

Canadian Brownfields Case Study

Colomac Mine Remediation Project



Figure A: Zone Pit 2 empty in 1997 - Source: [https://maps.canada.ca/journal/content-en.html?lang=en&appid=bf1c9c70b8d64f-](https://maps.canada.ca/journal/content-en.html?lang=en&appid=bf1c9c70b8d64f-3da9434edf39&appidalt=800276ab7d5046d5a-088238cac44d8d2&wbdisable=true#wb-cont)

PROJECT SUMMARY

Colomac Mine, located 220 kilometres north of Yellowknife, NT was an active gold mining site between the years of 1990 and 1997¹. The site has seen various ownership over the years from Neptune Resources Corporation, North Gate Exploration and Royal Oak Mines². Royal Oak Mines would be the final operator to hold rights to the site before it was placed into receivership, and responsibility was passed on to the Crown Indigenous Relations and Northern Affairs Canada (CIRNAC) in 1999. Funding for the remediation of Colomac Mine was provided through CIRNAC, and the site experienced closure and remediation up until 2011 with prominent progress seen in 2006-2007 and 2010-2011. The remoteness of Colomac Mine posed the greatest challenge and risk, with large scale demolition, civil earth works, hydrocarbon remediation and in situ remediation of water bodies occurring a considerable distance from Yellowknife. CIRNAC worked very closely with the indigenous Tlicho tribe in the area for consultation, training and remediation. This partnership would prove to be instrumental to informing sustainable strategies and unique intricacies of this sensitive environment. The Tlicho and other northern residents would benefit from over 75% of employment, over 90% of training from the remediation project, and the overall success would be recognized by the Consulting Engineers of Alberta's Award of Excellence in the environmental category in 2013³. The Colomac Mine Remediation Project was successfully completed, undergoes long-term monitoring to this day and sets a good precedent for the remediation of remote industrial sites in Canada.

QUICK FACTS

Location

Wek'eezhii, Northwest Territories

Project Type

Hydrocarbon, petrochemical & cyanide contamination

Site Size

850 hectares

Land Uses

Ongoing mineral exploration

Keywords/Special Features

Indigenous lands, land reclamation, hydrocarbon, cyanide, soil & tailings contamination

Website

<https://maps.canada.ca/journal/content-en.html?lang=en&appid=bf1c9c70b8d64f1850e-3da9434edf39&appidalt=800276ab7d5046d5a-088238cac44d8d2&wbdisable=true#wb-cont>

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Site Characteristics

The site is situated in a region known as Wek'eezhii, which is part of the traditional lands of the Tlicho⁴. This region spans the area between Great Bear Lake and Great Slave Lake in the Northwest Territories, and does not currently have a land use plan in place⁵. However, the indigenous use of this land was impacted by Colomac Mine, and the ensuing remediation project sought to preserve these uses. This region sees the migration of the Bathurst Caribou herd, and thus pertains to the economic situation of the Tlicho as they harvest caribou from this herd on an annual basis for their economy and subsistence⁶. The contamination of land from the mine's processes posed a great threat to these various natural occurrences in the area. Contaminants from the mine included open rock pits, mine infrastructure such as a mill and fuel tank yards, beached tailings and contaminated tailings water⁷. An estimated 23 petroleum related spills conjured potential hydrocarbon contamination, and free product rising to the surface of tailings ponds were observed floating in monitoring wells on site⁸. Furthermore, water contamination from cyanide processing of gold ore threatened widespread impact instigated by rising levels of natural inflow of water bodies in the area. At the time of the mine shutdown in 1997, the presence of these tailings containing cyanide was of greatest concern in the area, which was predicted to overflow by 2005⁹. Due to the lack of accessibility to the site and the sensitivity of the natural environment, it was pertinent to develop detailed strategies to tackle the remediation of such a multitude of potential contamination at Colomac Mine.

Cleanup

The remediation phases of Colomac Mine began in 2004 and ended in 2011, with various areas needing different types of strategies to ensure success.

An Enhanced Natural Removal program was implemented in order to contain tailings that were collected at Spruce Lake and Tailings Lake during the operations at the mine. By 1999, Spruce Lake was full of solid tailings and Tailings Lake was near overflowing its dams. As precautionary measures were taken to prevent this overflow, the result showed cyanide and other chemical contamination. Between 2003-2006, the contaminated waters in Tailings Lake and Zone 2 pit (an overflow precaution area)



Figure B: historic evidence of mine ownership through posters in 2003 - Source: <https://maps.canada.ca/journal/content-en.html?lang=en&appid=bf1c9c70b8d64fc1850e3da9434edf39&appid=800276ab7d5046d5a088238cac44d8d2&w=undefined&>

were treated naturally by adding phosphates in order to promote the growth of algae¹⁰. The use of algae is sustainable and enhances the breakdown of chemicals like cyanide and ammonia¹¹. Algae growth relies heavily on oxygenation of water, so diffusers were installed in Zone Pit 2 to increase and cycle oxygen from varying depths of the water¹².

Shoreline restoration was an important area of focus at the site, as contaminants were found in the shallow sediments specifically at Steeves Lake. These contaminants included benzene, ethyl-benzene, xylenes, petroleum hydrocarbon (PHC) and polyaromatic carbons (PAH). Impermeable layers were implemented on the shorelines to create long term solutions to the contamination of Steeves Lake. These layers were composed of waste rocks, geotextile material, infill of gravel, sand and peat and ensured that the parts of the shoreline that were contaminated didn't come into contact with the body of water itself. According to the Fisheries act, the total area available for fish habitat should remain unchanged. Thus, the government had to compensate for the loss in fish habitat by creating them anew. Among various techniques, the planting of native vegetation was used to supplement the growth of aquatic ecology. Highlights of the long term monitoring of these areas include the recording of burbot, slimy sculpin and lake chub downstream and upstream of the Dam 2 Channel, as well as growth of thick vegetation

on the banks of the channel which include willows and sedges planted by workers. A notable 70% of these plantings have survived¹³.

During processes during the mine's activity, two significant spills of diesel are estimated to combine to almost 50,000 litres. Monitoring wells were installed at two prominent spill locations, one at the site of the fuel tank yard and the other located at the former power plant where the day tank once stood. Bedrock deep below these areas became contaminated with this fuel, as it tends to freeze and crack upon its uppermost layer. This creates openings for the spilled fuel and other contaminants to seep deeper into the ground, making removal very difficult. Initially, tubes were inserted into parts of the bedrock and the diesel was trapped in the tubes as they were lifted out. Vacuum systems were also installed to collect diesel floating at surface levels. Collecting all of the spilled diesel is increasingly difficult as it flows with the groundwater, so it only reaches the surface of the bedrock when the water levels are appropriate. As such, it can remain trapped for many years. Luckily, these types of spills typically stay locked into the cracks in the bedrock and do not contaminate other bodies of water. Long-term monitoring of this continues at Colomac Mine¹⁴.

At the time that the dam was abandoned in 1999, there remained an additional dam that contained contaminated water. However, this

1B was constructed along with a new pumping system in order to reduce the amount of tailings into other areas. A spillway and discharge channel were also constructed in order to let water flow naturally between tailings lakes, filtering it through a pathway that was strong enough to sustain heavy flood water pressure. Tailings caps were designed to cover the tailings areas in order to prevent wildlife such as caribou from interacting with it. These caps were made of unused rocks taken from piles of mine waste on the site, as well as more geotextile cover to prevent contaminant particles from rising through the rocks. These covers allow wildlife to traverse over the area safely while preventing contact with the harmful substances below. They were specifically designed to exclude vegetation as not to draw animals such as caribou near¹⁵.

Mill chemicals and waste oil left over from production were collected and sent for processing off site on an annual basis over the course of almost a decade. Only some of the hazardous materials were dealt with on site, such as waste oil which was burned

in incinerators. The mill, maintenance shop, housing infrastructure and warehouses/storage buildings were all dismantled and shipped around the country to be repurposed¹⁶.

Redevelopment & Community Engagement

The community engagement and collaboration for the remediation at Colomac Mine is an admirable one, with much care and thought put particularly into the land's use by the Tlicho tribe and the resources inherently tied to their way of life. The attainment of a social license was vital to the project, which entails the involvement of the community in all phases of the project - from start to finish¹⁷.

Indigenous knowledge was applied in the remediation of Colomac Mine, particularly in the construction of berms that would create a protective separation between the three open pits on the site and wildlife, hunters and trappers in the area. Through site visits and consultation with the Tlicho, details regarding caribou habits would be informative to the success of the barriers. For example, caribou typically do not attempt to cross a barrier which

they cannot see over, and would be reluctant to expend the energy it takes to risk physical harm to themselves scrambling upon loose rocks. Thus the piling of such waste rocks from the mine site would prevent any harmful interaction between caribou and the open pits¹⁸.

Considerable resources were also put into educating members of the Tlicho on direct maintenance and remediation techniques to ideally preserve sites like Colomac Mine in the future. The decommissioning of wells and various types of environmental monitoring were aspirations of these training programs to bolster the Tlicho Lands protection Section of the Tlicho government¹⁹.

Financing & Policy Framework

The financing of the Colomac Mine remediation involved multiple stakeholders and funding sources. This demonstrated collaborative governance is essential in Canada's northern mine remediation projects. Following Royal Oak Mines' bankruptcy, the Canadian federal government worked through Crown Indigenous Relations and Northern Affairs Canada (CIRNAC) to fund initial remediation phases under the Northern Contaminated Sites Program (NCSP). This ensured accountability for abandoned environmental liabilities²⁰. The policy framework guiding the project emphasized significant Indigenous involvement. In alignment with modern treaties such as the Tlicho Agreement, Indigenous communities such as the Tlicho Government actively participated in remediation efforts²¹. Indigenous businesses directly undertook key aspects of the cleanup and benefited local economies by building community capacity and demonstrating effective partnership models for remediation activities²². Nighthawk Gold Corp. currently holds mineral rights to the site of Colomac Mine and is responsible for all future financing and development. Nighthawk operates under a Decision-Making Framework (DMF). This is a structured 10-step process established by the Federal Contaminated Sites Action Plan (FCSAP), which guides federal remediation efforts. This also includes financial assurances, environmental accountability, and stakeholder engagement²³. It also requires comprehensive reclamation responsibilities and ongoing Indigenous community engagement.



Figure C: re-vegetation along shoreline in August 2010 - Source: <https://maps.canada.ca/journal/content-en.html?lang=en&appid=bf1c9c70b8d64fc1850e3da9434edf39&appid=800276ab7d5046d5a088238cac44d8d2&w=undefined&>

Through private investments, strategic partnerships, and regulatory compliance, Nighthawk aims to uphold financial and environmental accountability while actively involving the Tlicho Government in benefit-sharing and co-management processes²⁴.

Ultimately, the financing approach embodies a comprehensive commitment to Indigenous participation, responsible environmental stewardship, and sustainable economic growth²⁵.

Future of Colomac Mine

The future of Colomac Mine presents a model

for responsible redevelopment, building upon successful remediation efforts. Now part of Nighthawk Gold Corp's Indin Lake Gold Property, ongoing mineral exploration seeks to expand gold resources along with the potential for the site to reopen as a sustainable and economically viable mining operation.

Future development will continue under rigorous oversight from the Mackenzie Valley Land and Water Board (MVLWB). Central to the site's redevelopment is continuous collaboration with Indigenous partners, particularly the Tlicho Government. Their role in earlier remediation phases established foundations for active future participation in co-

management and benefit-sharing agreements. Guided by the DMF, Nighthawk must provide financial assurances and adhere strictly to reclamation obligations. They must also maintain transparent community engagement practices. This structured approach prevents environmental and financial risks, ensuring sustainable resource management and economic benefits for local communities. The evolution of Colomac Mine from a contaminated site to a responsibly managed mining opportunity provides a benchmark for sustainable development practices, highlighting successful collaboration, accountability, and Indigenous governance.



Figure D: Tlicho elders and government, along with Federal workers in October 2017 - Source: <https://maps.canada.ca/journal/content-en.html?lang=en&appid=bf1c9c70b8d64f-c1850e3da9434edf39&appidalt=800276ab7d5046d5a088238cac44d8d2&wbdisable=truev>

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