

# Gahcho Kué Diamond Mine

2018 Canadian Consulting Engineering Awards

**HATCH**



*De Beers Canada set out to build the largest new diamond mine in the world since 2003. Gahcho Kué, located in Canada's remote Northwest Territories, was delivered two months ahead of schedule, within budget.*

A complete greenfield installation, the project had to overcome extreme cold temperatures and logistical challenges, including road access by a 420-kilometre winter ice road only available for two months of the year. Hatch managed the full EPCM contract for project implementation.



Figure 1 Gahcho Kué site.



# Project highlights

## Complexity

Gahcho Kué is a remote northern Canadian mine that lacks local and regional infrastructure, such as permanent roads and utilities. It required extensive infrastructure to sustain project operations, including power generation, sewage and water treatment, personnel accommodation, storage facilities for materials delivered on the winter ice road, and an aerodrome to provide year-round cargo, food, and passenger aircraft access.

Located 280 kilometres northeast of Yellowknife, Gahcho Kué was a complex project that required designs for extreme conditions and a rigid schedule for equipment and bulk deliveries. Key factors were:

- The remoteness of the site, with only winter ice road access for two months each year.
- The extremely cold climate, with temperatures frequently below -40°C.
- The compressed engineering schedule for shipping equipment and material on the winter ice road.
- The difficulty obtaining environmental permits in an Arctic environment, including fish out, lake dewatering, and dyke construction.
- The challenge of obtaining adequate numbers of qualified and competent trades personnel to work in the cold northern climate.

The project organization consisted of: project management, project controls, engineering, procurement, construction, and commissioning groups. All participated in project planning and the development of a project execution plan based on using one main general contractor and a schedule that gave due consideration to the limited time span when major equipment and material could be transported to the site.

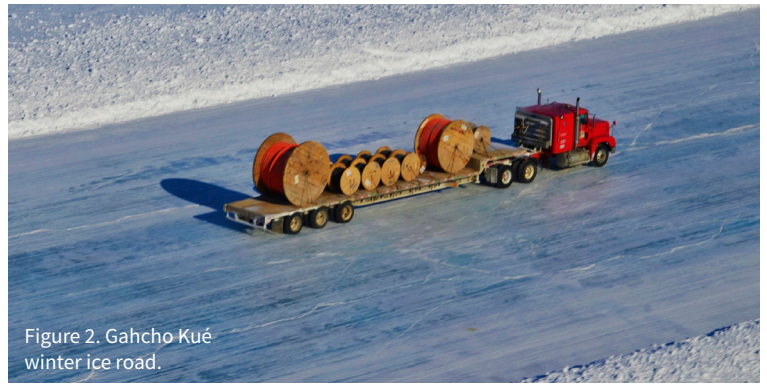


Figure 2. Gahcho Kué winter ice road.

The procurement and engineering efforts were focused on awarding purchase orders for supply and fabrication so that goods could be delivered on the annual winter road. In all, the project managed to transport 2,500 truckloads of material and equipment in 2015. This meant a dedicated construction team could successfully enclose the process plant structure by October 2015 to allow indoor work to continue during the winter months.

The Gahcho Kué site is a remote northern Canadian mining operation that lacks local and regional infrastructure.

A rigorous change management process was imperative to overcome the challenges encountered, including:

- Delayed water license leading to change of construction sequencing.
- Reorganizing the construction contract strategy when the single general contractor elected not to continue after months of planning.
- Modifying the process-plant foundation design and resequencing the construction work when ground conditions were found to be different than survey results.
- Extreme winter weather conditions for the plant's structural and mechanical design. The design of primary crushing and conveying circuit in an open environment required special attention during design and plant ramp-up.

Despite these challenges, the project was completed two months early and on budget.



Figure 3 a). Process plant building, August 2015.



Figure 3 b). Process plant building, September 2015.



Figure 8. Aerial of Gahcho Kué site, June 2014.

## Meeting Client's Needs

The Gahcho Kué Diamond Mine project was a resounding success, exceeding the expectations of De Beers Canada. The project was completed two months ahead of schedule, despite the challenging location and climate. Gahcho Kué achieved major successes, including safety and health achievements, early production ramp up, positive economic impact on the Canadian and local economy, and employment opportunities for the North.

The Gahcho Kué Diamond Mine exceeded the operating capacity during the first year of operations.



Figure 7. Gahcho Kué Grand Opening event.

The project's success further demonstrated to global peers and the world's diamond businesses that De Beers can successfully deliver a project in a challenging environment. Other project highlights include:



Winner of the **Project Management Institute's Project of the Year Award in 2016** (Montreal) and one of three finalists for the Global Project of the Year Award in 2017.



**Awarded the Viola R. MacMillan Award** by the Prospectors and Developers Association of Canada (PDAC) in 2017.



Awarded the **2016 Workplace Health and Safety Award** from the Yellowknife Chamber of Commerce.



## Environmental Benefits

A significant step in the Gahcho Kué project development was the finalization of the over-arching environmental agreement known as Ni Hadi Xi (Chipewyan for “Watching the Land”) Agreement with aboriginal parties in the Northwest Territories. This unique environmental monitoring and management agreement was co-signed by De Beers and the indigenous stakeholders of the Gahcho Kué mine.

The Ni Hadi Xi agreement provides a clear vehicle for building positive working relationships between all parties through represented forums. These forums are regularly scheduled to monitor and manage the mine’s interaction with the land.

An annual cycle of stakeholder engagement specific to environment and management-related concerns was used. It included, but was not limited to, the following activities:

- Quarterly meetings with designated staff of each indigenous party: IBA committee meetings, Tlicho Government Kwe Beh Working Group, Ni Hadi Xa, Yellowknives Dene First Nation Lands and Environment Committee.

- Spring community visits by De Beers staff.
- Summer visits by stakeholder representatives.
- Workshops on emerging issues.
- Ad hoc engagement, such as conference calls, meetings, community events, conferences, and government or aboriginal-led working groups, etc.
- Local environmental monitor.
- Local Mines and Land Inspector visits.

De Beers has a full-time environmental monitor on-site who represents the Ni Hadi Xa monitoring committee. The monitor reports directly to the committee and ensures that the company meets the environmental requirements. The placement of this environmental monitor is essential to maintaining trust and positive long-term relationships with local communities.

Figure 9. Spur Road, Gahcho Kué.





Figure 10. Process plant at Gahcho Kué.

Figure 11. Access to Gahcho Kué was possible via the winter ice road.



## Innovation

Gahcho Kué's project design was based on open-pit mining and construction of on-site processing facilities and infrastructure to support a mill-feed throughput rate of 3.0 million t/year over the twelve-year life of the mine. Hatch designed and developed the processing plant, infrastructure, services, and all supporting facilities to accommodate 600 personnel at the peak of construction during the Arctic summer in mid-2015, and prepared for continuous operation thereafter, with about 300 full-time employees per rotation at the fly-in/fly-out remote work site.

Engineering used lean board principles to accommodate the tight engineering schedule caused by the short ice road delivery window in February and March. Additionally, the group used innovative electronic data transfer methods with suppliers, reducing the time lag, improving efficiency, and increasing quality. Engineering development was based on engineered data with updates, as required, when certified data was received. 3D modelling was used with a construction simulation tool to optimize the construction sequencing. A state of the art material management system was applied to follow the material from engineering through construction. Close collaboration with the construction team during detail engineering resulted in the maximized use of modular designs.

One of the project's key success factors was the early production ramp up due to world class engineering development that led to quicker construction, and reduced rework and complications during start-up. The project commenced with production ramp up two months early, which allowed the mine to surpass its business plan by approximately 350,000cts, thereby exceeding the 2016 carat budget by 60%.





Figure 12. YKDFN representative signs the impact and benefits agreement.

## Social and Economic Benefits

The Gahcho Kué success story is the result of collaboration by multiple stakeholders: the client joint venture (De Beers Canada and Mountain Province Diamonds), the EPCM firms (Hatch, JDS, EBA, ADP), the Government of Northwest Territories (NTW), and six indigenous communities (Tlicho Government, Yellowknives Dene First Nation, Łutsel K'e Dene First Nation, North Slave Métis Alliance, Deninu Kué First Nation, and Northwest Territory Métis Nation). The project had a major impact on the local and regional communities and the Government of the Northwest Territories. De Beers emphasized maximum employment of local and regional community members.

The separate impact and benefits agreements (IBAs) signed with each of the six indigenous communities established positive relationships. Commitments in the areas of employment, training, business opportunities, and financial considerations were negotiated for the mine development.

The benefits to all project stakeholders were measured by the Socio-Economic Impact Report: De Beers Canada prepared by Ernst & Young LLP in September 2016:

- The project's contribution to the Canadian economy up until June 2016 exceeded CAD\$790 million.
- The direct economic contribution to the Northwest Territories (NWT) exceeded CAD\$440 million.
- Specific payments to NWT's government in the form of permits totaled CAD\$20 million.
- CAD\$4M was contributed to local indigenous community partners in the form of impact and benefit agreements (IBAs).
- The project's economic benefits to NWT and Canada are projected to be CAD\$5.7 billion and CAD\$6.7 billion, respectively, during the twelve-year mine life.

Ni Hadi Xi agreement provided a clear vehicle for building positive working relationships between all parties.

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