

Kemano T2 Project

Project update – Fall 2022



Photo of the T1 and T2 water intake (30m below surface)

Mission Accomplished!

Dear readers,

It's with mixed emotions that I am introducing the last Kemano T2 Project update. We are extremely proud of the work accomplished these past years but saddened to leave such a unique area where Mother Nature is in charge.

The recently completed Kemano T2 Tunnel has been generating power since the Operational Commissioning process was successfully completed in the summer. Both tunnels are now operating simultaneously to feed the Kemano Powerhouse after T1 operated on its own for more than 70 years.

This brings to a close what has been an extraordinary project delivered by so many, past and present. I am honored and moved to witness the result of the work of generations of workers over 3 decades. We were grateful to have been presented with the 2022 Tunnel Achievement Award for Project Excellence in September. This award recognizes successfully completed projects that demonstrate innovation and teamwork and provide benefits to the community, and it is the first time the Tunnel Achievement Award has recognized a private-sector project!

We have completed the demobilization of the project. A small team finalized the last of the non-waterway works during the past weeks. We have started the implementation of the revegetation plan, about which you will find more information in this Project Update.

Our goal was to deliver the Kemano T2 Project safely, in respect of the environment and surrounding communities, and I can proudly say, mission accomplished!



Alf Garnett
Project Manager
Kemano T2 Project

What happens to the 250,000m³ of rock that was bored out of the mountain to make the tunnel?

In the process of boring with the TBM (Tunnel Boring Machine), granite rock was crushed into fine particles of ~1/4 inch size, or less, similar to that of sand. These fine particles are layered on a waste rock spoil pile (spoil pile), covering an area of 1,400m², that was specifically designed by an engineer for stability. The pile is a stepped, flat design (not a pile like a mountain). It is situated on the edge of the Horetzky valley floor, in an area that is out of the avalanche pathways located in the valley.

The main concern is the effect of water on the spoil pile. We want to avoid erosion which could cause sediment to end up in the surrounding streams. In order to prevent this, a drainage system has been designed around the spoil pile. Sumps are situated strategically around the waste rock spoil pile and dykes have been built on the sides in case the surrounding streams change their course at some point. A Piezometer is used to measure any spoil pile movements. A certain amount of settlement is normal, as when you build a house.

Currently, the soil pile is behaving as expected. Water flow is continuously monitored through the spoil pile for early detection of flow changes. At present, 10 readings a month are taken to compare against the base line.

An environmental consultant has provided a prescription of natural flora for hand planting and have also recommended hydroseeding. This is the process where topsoil is placed on the spoil pile and then water, fertilizer and seeds are blown onto the area to give it a boost. Alpine elder is the predominant tree species that will be replaced on the spoil piles. A total of 2,500 seedling trees have been planted and are already taking root!



Before photo taken in August 2022



Soil pile AFTER photo taken beginning October 2022

The Kemano T2 Project in numbers

16km
tunnel,
5.72m dia.

250,000m³
of rock
excavated

30,600
tunnel lining
segments

440,000m³
of water
in the tunnel



Bifurcation tunnel - Construction



Bifurcation tunnel - Final



Downstream tunnel - Rehabilitation of the 8.4km tunnel that was completed in 1990s



Upstream tunnel - Bored and lined tunnel (segments)



Underground Area Manager Shawn Tucker and Surface Area Manager Graham Geeraert celebrate the successful water-up of the Kemano T2 Project

The commissioning of T2

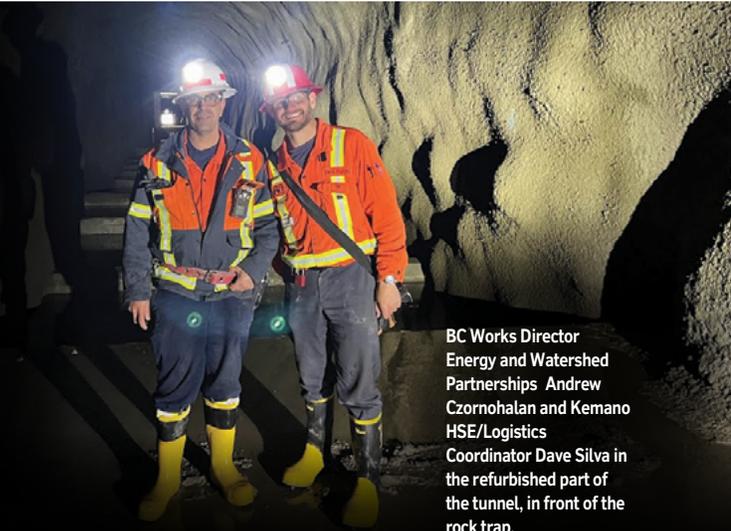
The construction of the second tunnel has already been completed a few months ago. The tunnel was filled up with water over 5 days to gradually increase the pressure on the tunnel walls. This is the safest way to water-up a new tunnel.

Once the tunnel was filled with water, a series of commissioning processes and tests were made to confirm the second tunnel can be used safely. T2 went through some testing to see how it would react when generators were shut down, for example, as can happen under unforeseen or emergency situations. When a generator is shut down, a pressure wave travels upstream through the

tunnel and we need to know that the construction of the tunnel can handle it. Nothing significant was found during this commissioning, and so the first megawatts of power out of T2 were produced! During the months following the completion and watering of the tunnel, the Kemano T2 Project Team was busy demobilizing the project.

Inside the tunnel – a final walk through

BC Works Director Energy and Watershed Partnerships Andrew Czornohalan, Superintendent Kitimat and Kemano Jimmy Gilbert and Kemano HSE/Logistics Coordinator Dave Silva walked the entire tunnel before it was watered up. The 16km had to be covered and backtracked many times as they exited the tunnel at various access points. What a surreal experience. They shared some pics with us.



BC Works Director Energy and Watershed Partnerships Andrew Czornohalan and Kemano HSE/Logistics Coordinator Dave Silva in the refurbished part of the tunnel, in front of the rock trap.



David Silva – Kemano HSE/Logistics Coordinator



Plaque mounted inside the tunnel in appreciation of all employees, contractors and supplies who made the completion of the Kemano T2 Project a success



Any rocks or debris that become loose in the tunnel while water is flowing, no matter their size, will tumble and end up in the rock trap, 40m long, 5m wide, and 5m deep instead of continuing their way to the power station turbines.

What will happen to T1?

The first tunnel (T1) has been serving us well since the 1950s but started showing signs of deterioration. The second tunnel that has been built in Kemano has a smaller diameter than T1 but is more efficient due to its pre-cast concrete lining and refurbishing that the Kemano T2 Project Team did to the tunnel in the 1990s.

Using both tunnels at the same time will allow Rio Tinto BC Works to reduce the stress put on T1 by decreasing the water flow. This will help keeping it functioning for many more years. We will continue to inspect T1 every couple of years with underwater submarine inspections.

How we protected the mountain goats while doing avalanche control

Did you know that the Ungulate Winter Range in North Coast BC is the largest in the world? British Columbia has over 50% of the world's population of mountain goats and about 50% of these occur in the Skeena region (northwestern portion of British Columbia). Their over-wintering habitat is protected in British Columbia. According to the British Columbia Mountain Goat Society, "the total number of mountain goats in the world is estimated at between 80,000 and 110,000. Over half the world population live in British Columbia (50,000) with the greatest population density centred on the Terrace/Smithers area of central British Columbia."



FUN FACT:

Mountain goats are not goats at all! Mountain goats are distantly related to antelope and musk oxen and closely related to the alpine ungulates of Asia and Europe including the serow and chamois. Scientific literature suggests that mountain goats moved across a land bridge (Bering Sea) from northern Asia to North America about 40,000 years ago during the Wisconsin Glacial period.

Winter is a difficult time for mountain goats. Despite being adapted to mountain environments, they still must face cold temperatures, deep snows, and low food resources in the winter. These circumstances create high energy demands and so any additional stress can be detrimental. No wonder Rio Tinto takes such care when it comes to avalanche control measures and helicopter activity because they can cause major disturbances.

There are 38 natural avalanche paths over the 10km distance from the Kemano to Horetzky valleys and avalanche control is required during the winter and spring to protect workers using the roads from mother nature doing her thing. However, such activities could cause extreme stress to the mountain goat population and so a goat monitoring program was initiated.

Rio Tinto has the largest independently run avalanche control programme in Northern America, with experts from around the world using cutting edge technology (same as that used in the Alps). On average 3 avalanche techs

were on site from November to mid-May. Gazex cannons were installed that ran on propane and oxygen and 'heli-bombing' could also be used where technicians throw a 25kg bag to trigger an avalanche. There have been several instances where the helicopter and avalanche control team have either altered their flight path to avoid stressing goats or delayed bombing missions to protect goats and allow them to move when they have been in the vicinity of avalanche pathway.

Good news is that there have been no goat mortalities from the project, in fact the goat population may have increased in and around the Kemano/Horetzky Valley! Each year before the avalanche season begins, the biologists complete a mountain goat occupancy survey and also provide refresher "goat spotting" training to the Avalanche technologists, Environmental Monitors and other Project personnel. The end of season monitoring data is then collected, tabulated and provided to the government.

This highly successful initiative has provided the opportunity for other operations within BC to follow Rio Tinto's lead.



Hi! My name is Sophie.

I was the Communities and Social Performance Advisor for the Kemano T2 Project.

Part of my role was to be the connection between the project and the community. The project updates were aimed at giving you interesting and informative insights on what was happening on the project, underground and on the ground. The project is completed, but please don't hesitate to reach out to bcworksinfo@riotinto.com if you have questions about the tunnels, Kemano Operations or the BC Works smelter in Kitimat.

About the project

The BC Work's smelter in Kitimat is powered by the Kemano Powerhouse, which receives water from the Nechako Reservoir via a single tunnel that is over 60 years old. The completion of a second tunnel ensures the long-term reliability of the power supply that energizes Rio Tinto's BC Works

smelter in Kitimat. The smelter produces aluminium with one of the lowest carbon footprints in the world.

Rio Tinto continued to operate the existing tunnel and monitor its condition until the T2 Project was completed. Since the completion of the second tunnel, Rio Tinto is using

both tunnels at the same time and continues to monitor the condition of the first tunnel.

Rio Tinto and all the contractors working on the Kemano T2 Project maximized the involvement of local businesses and First Nations in the project.

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