Canadian Brownfields Case Study

New Calumet Mine Remediation

Source: WSP Canada

Tailings ponds Area A, B and C fully remediated at the former New Calumet mine site. To the left is Area A, in the middle is Area B and in the far right corner is Area C. The Ottawa River can be seen behind the remediated site.

PROJECT SUMMARY

The New Calumet Gold Mine was remediated in 2018 and was the recipient of the 2019 Canadian Consulting Engineering Awards in the category of natural resources, mines, industry and energy. A project funded by the Quebec Ministry of Energy and Natural Resources' Reclamation of Abandoned Mining Sites Program, WSP was commissioned to execute the $15 million restoration. This remediation project relied heavily on the use of geosynthetic clay liners to reduce oxygen and water infiltration of contaminants in surface and groundwater. While the tailings were not found to be acid-generating, the high concentrations of lead and other toxic metals made the remediation of the site imperative. A wetland running through the site was preserved and expanded, and efforts were made to prevent further erosion of the shorelines present on the site. The site's dam was stabilized, and unstable pillars were demolished and crushed for backfill.

The New Calumet Mine property is located in L'Île-du-Grand-Calumet in the Outaouais region of Pontiac Regional County, in southwestern Quebec, with frontage on the Ottawa River. Zinc, lead, silver and gold were discovered at the site in 1893. Between 1942 and 1968, the "unknown giant of Canadian mining", Thayer Lindsley – founder of Ventures Limited - extracted 3.8 million tonnes of massive sulphide ore from the site, containing mostly zinc and lead with trace amounts of gold and silver. This operation generated three mine tailings storage areas totalling 22 hectares. The 109 hectare site was acquired by John MacLatchy in the late 1970s for recreational use. Lacana Mining Ltd. discovered significant gold mineralization on the property in 1986, when mining efforts recommenced but never materialized.

QUICK FACTS

Location
L'Île-du-Grand-Calumet, Quebec

Project type
Mine remediation

Site size
109 hectares

Land uses
Private, recreation

Keywords/special features
Gold mine, mine remediation, lead tailings, capillary barrier system, geosynthetic clay liner, wetland protection

Website
Restauration du site minier abandonné New Calumet

Project address
Duffyville, Quebec
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Case studies were prepared as a course assignment by students enrolled in PL8312/PLE845: Brownfields & Sustainable Development, School of Urban and Regional Planning, Ryerson University (Winter 2021). Information for the case studies was obtained from online sources, available reports, and, in some cases, site visits and direct communication with stakeholders.

If you are aware of any errors or updates to the case studies, please contact chris.desousa@ryerson.ca

Site Characteristics

Despite continued efforts to extract gold, the mine was partially decommissioned in the 1970s. The incomplete site closure left the mine with unstable infrastructure and uncovered and disused tailings, causing a risk to the local environment. The total volume of tailings present on the site was estimated at 1,300,000 m3 and the tailings covered an area of approximately 220,700 m2.

Initial assessments found erosion of surface residues and dust in surface waters and the surrounding environment; the three tailings ponds had acid generating potential and were considered leachable; surface water, groundwater and sediment had concentrations above the applicable standards for many metals; and dikes and pillars were found to be unstable. In 2013, the Ministry of Energy and Natural Resources (MERN) commissioned WSP Canada to begin the mine closure and remediation process.

Source: Heather Jaggard (2012)

Area B, the tallest waste pile on site, was leveled and moved to Area C during the early stages of remediation.

Contaminants & Cleanup Efforts

Over a 26 year period, approximately 2.5 million tonnes of tailings were deposited in the three tailings ponds on the site. The tailings were slightly alkaline due to the presence of carbonate-rich calcite in the host rock which acted as the primary acid neutralizer in the tailings. Despite the tailings at New Calumet not being acid-generating, they still posed environmental as well as public health and safety risks. Toxic minerals at the site included lead, cadmium, copper and nickel. Toxic by-products in the tailings and waste piles, especially lead, were of major concern because they could be ingested through airborne particles. Windblown dispersion, particularly from Area B, contaminated surfaces and watercourses.

In the 1950s, a dam that was built to contain the most low-lying tailings pond broke (Area A) and released an undisclosed amount of tailings into the Ottawa River. Fine tailings could be seen along the mouth of the creek on the property, which dumped into the Ottawa River. The owner of the property, John MacLatchy, made significant efforts to re-naturalize the site, repopulating certain areas with poplars, grasses, shrubs and herbaceous flowering plants. Parts of the site re-naturalized on its own with forest and marshland. Lead sampling in 2010 found that lead concentrations were 114 times higher than the Canadian Council for Ministers of the Environment (CCME) residential guidelines and 27 times higher than the CCME industrial guidelines for lead in soil. Testing also found that lead exceeded the Hazard Quotient (HQ) by 4.5 to 16 times, indicating a significant risk to human health.

Planning and Redevelopment

The municipality of Ile-du-Grand-Calumet was consulted about the remediation of the New Calumet Mine in June 2015. Representatives from WSP and MERN were present to address questions and concerns from the public. Residents expressed concerns about habitat loss for swallows at one of the tailings ponds which was resolved through an engineered nesting facility. Residents also expressed concerns about the public financing of the project. Representatives discussed the risks associated with the tailings and answered questions about remediation methods. WSP was still waiting on authorization from MERN to proceed with the restoration during the consultation period.

Once approved, the remediation of the site began with transferring some of the waste material from Area B - which was approximately 90 feet tall at

Area B nearing completion. The site has been levelled and geosynthetic clay liner is being backfilled with local silt.

Source: WSP Canada

its peak - to Area C. Both site's tailings were leveled in order to receive the geosynthetic clay liner. In order to cover the tailings and prevent windblown dispersion. Once the excess tailings were transferred from Area B to Area C, both tailings ponds were covered with geosynthetic clay liners (GCL) to block oxygen supply and the sites were backfilled with the materials to form a capillary barrier system.

Area A was fully saturated with water and required extensive care. A capillary barrier system was also installed to prevent tailings from infiltrating the creek and wetland running through it. Workers had to be very careful to preserve the natural vegetation and active fauna in this area. Since the wetland was acting as a natural filter and erosion barrier, WSP decided to expand it. The geosynthetic clay liner was secured to the new shoreline and riprap was integrated into the natural environment to further prevent erosion and stabilize the area.

Unstable pillars were taken down and rock material was added to the downstream slope of the creek to increase the stability of the dike. Once the GCL was laid, the sites were backfilled with silt, sand, gravel, repurposed crushed concrete, stone, other granular material and topsoil to support vegetation. There was no direct action plan implemented to address surface and groundwater contamination, however it was argued that remediation efforts would improve water quality. WSP's remediation plan for the exhausted mine employed members of the local workforce and purchased local aggregate materials.

Financing

The total cost of the project was approximately $15 million. The project was financed through a Reclamation of Abandoned Mining Sites program offered by the MERN in Quebec. Initiated in 2007, this program began by creating a database of exhausted mines in Quebec without a known or solvent owner. On March 31, 2017, the MERN allocated $1.2 billion for the remediation of these 459 sites. Since 2006, the MERN has invested $157 million in the reclamation of abandoned or troubled mining sites. The program also includes a restoration work plan with environmental guidelines that must be met by the contractor.

Challenges & Lessons Learned

While this remediation project was fairly straightforward, WSP did encounter some challenges along the way. An effective capillary barrier requires the first layer of backfill to be an impermeable material. In the absence of a silt deposit on site, WSP used drones to locate a silt deposit 10 kilometres from the site and used that material for the first layer of backfill. This was done in collaboration with seven adjacent property owners. The capillary break layer on top of the silt is comprised of sand and gravel which acts as an additional protective barrier.

The excavation, transport and placement of the silt required for Area A had to be completed in dry conditions which was very difficult given that Area A was completely saturated. Sloped areas presented unique challenges for the transportation of materials and grading of the backfill. Dump trucks equipped with conveyor belts mechanically spread the backfill material over large areas. Area A, being the most ecologically sensitive tailings pond, had already significantly re-naturalized since the mine was decommissioned. In order to preserve the newly re-established vegetation - which also acts as buffer preventing further erosion - WSP expanded the existing swamp and brought the capillary barrier up to the shoreline. They also installed riprap along the shoreline to prevent further erosion.

Current State

As of March 10, 2021, Sphinx Resources (TSVZ:SFX), who have over 200 mining claims in the region, released an official statement that they are buying 100% interest in the former New Calumet mine. The release states that they are purchasing the property "from a pair of prospectors" for 7.5 million common shares of Sphinx and a 1% net smelter return.

Sphinx claims it will consolidate its databank for the properties and a drill program will commence. Sphinx has said it will test the targeted sites for precious metals as well as zinc and copper.

Source: WSP Canada

Area A during remediation. The creek and marshland running through the site were protected due to natural filtration and buffering qualities. GCL was brought as close to the shoreline as possible where riprap was installed to prevent any further erosion of this ecologically sensitive area.

Endnotes

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