

April 30, 2020

Canadian Consulting Engineer Magazine  
111 Gordon Baker Road, Suite 400  
Toronto, Ontario  
M3H 3R1

**Attention: Mr. Peter Saunders**

Dear Mr. Saunders:

**Re: Award Submission  
ACEC Canada 2020**

The Hamlet of Kugaaruk (formerly known as Pelly Bay) is situated in Canada's high arctic, located on the Simpson Peninsula with a current population of approximately 930 people. There is one school in the community that provides Kindergarten to Grade 12 education.

The RFP for the design-build project identified that:

*"The community of Kugaaruk is in urgent need of a new High School replacement after a recent fire (March 1, 2017) incident eliminated the existing Kugaardjuq School building. The new building, with an approximate GFA of 3,854 m<sup>2</sup>, will accommodate up to 450 students in Kindergarten to Grade 12.*

*A Design-Build procurement process, rather than a traditional Design-Bid-Build, will be utilized to ensure the fastest possible project completion."*

Kugaaruk is located South of a collection of small islands at the South end of the Gulf of Boothia in Pelly Bay. The predominant winds from the North tend to blow the pack ice into the bay making it extremely difficult for the barge to access the Hamlet.

The school that was destroyed by fire was the only school in the Hamlet. The repercussions of the fire were that there was no school for all children in the Hamlet. The school also served as a gathering location for the entire community, often hosting community feasts, weddings, local sporting events,



Figure 1 - Map of Nunavut



Figure 2 - Map of Pelly Bay (Courtesy Google)

and providing a place for games and recreation on evenings and weekends. The loss of the school was a major blow to the entire community.

The impact of the community due to the loss of the school was immeasurable. Over 325 students in the community had no place to go to school. The community's only fire truck responded to the blaze, with all 30-firefighters battling for over 20-hours in temperatures as low as  $-35^{\circ}\text{C}$  with a 45-kph wind. The fire fighters were no match for the fire. The nearby power station and associated bulk fuel tanks were considered in jeopardy due to the closeness of the fire. The investigation determined that the cause of the fire was arson.



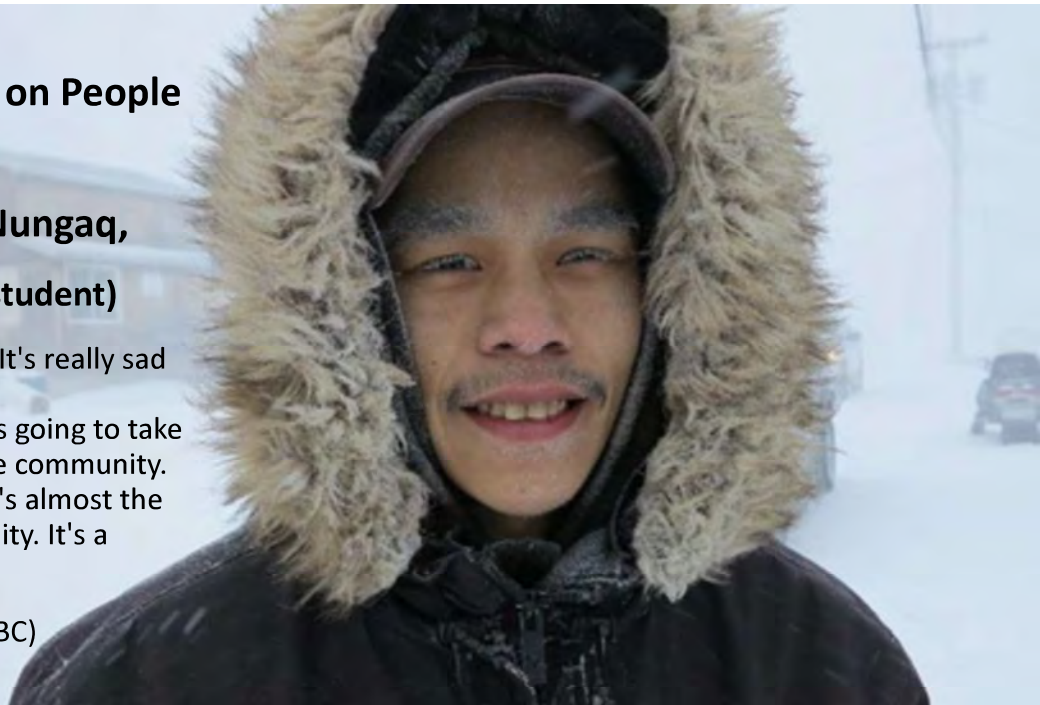
Immediately after the fire, the Territorial Government chartered a plane to Kugaaruk and met with the entire community including students, teachers, parents, and the Hamlet council to discuss the next steps. Plans were immediately put in place for temporary classrooms and for a replacement school. The community was involved throughout the entire planning and rebuilding process.

## **The Impact on People**

**Pauloosie Nungaq,  
(a Grade 10 student)**

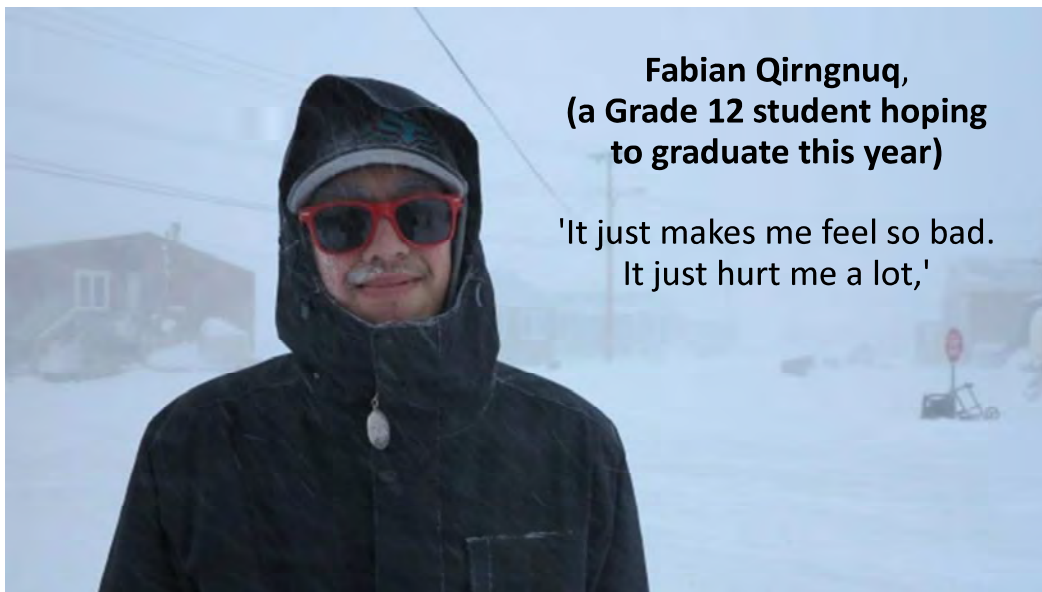
"It's really sad. It's really sad for the whole community...It's going to take time to heal the community. It's a big loss. It's almost the whole community. It's a school."

(Mitch Wiles/CBC)



**Fabian Qirngnuq,  
(a Grade 12 student hoping  
to graduate this year)**

'It just makes me feel so bad.  
It just hurt me a lot,'



**Principal Jerry Maciuk**

'Every effort is being made to make sure that our potential eight or nine graduates from Grade 12 this year, we will make them graduate... we cannot give up easily.'

(Mitch Wiles/CBC)



The Request for a Design-Build Proposal was originally issued on March 31, 2017 with a closing date of May 12, 2017. The project was awarded on June 15, 2017 to the Design-Build Team of Kudlik Construction Ltd., with Accutech Engineering Inc. as the lead consultant. The completion date for the finished building required in the contract was August 31, 2019; in time for the 2019/20 school year.

Constructing a +/-4,600-m<sup>2</sup> building in Nunavut on a fast-track basis is extremely challenging primarily due to logistics of materials, equipment and manpower. All construction equipment and materials must be brought into the community on the single annual sealift. Kugaaruk is especially challenging due to its geographic location. All people must be flown to site and accommodation and food must be provided for the construction staff due to a lack of available local lodging. All lodging, kitchen, washrooms, laundry facilities, etc. for the construction staff must be transported to site on the barge in 2017.

This size of project would typically take minimum three-years and likely four-years to complete. The design-build team had two years from date of award to building turn-over.

The risks accepted by the Design-Build Team (DBT) were numerous including items such as unpredictable weather conditions, flow of sea ice blocking the entry to Pelly Bay and Gulf of Boothia for the barges, ability of the Owner to respond to questions and review submissions within the timeframe required, ability of the DBT engineers and architects to produce the work required, and the quality/accuracy of the work, availability of labour and material necessary to construct and erect the entire building structure in a very condensed timeline, risk of geotechnical conditions inconsistent with the actual conditions, space available on the barge, design and fabrication accuracy of the structural steel, accuracy of the construction documents given the extremely condensed timeline, etc. Items missed or incorrectly identified result in air-freighting materials to

site which may not always be possible. Missing or incorrect materials can result in losing one full construction year.

Some of the major challenges to the project included:

- ***Timeline challenges:*** given the remoteness of this Nunavut community and short construction season, it was originally forecast to take three or four years to build a new school in Kugaaruk. The team needed to find a way to go from Design Build to occupancy in 24 months
- ***Maritime transport:*** with only one maritime transport per year departing mid August the challenge was to get the maximum amount of construction material onto the boat in less than 3 months for the first construction period. The sealift for the second construction period, between September 2018 and final building turn-over, had to contain all construction materials including Furniture, Fixtures and Equipment to turn over the finished school.
- ***Building in winter:*** given the harsh climate, the design requirements and restricted daylight the challenge was to develop a plan to allow for maximum productivity even during the coldest period.

The story of rebuilding the school in Kugaaruk has as much to do with the human story behind the project as it does the “bricks and mortar” of the construction process. The complete team delivered the school in record time, worked very hard and worked together, with everyone pulling towards a common goal for a community that suffered a tragic loss. The importance of the school in the remote Hamlet of Kugaaruk is difficult to understand for people from the south; the school is the only building where groups of children can play indoors together, where the community can celebrate and host feasts; the school is a critical infrastructure to the people of Kugaaruk.

## **Project Delivery**

The Owner’s primary requirement was achieving the schedule. The schedule provided maximum of three months to finalize the building design and envelope design, obtain approval from the Owner, their client group and the User Groups, design the structural steel, submit and review engineered shop drawings for the structural steel, fabricate the structural steel and deliver the structural steel for September 2017 delivery; in time for the only barge to Kugaaruk.

The Design-Build Team (DBT) completed the architectural design of the building shell and obtained approval of the Owner. This permitted the structural engineers to design the foundation and structural steel.

All designs were reviewed by the Hamlet, Government of Nunavut staff and their User Groups in time to meet the sealift schedule. Given the size of the project, this was a huge accomplishment.

The foundation materials, heavy equipment, and temporary worker camp were delivered to site on the first available barge. This permitted the foundations to be constructed prior to the arrival of the structure and provide a fully functional camp for the workers.

The foundation construction starting immediately on arrival of material. The structural steel for the entire building envelope was delivered to site on the last barge of 2017, with a Canadian Coast Guard ice breaker leading the way, due to the ice blocking the entry to Pelly Bay.



All material required to construct the foundation, steel structure, roof, underground mechanical and electrical works, and the complete building envelope arrived in late fall 2017. The structure and envelope needed to be complete prior to the arrival of the first 2018 barge.

Given the extremely tight timelines and unpredictable weather, the Design-Builder developed risk mitigation strategies to deliver the material to site.

An early winter in 2017 caused the job to shut down early with the structural steel only partially erected causing a three-month construction delay.

The constructor returned to site in early April to clear the snow and worked to complete the structural steel. The building envelope started immediately. The constructor implemented measures in 2018 to regain the lost time.



The envelope was completed mid-2018. All materials for the interior of the school, including all mechanical and electrical equipment, arrived on the barges in 2018. All material to finish the school was on site by the end of 2018 as the completion date was prior to the first barge of 2019.

The DBT produced a state-of-the-art energy efficient school with extremely high-quality materials and workmanship on time and on budget. The school provided is non-combustible construction. No part of the building envelope within reach from grade is combustible.



## **Energy Efficiency Construction and Operation**

All heating and electricity in Kugaaruk are provided by diesel fuel. One of the byproducts of burning diesel to generate heat or electricity is green-house gases. One objective of the project was to reduce total energy consumptions and cost within the school. Electricity costs in 2020 are approximately 116-cents per kW-hr in Kugaaruk compared to approximately 9-cents per kW-hr in Winnipeg, Manitoba.

The new school provided a highly energy-efficient building envelope and associated building systems. As part of the project, Accutech Engineering Inc. completed energy models for the new school. Based on the models provided, we estimated that the new school will use approximately 50% less total energy than a typical Nunavut school of the same size. This significant decrease was accomplished by:

- Implementing a highly efficient building envelope with high effective thermal resistance values and virtually zero air infiltration through the envelope.
- Implementing computerized building management system with energy efficiency programmed operation, while maintaining security of heat and building environment.
- Use high-efficiency boilers that can easily be maintained by the local maintainers.
- Provide conditioning of the power supply to the entire building to minimize spikes and surges and thus the potential to damage sensitive electrical controls.
- Use energy efficient mechanical systems and selective use of Variable Frequency Drives on motors.
- Thoroughly commission and monitor the performance of the mechanical and electrical systems in the school prior to occupancy. Continue to monitor and fine-tune the operation of the systems through the warranty period to maintain the energy goals and building conditions.

By the continuous monitoring and fine-tuning the controls, the design team was able to confirm proper operation of the systems, security of the building environment, and achieve energy targets.

## **Meeting the needs of the Community**

The Owner of the project had three main goals:

- Expedited delivery of the project.
- Completion on a fixed budget.
- Meaningful community engagement.

Accutech was able to achieve all these goals through the development and implementation of a phased and iterative design approach. This method of time and resource management required the creation of multiple critical path streams that allowed for continual progress to be made throughout design and construction.

Specifically, the on-time delivery of the project was enabled by including all stakeholders in the design and fabrication phase of the project. By working directly with the builder, manufacturers

and suppliers, the Design Team was able to create an appropriate and efficient design capable of being fabricated, shipped and assembled within the timeline.

Accutech and Kudlik Construction were able to fix and maintain the project budget through the implementation of this same iterative communication approach. Consistent communication between Engineer, Builder, and Owner allowed the team to keep the construction quality high while keeping the project overall on budget.

As a key stakeholder, the community was engaged frequently throughout the project to inform on many aspects of the design. Several key community components were included within the project. This includes custom exterior artwork featuring a Bowhead Whale and Hunter with a Kakivak (fish spear), the “Skin Room”, and a custom monument to the former school that was built with stone re-purposed from the original school building.

Throughout the construction, the team of architects and engineers completed regular inspections to confirm adherence to the design and the quality requirements were met or exceeded. The mechanical and electrical system were thoroughly commissioning prior to turnover.

The school achieved substantial completion on August 15, 2019 at the completion of a 30-day testing period. The project was delivered on time, on budget and to a very high quality of design and construction.

<b>Contacts</b>		<b>Telephone Number</b>
Owner	Government of Nunavut Mr. Eiryn Devereaux	(867) 975-5374
Design Builder	Kudlik Construction Ltd. Mr. Rene Deziel, P.Eng. Mr. Rob Hellstrom	(867) 979-1166
Design Consultants	Accutech Engineering Inc. Mr. Brent Wall, P.Eng.	(204) 944-1555
	Parkin Architects Ltd. Mr. Robert Boraks, RAIC, OAA	(613) 739-7700



The story of rebuilding the school in Kugaaruk has as much to do with the human story behind the project as it does the “bricks and mortar” of the construction process. The complete team who delivered the school in record time worked very hard and worked together, with everyone pulling towards a common goal of delivering a new school to a community that suffered a tragic loss. The importance of the school in the remote Hamlet of Kugaaruk is difficult to understand for people from the south; the school is the only building where groups children can play indoors together, where the community can celebrate and host feasts; the school is a critical infrastructure to the people of Kugaaruk.

This size of project would typically take minimum three-years and likely four-years to complete. The design-build team had two years from date of award to building turn-over. This team delivered the school that the people of Kugaaruk wanted, that was extremely high-quality and energy efficient in record time.

Yours truly,

**ACCUTECH ENGINEERING INC.**

Brent Wall, P.Eng.  
President & CEO