TUKTUUUYAQTUUQ
Road raising erosion mitigation project

By Esther Lambert
THE SCIENCE

Road raising may be part of an adaptation and resilience strategy in response to sea-level rise and coastal erosion for coastal communities across the country. Climate- and environment-related factors posing a threat to coastal communities include an increase in the duration of open-water season from June to September and May to October/November over the past 20 years. This has been attributed to higher temperatures over longer seasonal durations, resulting in coastline exposure to a higher frequency of storm surges and increased coastal erosion. Road raising, coupled with other regular, costly and logistically challenging maintenance of gravel roads and highways that are close to the coastline, may form part of a coastal erosion protection approach.

THE TRIGGER

Located on the shores of the Arctic Ocean east of the Mackenzie Delta, Tuktuuyaqtuuq is an Inuvialuit Hamlet with a population of approximately 1,026 (2017) and accessible via the Inuvik Tuktuuyaqtuuq Highway completed in 2017. Warmer temperatures have led to a doubling in the frequency of summer storms during open-water season from one to two per summer to three to four, combined with a change in the level of storm surge from 1.7 to 1.9 m. As such, the rate of erosion has increased from 1.8 to 2.5 m per year. Increased erosion has exposed the permafrost, leading to increased extent and depth of degradation, which undermines houses and roads located adjacent to the shoreline. Community consultations also brought to light these effects on the community and the huge economic impact of rehabilitation.

Although no formal risk assessment was undertaken the Modelling for Coastal Erosion report, completed for the community in 2018-19, documented current impacts and provided scenarios for erosion and permafrost degradation over the next 30 years, taking future climate into consideration. Adding to the scientific rationale behind taking risk reduction action, more than 10 local studies were conducted by universities and federal government departments. These examined a range of issues from measuring and characterizing permafrost depth, distribution of erosion, and historical trends, which contributed to the scientific evidence required in funding applications. A key trigger was the availability of funding from the Government of Northwest Territories and the federal government (Disaster Mitigation and Adaptation Fund – DMAF) coupled with successful proposals that have secured $12 million for the road raising project.

THE APPROACH

The Hamlet held community consultations to discuss the results of the Erosion Modelling Study and application of its recommendations. The policies of the Disaster Mitigation and Adaptation Fund program guided eligibility, implementation, and use of funds. Scientific experts and the consultants that completed the Modelling for Coastal Erosion report attended these meetings. In addition to the road raising project, more than 15 houses have been moved in response to erosion near the shoreline, funded
in part by the Government of the Northwest Territories.

From a technical standpoint, Tuktuuyaqtuuq is using a riprap design to cover the sides of the elevated roadway, which virtually eliminates erosion and protects the permafrost. Ground insulation is used to prevent moisture propagation and to separate the permafrost foundation from the gravel cover.

The Hamlet is managing to implement this project, but not without challenges. For example, road raising requires the installation of much larger (36 to 48 inch) culverts that require road transport (air transport is prohibitive) via the Yukon using ice roads on sections of the route that are available for a limited time. Hence, the timing of intended works is critical for materials supply and must inform planning. Planning and construction must consider longer timeframes for supply of materials and labour since the construction season is limited.

As with other northern communities, the Hamlet does not have engineers or planners on staff, so there is a reliance on other levels of government and consultants to provide guidance and funding for engineering and planning services. Furthermore, only two to three firms provide erosion mitigation services, hence impacting schedule and costs. The cost of travel and accommodation for trades people who must be flown in for a short construction season (two to three months) each year means that

Figure 15: Tuktuuyaqtuuq is using a riprap design to cover the sides of the elevated roadway. (Source: Adobe Stock Photo)
high productivity during the construction period is crucial to ensure progress and completion of projects. The COVID-19 pandemic has resulted in an added layer of complexity as contractors are not as available as before. Overcoming these issues has required extensive logistics, supply, and personnel planning over multiple years and a commitment to include the community in decision-making.

THE OUTCOME

The road raising project is ongoing. About a third of the funding has been spent ($4 million out of $12 million total) to date. Improvement in road performance has been achieved and, in combination with diligent maintenance and related response to climate-related events, is helping to assure the continued viability of the roadway and its vital contribution to the community in its present location from the current and projected threat of sea-level rise and storm surges. In addition, there are now reduced maintenance and repair costs for the completed sections of the elevated road through reduced erosion and lower occurrence of other processes such as frost heave and pothole formation.

Local residents have greater awareness and support for the necessity of the adaptation measures and there has been strong collaboration with territorial and federal government departments for funding, staff, and expertise (both science- and engineering-related). Additionally, there is now a wider recognition of the challenges of implementing adaptation, including longer timelines, increased costs, and logistical challenges, which have helped to convince funding agencies to relax timelines and flow of funding from original plans.

A WORD FROM TUKTUUYAQTUUQ

Amidst the growing social and economic challenges faced by northern communities – challenges made increasingly more difficult by the COVID-19 pandemic and the changing climate – Shawn Stuckey, Senior Administrative Officer for Tuktuuyaqtuuq, believes that indigenous communities can still secure some success in protecting their infrastructure against climate change. He recommended a three-pronged approach that consists of securing funding, sourcing the right expertise, and ensuring planning that includes public engagement. He urged communities to seek scientific expertise and experience from fellow northern communities, territorial and federal government departments, especially Natural Resources Canada and the National Research Council, stating that this advice can often be obtained at no direct cost. He also encouraged, “Engaging university research programs to understand the science behind the problems now and those expected with future climate change and securing funding from federal programs such as the DMAF.”