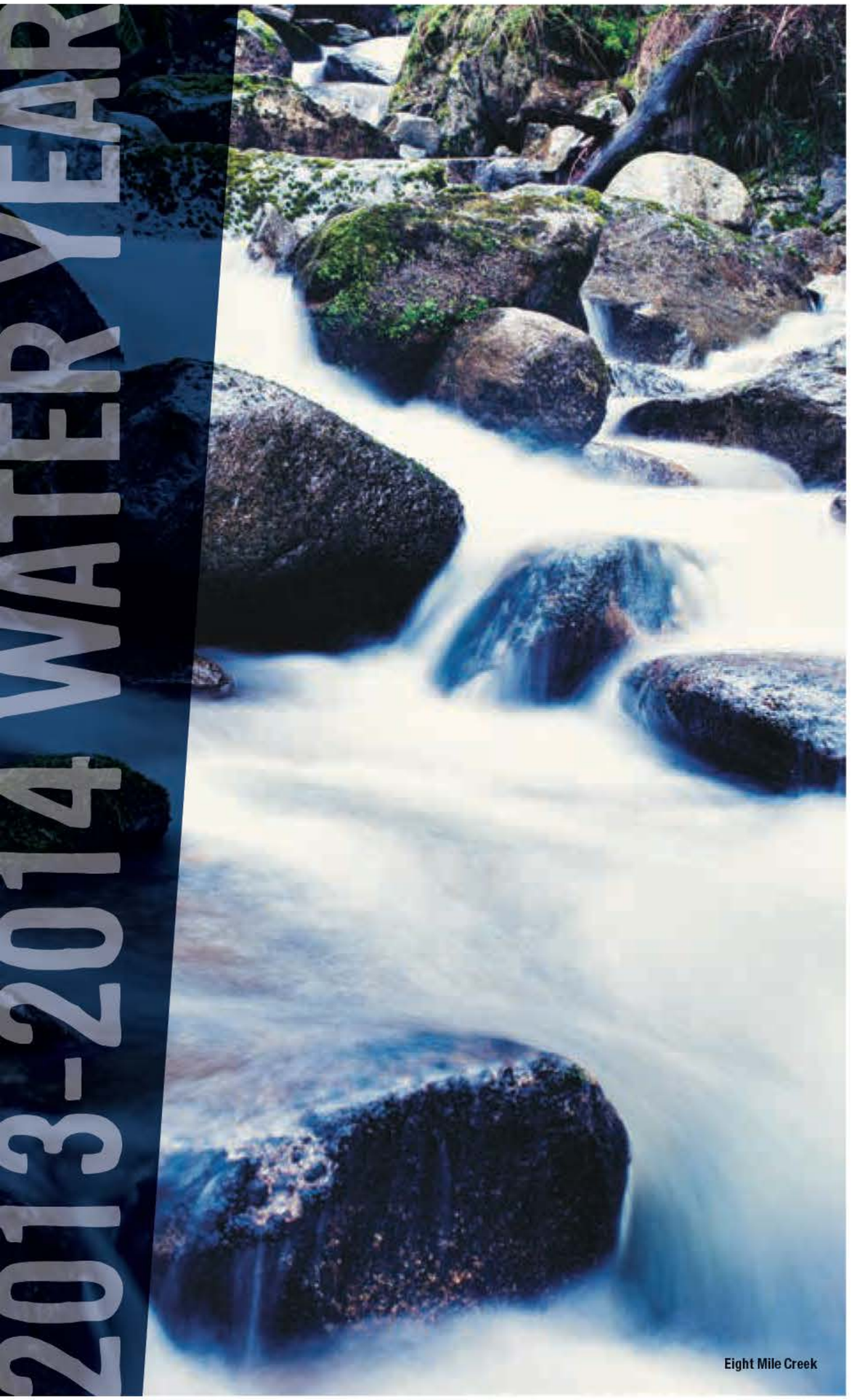
SNOWY HYDRO DOES NOT DETERMINE RELEASES FROM THE SCHEME OR TO IRRIGATORS…

Snowy Scheme releases and the other River Murray and Murrumbidgee River catchment inflows are re-regulated by Hume Dam on the River Murray and Blowering Dam on the Tumut River – neither of which are owned or controlled by Snowy Hydro.

Water releases for extractive and environmental uses along the Upper River Murray are managed by the Murray-Darling Basin Authority, principally through releases from Dartmouth and Hume Dams (the Snowy Scheme does not make releases into nor has any control over the operation of Dartmouth Dam).

Water releases for extractive and environmental uses along the Murrumbidgee River are managed by the NSW State Water Corporation, principally through releases from Blowering and Burrinjuck Dams (again, the Snowy Scheme does not have any control over the operation of Burrinjuck Dam).





Eight Mile Creek

THE 2013-2014 WATER YEAR – WHAT WATER CAME IN…

2013-2014 INFLOWS

Snowy Scheme inflows for 2013–14 were 2,338GL which is about 84% of the long term average of 2,786GL.

We would need multiple years of average or above average inflows to see major sustained improvements in lake levels. In 2013-14 we received below average inflows, therefore further increasing the time it will take for storages to return to long-term average levels.

SNOWY SCHEME STORAGES FOR 2013-2014

Snowy Scheme storage levels are referred to in two different measurements, 'Active Storage' and 'Gross Storage'.

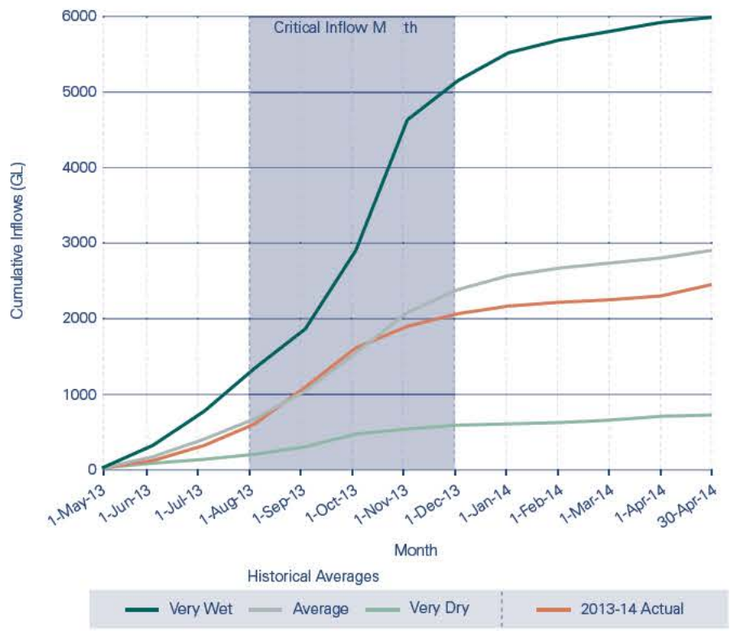
Active storage is the water that generally can be accessed by either pumping or through release via dams or through power stations. Gross storage is the total amount of water behind the dam wall including the water that cannot ordinarily be accessed due to the design of the Snowy Scheme infrastructure.

For the purposes of our business operations, active storage is used, whereas recreational users are generally more interested in and familiar with gross storage. For example, Lake Jindabyne could experience a 0% active storage level but the lake itself would be then at approximately 44% gross storage. This remaining water cannot be accessed via the pumping station due to the physical design limitations of the Snowy Scheme.

At the end of the 2012–13 water year, Snowy Scheme active storage was 2,296GL. This is equivalent to 43.3% of the total active storage capacity.

During the 2013–14 water year, active storage decreased by 128GL to 2,168GL at the end of the year, which is 40.9% of the total active storage capacity.

SNOWY SCHEME INFLOW FOR MAY 2013 - APR 2014



SNOWY SCHEME ACTIVE STORAGE FOR 2013 - 2014 WATER YEAR

LAKE LEVELS

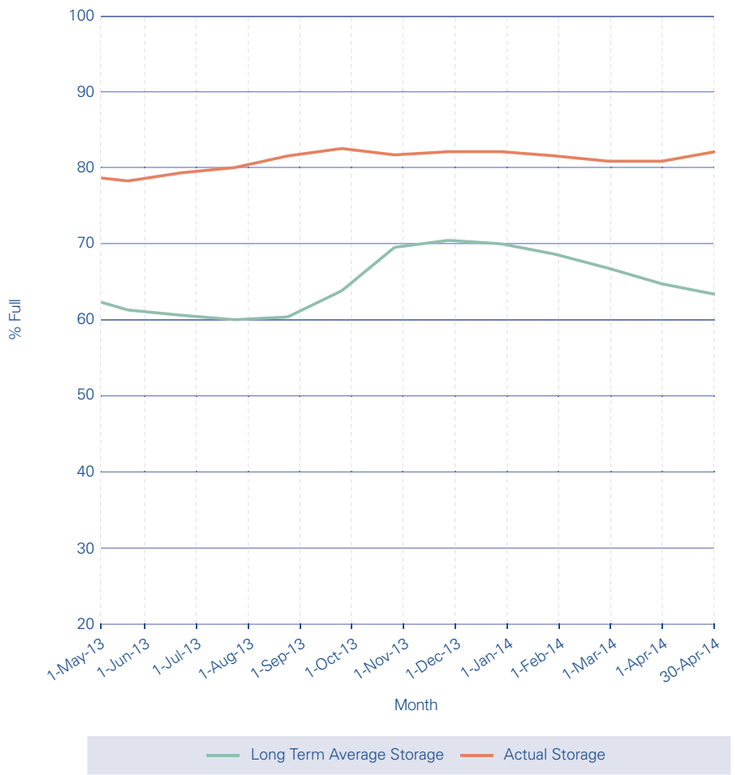
The Snowy Scheme's main storage, Lake Eucumbene, ended the 2013-14 year lower than the previous and below the long-term average storage level.

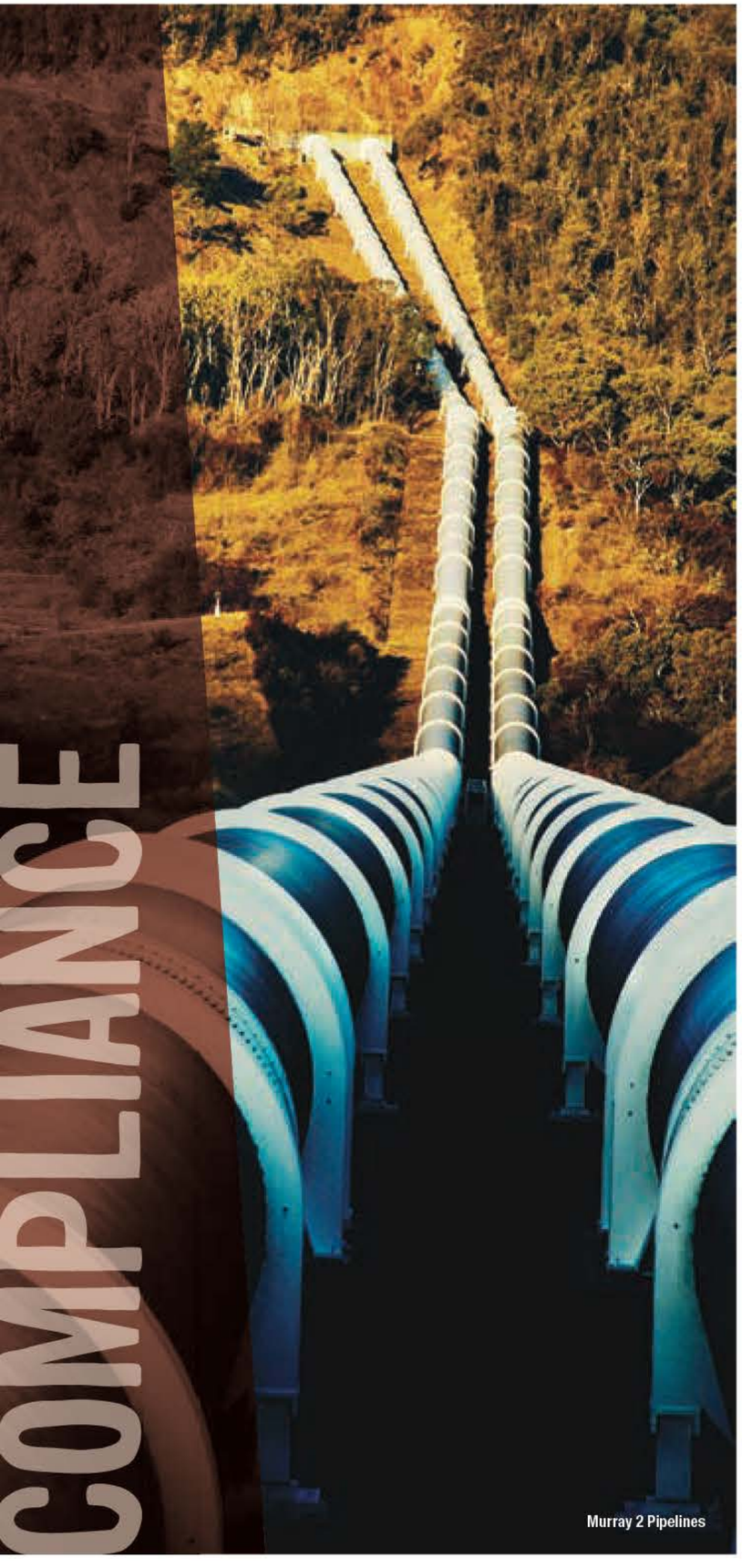
The level of Lake Jindabyne at the end of the 2013-14 water year was slightly higher than that of the previous year, and the storage level remains well above the long term average storage level. As discussed earlier, this is in order to ensure security of supply for the environmental flows and flushing flows out of Jindabyne Dam into the Snowy River.

Snowy Hydro reports gross storage levels to local tourism operators and the local community on our website. Lake levels for our three main storages of Jindabyne, Eucumbene and Tantangara are provided weekly and are available at **www.snowyhydro.com.au**. Our website also includes a lake level comparison calculator where it can be seen that lake levels have improved since the height of the drought in 2006–07 in line with improvements in annual inflows.

LAKE EUCUMBENE GROSS STORAGE FOR 2013 - 2014 WATER YEAR

LAKE JINDABYNE GROSS STORAGE FOR 2013 - 2014 WATER YEAR





Murray 2 Pipelines

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 2013–14 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 Aqueduct
- Environmental releases into the Snowy River from Bar Ridge and Diggers Creek 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 2013–14 water year.

The total accounted release volume was 990GL. This was made up of:

- 822GL being the 2013–14 Required Annual Release calculated under the Snowy Water Licence; plus
- 168GL of pre-release of the 2014–15 Required Annual Release; plus
- 0GL 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 21GL of Montane environmental flow releases provided to the Geehi and Swampy Plains River which did not flow through Scheme power stations.

MURRUMBIDGEE RIVER CATCHMENT

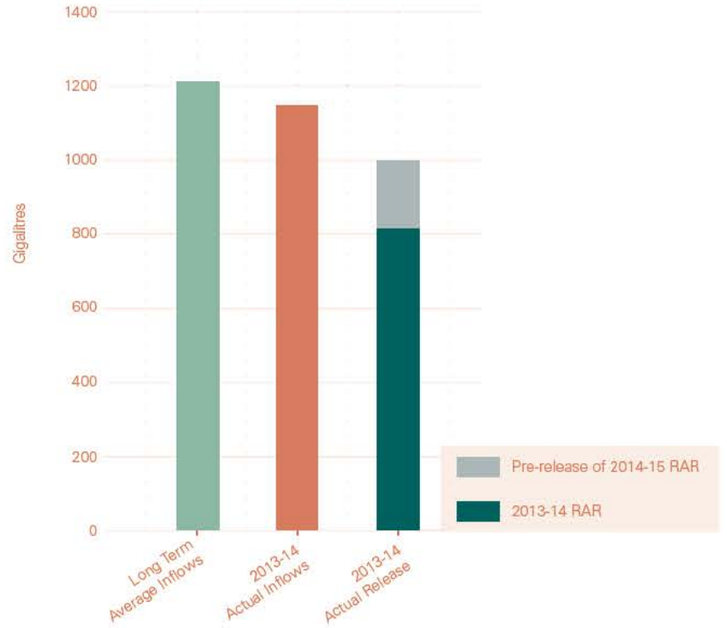
Snowy Hydro complied with its obligation to target the Required Annual Release from the Snowy-Tumut Development to the Murrumbidgee River catchment during the 2013–14 water year.

The total accounted release volume was 1040GL. This was made up of:

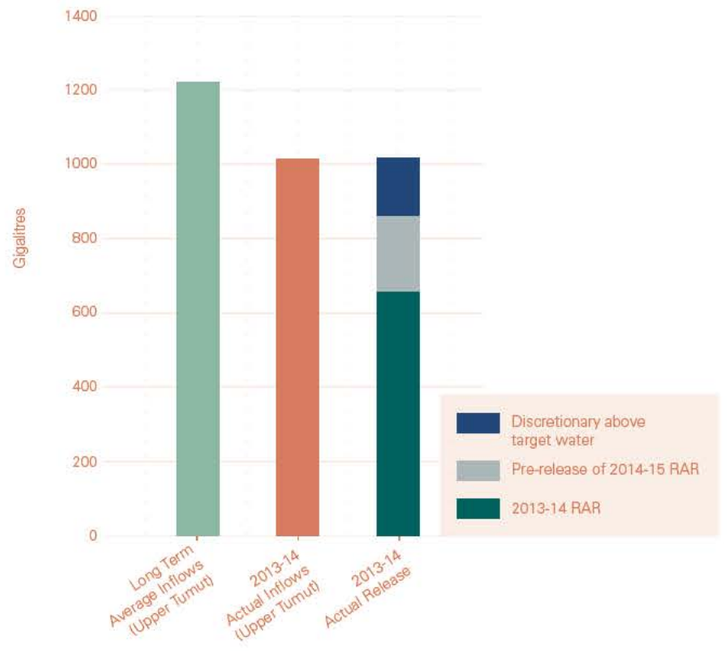
- 689GL being the 2013–14 Required Annual Release calculated under the Snowy Water Licence; plus
- 200GL of pre-release of the 2014–15 Required Annual Release; plus
- 151GL of Discretionary Above Target Water release (water not required for RAR releases that Snowy Hydro is able to release at its discretion).

This total release volume includes 38GL of montane environmental flow releases provided to the Murrumbidgee and Goodradigbee Rivers which did not flow through Scheme power stations.

INFLOWS AND RELEASES TO THE RIVER MURRAY CATCHMENT DURING 2013-2014



INFLOWS AND RELEASES TO THE MURRUMBIDGEE CATCHMENT DURING 2013-2014



ENVIRONMENTAL RELEASES

SNOWY RIVER ENVIRONMENTAL FLOWS

As an outcome of the Snowy Water Inquiry commissioned in 1998 into flows down the Snowy River, the releases from the Scheme into the Snowy River have increased. The key element of the environmental flow arrangements under the *Snowy Water Licence* (known as the Snowy River Increased Flows Program (SRIF)) is that the total volume of environmental flows delivered to the Snowy River each year is determined by allocations to entitlements secured by water savings achieved by the Governments to date.

Snowy Hydro does not own the entitlements for the Snowy River environmental flows and is not responsible for securing water savings or for setting the release targets. Snowy Hydro is simply required to meet release targets notified to it by the NSW Office of Water under the *Snowy Water Licence*.

While additional releases to the Snowy River have been occurring since 2002, until 2011-12 water had been limited due to the impact of prolonged droughts and low water availability. With improved inflows, as well as the NSW Office of Water and Victorian Department of Sustainability and the Environment securing over $400million of water entitlements, the Snowy River is now subject to secure environmental flows.

The adjacent table sets out the major steps and accountabilities in the process, from securing water savings on the western rivers through to the actual release of environmental flows.

MAJOR STEP	WHO IS RESPONSIBLE
Securing verified water savings from water savings projects on the River Murray or Murrumbidgee River (or purchase of water entitlements).	Water for Rivers **waterforrivers.org.au**
Transferring verified water savings into Environmental Entitlements.	NSW Office of Water **water.nsw.gov.au** VIC Department of Sustainability and Environment **dse.vic.gov.au**
Calculating annual allocations from the Environmental Entitlements each year (in arrears).	NSW Office of Water **water.nsw.gov.au** VIC Department of Sustainability and Environment **dse.vic.gov.au**
Apportioning the annual allocations between the Snowy River Increased Flows and River Murray Increased Flows.	NSW Office of Water **water.nsw.gov.au**
The determining of annual, monthly and daily release volumes for Snowy River Increased Flows.	NSW Office of Water **water.nsw.gov.au**
Notifying Snowy Hydro of annual, monthly and daily release volumes for Snowy River Increased Flows.	NSW Office of Water **water.nsw.gov.au**
Providing infrastructure to enable Snowy River Increased Flows from Jindabyne Dam and modifying existing infrastructure to enable Snowy Montane Rivers Increased Flows.	Snowy Hydro **snowyhydro.com.au**
Targeting releases of Snowy River Increased Flows from Jindabyne Dam and those structures nominated for Snowy Montane Rivers Increased Flows.	Snowy Hydro **snowyhydro.com.au**

SNOWY RIVER INCREASED FLOWS

Snowy Hydro complied with its obligation to target releases from Jindabyne Dam for environmental purposes during the 2013–14 water year.

The volume of Snowy River Increased Flows (SRIF) released from Jindabyne Dam during the 2013–14 water year was 183.4GL, which was 1.4GL above the target volume of 182.1GL. That excess is well within the +/–10% annual tolerance around the target volumes allowed under the *Snowy Water Licence*. The 2014–15 target has been adjusted down to account for this release surplus.

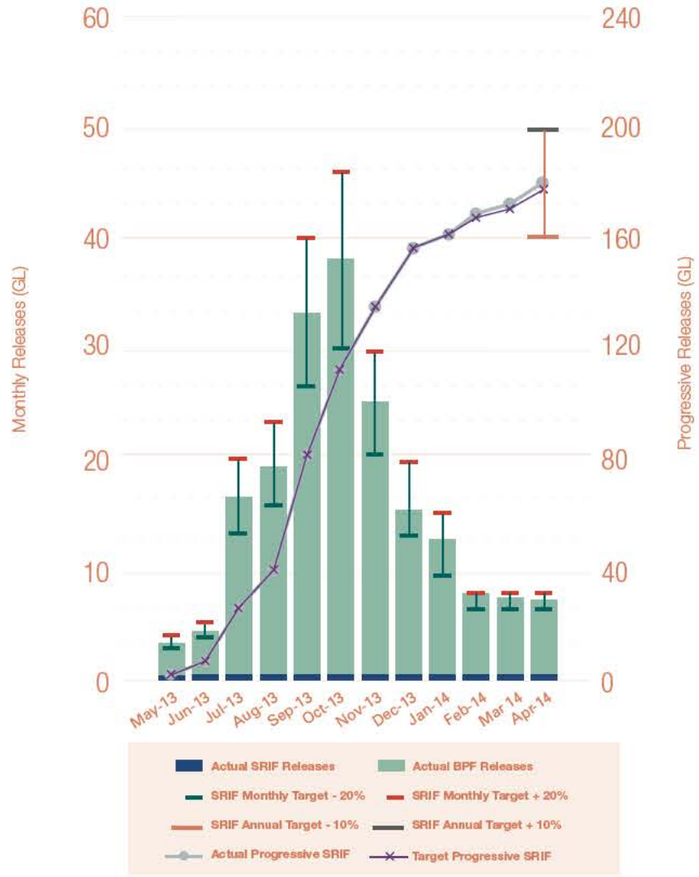
In addition to the environmental releases, 8.5GL Base Passing Flow (BPF) was also released from Jindabyne Dam and 0.5GL riparian flow was released from the Mowamba Weir.

All monthly releases were within the +/–20% monthly tolerance around the target volumes and daily releases were within the +/–20% daily tolerance allowed under the *Snowy Water Licence*.

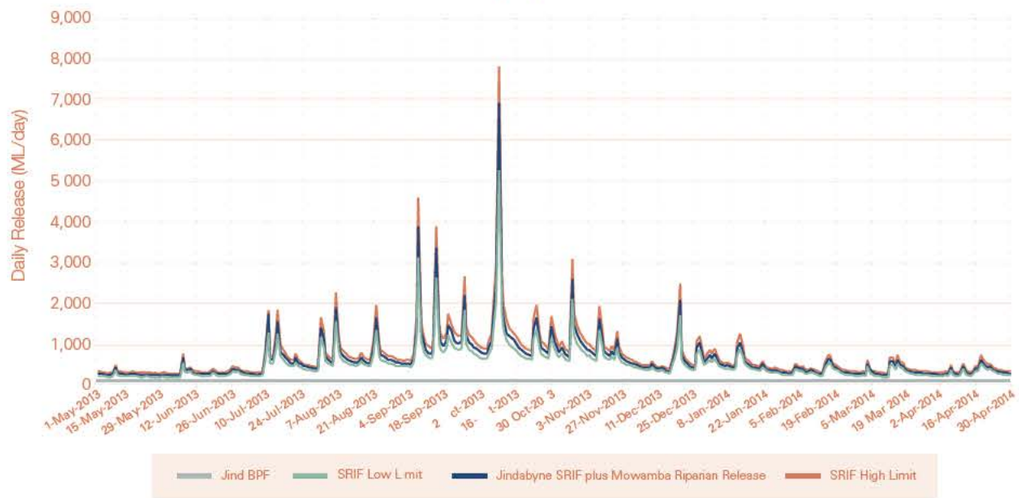
As allocations for the 2013–14 water year once again exceeded 100GL, a flushing flow was delivered to the Snowy River as set out on page 25.

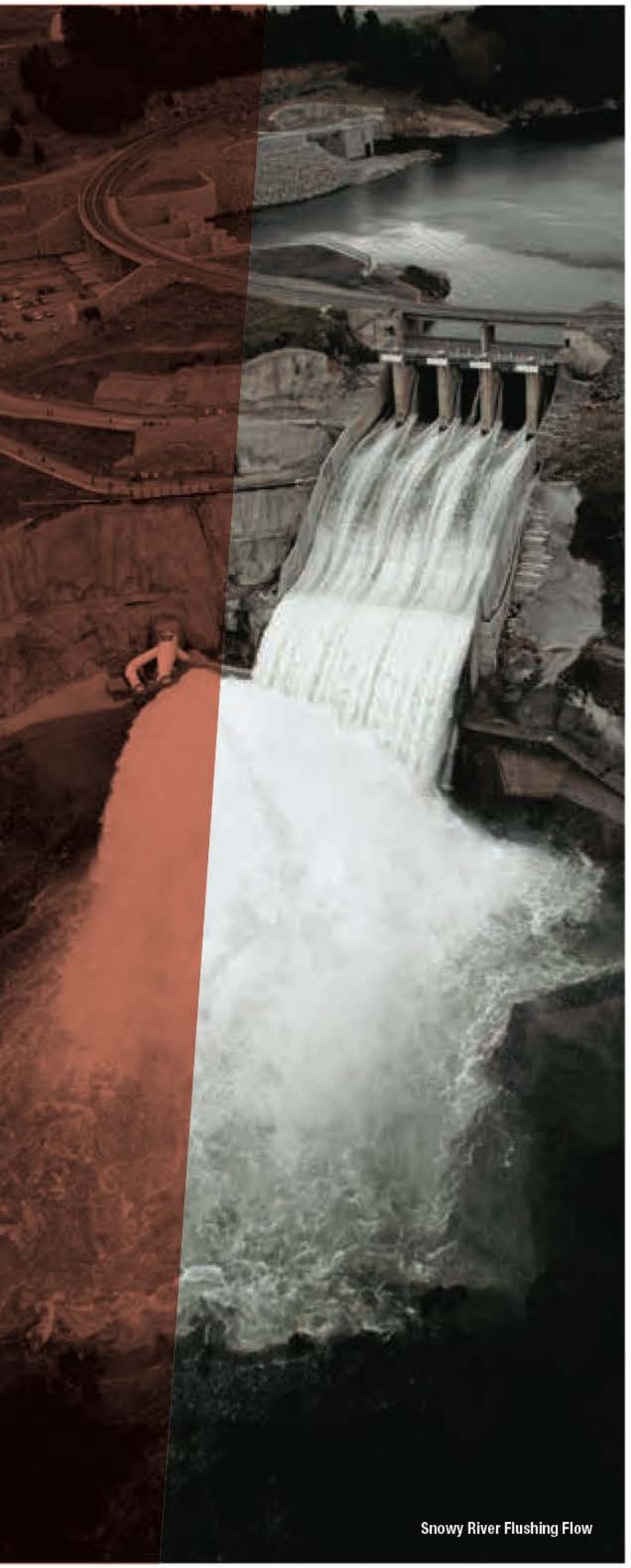
The comparison of the annual, monthly and daily release targets for the Snowy River Increased Flow releases against the actual releases is shown in the following charts.

SNOWY RIVER INCREASED FLOWS AND JINDABYNE BASE PASSING FLOW RELEASES INCLUDING MOWAMBA RIPARIAN RELEASES



SNOWY RIVER INCREASED FLOWS (SRIF) AND JINDABYNE BASE PASSING FLOW (BPF) RELEASES AND DAILY LIMITS





Snowy River Flushing Flow

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 Office of 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 the 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 macroinvertebrates.

In October 2013 Snowy Hydro delivered another flushing flow, following on from the first in October 2011 and second in September 2012. The release pattern was set by the NSW Office of Water with releases peaking at 7GL per day and was discharged through the large spillway gates as well as the cone valves.

The NSW Office of 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.

Snowy Hydro Engineers, Hydrologists, Technical and Support staff spent months in the planning of the releases with the focus on safety of the public, especially on site, where a temporary public viewing area was established.

The temporary public viewing area was adjacent to the spillway and included a controlled parking area so people could come and see the releases first hand.

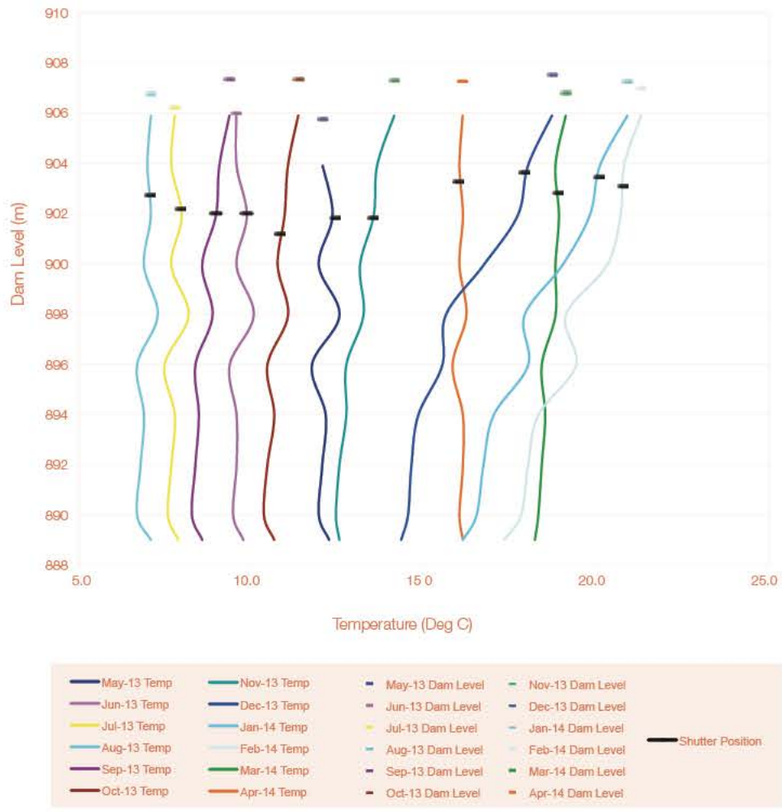
THE TEMPERATURE OF RELEASES FROM LAKE JINDABYNE

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 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 exist in the intake channel when the lake is at high 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 opposite, 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 2013–14 water year. Montane Rivers are those that are located in a mountainous area.

During the 2013–14 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 (a tributary of the Geehi River; and
- Bar Ridge and Diggers Creek Aqueducts to Tolbar Creek and Diggers Creek respectively (tributaries of the Snowy River).

This was the first year that releases had been targeted from Bar Ridge and Diggers Creek Aqueducts to the Snowy River, signalling the continuing implementation of this environmental flows program.

The target volume for Snowy Montane Rivers Increased Flows totalled 78.2GL, with 29.8GL from Tantangara Dam, 12GL from Goodradigbee Aqueduct, 17.5GL from Middle Creek, and 18.9GL from Bar Ridge and Diggers Creek Aqueducts, all to be targeted over the whole water year.

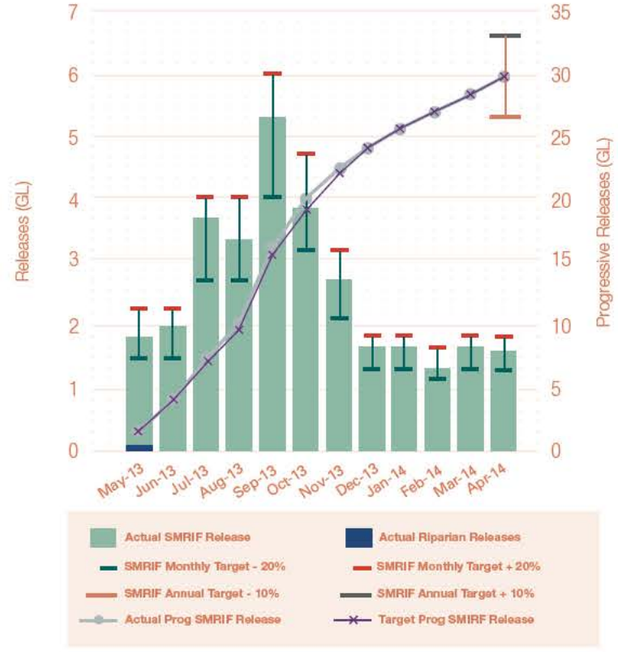
The total actual montane release volume was 75.1GL. This was made up of 29.9GL from Tantangara Dam, 7.6GL from Goodradigbee Aqueduct, 20.7GL from Middle Creek Aqueduct and 16.9GL from Bar Ridge and Diggers Creek Aqueducts, released over the whole water year.

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

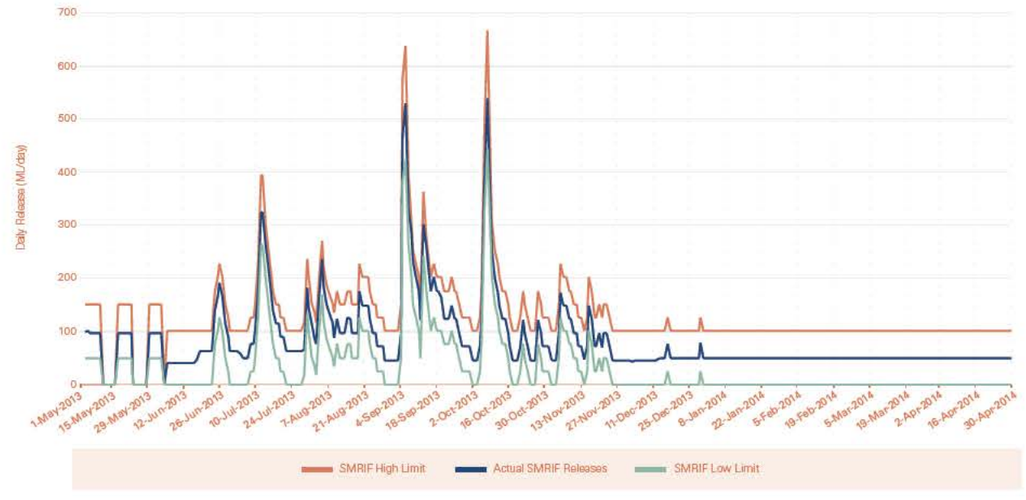
Monthly releases from Goodradigbee, Middle Creek, Bar Ridge and Diggers Creek are also provided on pages 29 and 30. As these releases are made from small catchments and the inflows (and therefore releases) cannot be predicted or controlled, there are no annual compliance targets for these releases. The above/below target delivery of water in these catchments in 2013-14 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.

Goodradigbee Diversion Structure

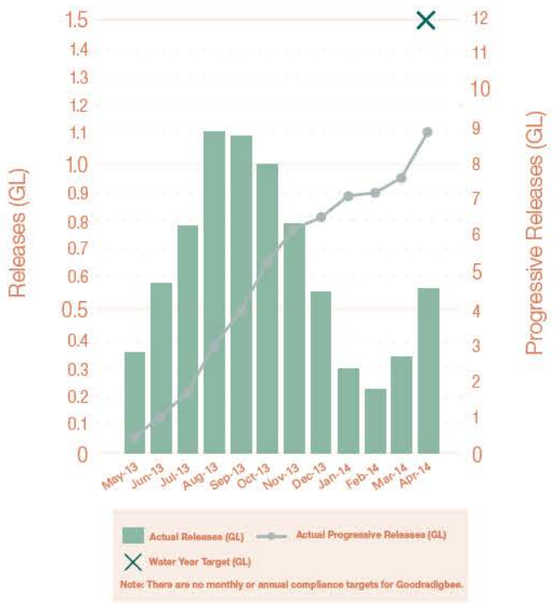
SNOWY MONTANE RIVERS INCREASED FLOWS AND RIPARIAN RELEASES FROM TANTANGARA DAM



SNOWY MONTANE RIVERS INCREASED FLOWS FROM TANTANGARA DAM AND DAILY LIMITS

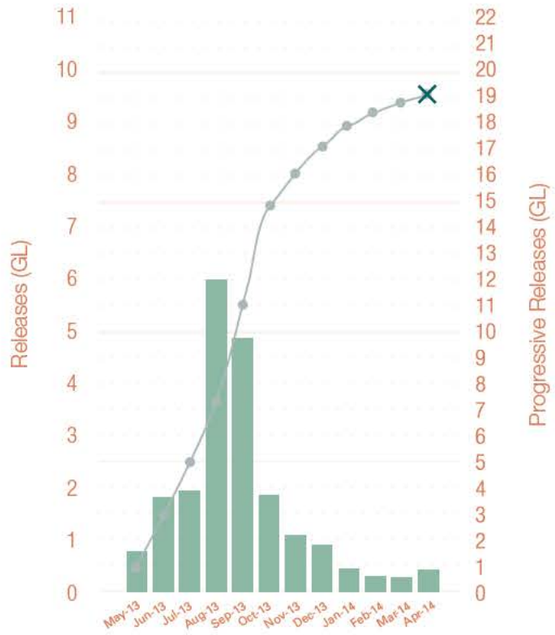


SNOWY MONTANE RIVERS INCREASED FLOWS FROM GOODRADIGBEE WEIR



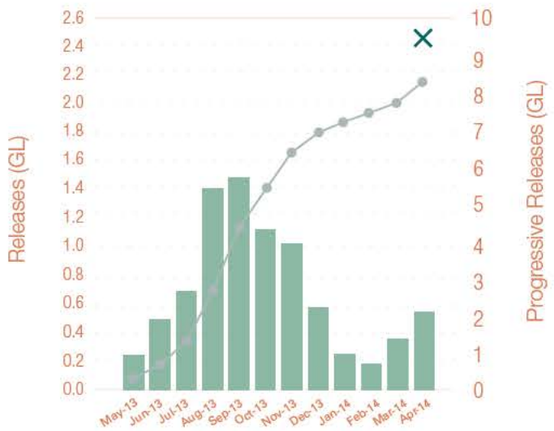
Note: There are no monthly or annual compliance targets for Goodradigbee.

SNOWY MONTANE RIVERS INCREASED FLOWS FROM MIDDLE CREEK AQUEDUCT



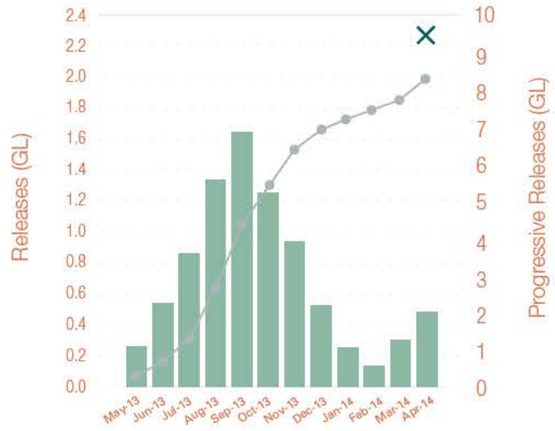
Note: There are no monthly or annual compliance targets for Middle Creek.

SNOWY MONTANE RIVERS INCREASED FLOWS FROM DIGGERS CREEK AQUEDUCT



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

SNOWY MONTANE RIVERS INCREASED FLOWS FROM BAR RIDGE AQUEDUCT



Note: There are no monthly or annual compliance targets for Bar Ridge.

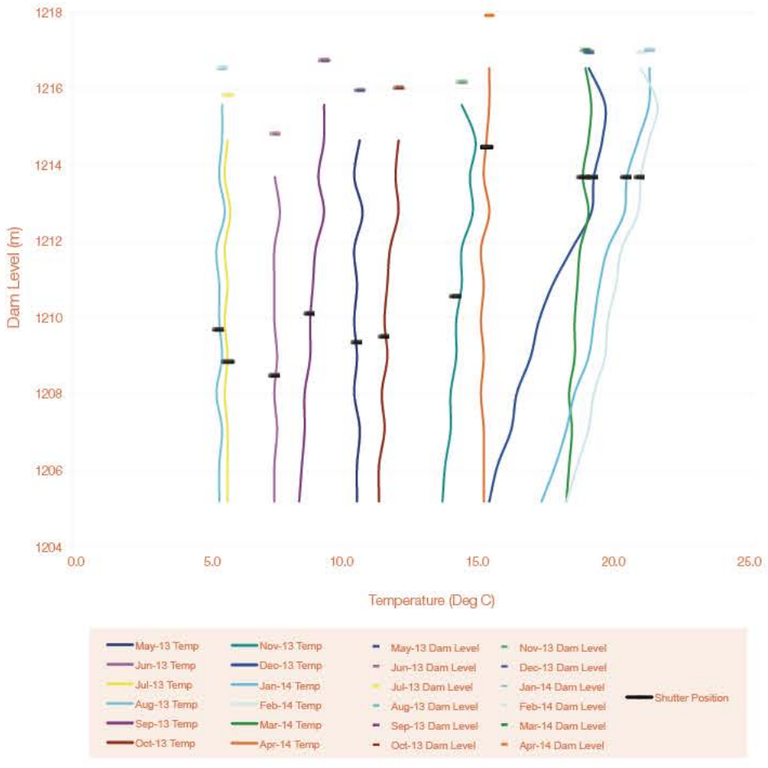
THE TEMPERATURE OF RELEASES FROM TANTANGARA RESERVOIR

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 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 opposite, a persistent thermocline was not present during the 2013-14 water year.

TANTANGARA DAM INTAKE WATER TEMPERATURES AND LEVEL



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VERIFICATION STATEMENT

Snowy Hydro Limited commissioned BSI to independently verify the data from its Water Operations Report for the 2013-2014 Water Year; specifically, compliance against required annual water release targets set under the *Snowy Water Licence* and actual releases made by Snowy Hydro Ltd.

Responsibilities of the Verifier:

BSI was not responsible for the preparation of any part of the report. The audit was conducted using recognised assessment techniques based on ISO19011 with the 2013-2014 Water Operations Report as the principal reference. The audit was a desktop review of Snowy Hydro Limited's water accounting and operating databases, documented procedures and included interviews with operational staff.

Scope:

Numerical values provided in the Water Operations Report were compared with the required target volumes from the approved Annual Water Operating Plan for the 2013-2014 Water Year and actual releases were compared with a sample of entries from the water accounting databases. Records of maintenance and calibration of equipment used in monitoring water releases were also reviewed.

The verification process reviewed data for reasonableness and where practical checked the order of magnitude, but detailed calculations were not carried out.

Verification Statement:

Based on the data review process applied during the audit, there is evidence to support that the Water Operations Report for the 2013-2014 Water Year is materially correct and is a fair representation of the water operations.

Dr David Holliday
Environmental Auditor
RABQSA Certificate no. 7947694-116404
20 June 2014

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