NIRB Application for Screening #125047

Iqaluit Airport - Approach Lighting Replacement

Application Type:	New
Project Type:	Infrastructure
Application Date:	1/18/2017 10:53:39 PM
Period of Operation:	From 2017-07-01 to 2017-03-31
Proposed Authorization:	From 2017-01-01 to 2017-03-31
Project proponent:	John Hawkins Government of Nunavut Box 1000, Station 720 Iqaluit Nunavut X0A 0H0 Canada Tel: 867 975-7771, fax: 867 979-6985

DETAILS

Non-technical project proposal description

English: Iqaluit is the business and government centre for the Baffin region and the capital of Nunavut. The Iqaluit International Airport serves as the only catchment for 11 Qikiqtaaluk region communities, and is the only conduit between these communities and the rest of Canada. The Iqaluit International Airport Improvement project is being undertaken as a P3 project and includes: a new airport building, expanded aprons for aircraft to park, new lighting systems, an upgraded runway, and a new combined services building that will house the fire-fighting vehicles, support equipment and heavy equipment. The current non-standard runway approach lighting system is nearly 30 years old and has reached the end of its expected lifespan. The existing approach lighting system is difficult to maintain for much of the year due to access restrictions and does not comply with the existing standards for approach lighting systems. Its length was shortened due to its proximity to Koojesse Inlet and extends only 273.5 m instead of the prescribed 720 m. Therefore, to comply with the current standards, the approach lighting system must be extended by 450 m to the south-east into Koojesse Inlet. This extension incorporates the same number of steady burning lights as the system it is replacing. The vertical alignment, intensity and beam focus of the new steady burning lights are unchanged from the existing system although the system is elongated by 450 m. The only other change from the existing system is that the two (2) simultaneously flashing strobes at the threshold end are replaced with five (5) sequenced strobes at the outer end. Since approximately 80% of aircraft movements at the Iqaluit International Airport rely on instrument approaches, simply removing the existing approach lighting system would have a negative impact on aviation safety. Additionally, there are limited alternate airports to which to divert due to weather. Four (4) approach lighting configuration options were considered and presented to Transport Canada in 2012: Option 1 – Compliant approach lighting configuration (extending into Frobisher Bay) with no changes to runway; Option 2 – Compliant approach lighting configuration and displacement of the runway (by 447.3 m); Option 3 – Non-compliant lighting configuration and modification of airport usability (420 m in length); Option 4 – Non-compliant lighting configuration and modification of airport usability (540 m in length). Option 2 was rejected since it would have significant operational impacts. While options 3 and 4 were not dismissed by Transport Canada, changes would need to be made to the level of service. This would likely be unacceptable to stakeholders and would reduce airport usability. Therefore, option 1 was found to be the preferred alternative as it meets the regulatory requirements and does not impact the current airport operations. To extend the lighting structure into Koojesse Inlet, a breakwater (consisting of rubble) must be built. The rubble will be provided by the local quarry and trucks will haul the material to the site. In total, 12 lighting bars are needed to comply with standards (3 on-land and 9 on the new breakwater). The existing lighting bars will be replaced by new ones. To access the construction site, the existing sewage lagoon road will be extended. The project will be realized over a two (2) year period with effective work being conducted from July to November. The construction activities will employ about 20 individuals for its duration.

French: Not available

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Personnel

Personnel on site: 20
Days on site: 186
Total Person days: 3720
Period of operation: from 2017-07-01 to 2018-10-31
Proposed term of operation: from 2017-01-01 to 2017-03-31

ACTIVITIES

Project Activities

Location	Activity Type	Land Status	Site History	Site Archaeological or Palentological Value	Proximity to the nearest communities and any protected areas
Airport Lighting Infrastructure	Offshore Infrastructure (port, break water, dock)	Marine	Koojeese Inlet, used for navigation.	Not applicable	in Iqaluit
Airport Lighting Infrastructure	Access Road	Crown	Already used for existing approach lighting infrastrcutre.	Not applicable	in Iqaluit

Community Involvement and Regional Benefits

Community	Name	Organization	Date Contacted
Information is not available			

AUTHORIZATIONS

Project Locations

South Baffin

Project Authorization

Authorizing Agency	Authorization Description	Current Status	Date Issued / Applied	Expiry Date
Transport Canada	Funding for airport lighting replacement	Applied, Decision Pending		

MATERIAL USE

Equipment to be used (including drills, pumps, aircraft, vehicles etc.)

Equipment Type	Quantity	Size - Dimensions	Proposed Use
see type 2 form	0	see type 2 form	see type 2 form

Detail Fuel and Hazardous Material Use

Fuel / Material	Type	Number of Containers	Container Capacity	Total Amount	Units	Proposed Use
Diesel	fuel	1	1	1	Liters	see type 2 form
see type 2 form	hazardous	1	1	1	Liters	see type 2 form

Project Water Consumption

Daily Amount (m3)	Proposed Water Retrieval Methods	Proposed Water Retrieval Location
0	see type 2 form	see type 2 form

WASTE

Waste Management

Project Activity	Type of Waste	Projected Amount Generated	Method of Disposal	Additional Treatment Procedures
Offshore Infrastructure (port, break water, dock)	Other,	0	see type 2 form	see type 2 form

Environmental Impacts

see type 2 form

DETAILS PART 2

Project General Information

Iqaluit is the business and government centre for the Baffin region and the capital of Nunavut. Located on the southern portion of Baffin Island on Koojesse Inlet, Iqaluit is the largest community in Nunavut and the gateway to the Arctic from Eastern Canada. The Iqaluit International Airport serves as the only catchment for 11 Qikiqtaaluk region communities (over 120,000 passengers annually), and is the only conduit between these communities and the rest of Canada. The population of these communities totals approximately 18,000. The Iqaluit International Airport Improvement project is being undertaken as a P3 project and includes: a new airport building, expanded aprons for aircraft to park, new lighting systems, an upgraded runway, and a new combined services building that will house the fire-fighting vehicles, support equipment and heavy equipment. The current non-standard runway approach lighting system is nearly 30 years old and has reached the end of its expected lifespan. The existing approach lighting system is difficult to maintain for much of the year due to access restrictions and does not comply with the existing standards for approach lighting systems (TP312E 4th Edition). Its length was shortened due to its proximity to Koojesse Inlet and extends only 273.5 m instead of the prescribed 720 m. Therefore, to comply with the current standards, the approach lighting system must be extended by 450 m to the south-east into Koojesse Inlet (located in Frobisher Bay). This extension incorporates the same number of steady burning lights as the system it is replacing. The vertical alignment, intensity and beam focus of the new steady burning lights are unchanged from the existing system although the system is elongated by 450 m. The only other change from the existing system is that the two (2) simultaneously flashing strobes at the threshold end are replaced with five (5) sequenced strobes at the outer end. As approximately 80% of aircraft movements at the Iqaluit International Airport rely on instrument approaches, simply removing the existing approach lighting system would have a negative impact on aviation safety. Additionally, there are limited alternate airports to which to divert due to weather. Four (4) approach lighting configuration options were considered and presented to Transport Canada in 2012: Option 1 – Compliant approach lighting configuration (extending into Frobisher Bay) with no changes to runway; Option 2 – Compliant approach lighting configuration and displacement of the runway (by 447.3 m); Option 3 – Non-compliant lighting configuration and modification of airport usability (420 m in length); Option 4 – Non-compliant lighting configuration and modification of airport usability (540 m in length). Option 2 was rejected since it would have significant operational impacts. While options 3 and 4 were not dismissed by Transport Canada, changes would need to be made to the level of service. This would likely be unacceptable to stakeholders and would reduce airport usability in poor weather conditions (low visibility, low ceiling height or in cross wind conditions). Option 1 was found to be the preferred alternative as it meets the regulatory requirements and does not impact with the current airport operations. Once it was decided that the approach lighting structure would extend into Koojesse Inlet, engineering studies were completed to choose the best support structure. Two (2) functional requirements were identified: a year-round access for a boom-lift to perform maintenance operations at the lighting equipment and a structure that would be very stable as the lighting systems have a very low tolerance to movement. The rubble mound breakwater, which consists of constructing a pier with granular material, was deemed the best option as it offers the required stability. Lighting support structures and an access road for maintenance will be located on top of the breakwater, while electrical conduits will be installed below its surface. This breakwater will facilitate approach light tower installation and maintenance operations. The crest surface of the breakwater will provide an access route for maintenance vehicles and will be accessible by the existing road located to the east of the sewage lagoon. The preliminary design of the breakwater was based on environmental data provided in recent studies of water level, wave and ice conditions. Preliminary technical drawings are provided in Appendix B, including a plan, profile and typical cross-sections of the rubble mound. The drawings are based on detailed topographic and hydrographic surveys that were conducted in July 2015. Twelve (12) light fixtures are projected. Bars 34-1 through 34-3 (refer to Appendix B) are located above extreme high-tide level. These bars will be installed on insulated infrastructure and will be accessible by land, on either side of Akilliq Drive, at all times. Bars 34-4 through 34-12 will be installed, within the intertidal zone, on the breakwater, also above the extreme high-tide level. The lights are aimed towards the sky and partly shielded, when one is off 45 degrees from their center, they are barely visible. Depending on their positions the lights are either stroboscopic (Bars 34-7 to 34-12) with a very distinct flashing sequence or steady burning (Bars 34-1 to 34-6). The lights are turned on when a plane commences final approach for the runway and are left on for about 20 minutes. Site photos, illustrating the current non-standard lighting system and general project area, can be found in Appendix C. The project will be realized over a two (2) year period with effective work being conducted from July to November. The construction activities will employ about 20 individuals for its duration.

DFO Operational Statement of Conformity

Not applicable

Transportation

As indicated previously, Map 2-1 locates the project and its components. The access road that will lead to the construction area is positioned. Additionally, the quarry from which the rubble will be supplied can also be found on Map 2-2. At this point in time, it is anticipated that more than 200,000 t of material will need to be brought to the construction site. Depending on the rock truck's capacity and the project as currently scheduled, this could represent about 90 trips per workday between the months of July and November, in the first year, and 90 trips per day in July and August of the second year. This includes the fill material that would be needed to build the access road.

Camp Site

Not applicable

Equipment

Rock trucks of about 20 t capacity and large track excavators will be used. The rock trucks will haul the material between the quarry and the construction site while the excavators will position it along the access road and breakwater.

Water

The access road leading to the work areas will be watered down in dry periods to minimize dust emissions. Methods of the City of Iqaluit for water retrieval will be complied with (supply and location).

Waste Water (Grey water, Sewage, Other)

Apart from sewage waste associated with the presence of portable toilets on-site for the workers (most likely 2), there will be no generation of wastewater.

Fuel

Fuelling operations will be restricted to a designated area. The designated area will be at a minimum of 30 m from any waterbody. Fuelling operations will be monitored and carried out in compliance with the appropriate environmental standards. Also, construction equipment will be maintained in compliance with the manufacturer's recommendations. All spills will be reported to the appropriate environmental authorities and actions will be taken immediately to remediate the spill. At this stage of the project, it is unknown where the fuelling will take place.

Chemical and Hazardous Material

No chemicals or hazardous materials shall be located on site. All oil changes for the machinery shall be done outside of the work areas.

Workforce and Human Resources / Socio-Economic Impacts

The value of the contract is about $14M. It would employ about 20 individuals on average, for 2 years between the months of July and November. The Government of Nunavut's issue and standard contract policy favours the local workforce in the awarding process. It is very likely the workers will be from Iqaluit and travel to the construction site by their own means.

Public Involvement / Traditional Knowledge

Given that the project area is located within the limits of the City of Iqaluit, the local population is the most likely to be affected. Marine users could be impacted by the presence of the breakwater. Local businesses will benefit due to the construction contract, while the local workforce will be employed and profit from it. As of now, three (3) federal agencies have been consulted with regards to the project. In 2012, the assessment of alternatives was submitted to Transport Canada (TC) for consideration. Following this review, the current project, as proposed, was developed. TC has indicated that further evaluation is needed, including consultations with stakeholders such as marine users. Consultations with Fisheries and Oceans Canada (DFO) were undertaken and will be pursued; however DFO's initial comments do not suggest that the project would result in adverse environmental effects. The Canadian Coast Guard (CCG) has issued some concerns with regards to the lighting sequence and its possible conflict with the existing beacons that guide the ships towards the channel. Discussions are ongoing with engineers and the CCG to address this concern. To continue with the consultation process, various sessions will be organized as part of the public involvement plan if an environmental impact statement is required. These sessions will confirm that the project does not impact traditional activities and integrates the local concerns, if any, into the design, the development of mitigation measures and/or monitoring. Key stakeholders, including the Amarok Hunters and Trappers Association, and community members will be met with.

SECTION A: Roads/Trails: Project Information

In order to reach the future breakwater site, the existing sewage lagoon road will be extended to the inter-tidal zone. This new road will be gated and not become public. Location of the access road can be found in Maps 2-1 and 2-2. It will be cleared of snow during the winter season and be under the responsibility of the Iqaluit airport. There are no water crossings; rock fill will be used to build this road. It is estimated that the access road and breakwater will be accessed once a month in order to perform Transport Canada's required maintenance and safety inspections of the approach lighting structure, and if need be, replace any dysfunctional equipment (e.g. change bulbs).

SECTION A: Roads/Trails: All-Weather Road/Access Trail

Refer to previous section

SECTION D: Offshore Infrastructure: Facility

The topographic and bathymetric data collected during field investigations are presented in section 0. A description of the water levels to be expected in Koojesse Inlet as well as its tidal processes is also provided. Furthermore, preliminary technical drawings are provided in Appendix B, including a plan, profile and typical cross-sections of the breakwater. To determine the stone sizes that would need to be used for constructing the proposed breakwater, the existing breakwater located in the eastern part of Koojesse Inlet was inspected by WSP in July 2015 (approximately 1 km away from the proposed study site). Following the field investigations and the wave hindcast study it was determined that 2 t armour stone would be needed to protect the structure from the elements. A geotechnical study is needed to assess if the lighting bars will need to be anchored separately from the breakwater to ensure their stability. All work areas are located within the Nunavut Settlement Area (area A). Additionally, the design follows Transport Canada's guidelines that identify a 100-yr useful residual life.

SECTION D: Offshore Infrastructure: Facility Construction

IQALUIT AIRPORT QUARRY The Iqaluit Airport quarry is currently extracting rock and granular material for the purposes of constructing the Iqaluit International Airport Improvement Project. The quarry is relatively close to the site (3 km), and is located east of the runway and north of the taxiway complex on Iqaluit International Airport land. The Nunavut Commissioner's Land Regulations do not apply to the Commissioner's Airport Lands Regulations and accordingly, airports do not require any permits for quarrying on their land provided that the aggregate material is to be used for airport use and purposes. The quarry activities and operations are currently run by Kudlik Construction Ltd. (Kudlik). A representative of the company was met in July 2015, and WSP viewed the quarry site, its operations, the type of aggregates produced and the testing that was done on the aggregates. During the quarry visit, two main rock formations were observed. The first rock formation is light grey pinkish granitoid. Very little fracture sets were observed. Most of the fractures were random and the rock quality is considered to be very good to excellent. The second rock formation is a dark grey granodiorite rock. Occasional veins of granitoid can be found within this formation. The contact planes between the veins and the main formation are generally disintegrating and are very weak. Aside from the veins, the formation is also of relatively good quality with little fracturing and no noticeable chemical alterations. Overall, with the exception of the vein areas, both rock formations could be potentially used in the construction of the rubble mound, since they show no signs of degradation or disintegration, and are structurally sound. According to the quarry representative, production of large boulder sizes can be readily accommodated. Although the rocks that will be used for the breakwater will come from the quarry, the operations linked to its site are not included in the project's scope. CONSTRUCTION As currently estimated, 209,300 t of stone will be needed to build the breakwater. Most of the material required will be for the breakwater's core (153,500 t). Filter stone will be added around the core (19,000 t) and finally armour stone will protect the breakwater from the elements (36,800 t). The weight of the various materials is as follows: blasted rock (from a few kilograms to 100 kg) (core), 200 kg (filter) and 2 t (armour). To build the breakwater, the finer material that is needed for the core will be extended into the bay. The surrounding filter and armour stones will be laid down as the workers advance. The breakwater could be built right away at the required elevation or could be laid down gradually by working above the tide levels. The construction methods will be developed in the detail design as well as methods for mitigating the release of suspended solids. Once the breakwater is completed, the lighting bars will be assembled along it. During construction, an engineer will be present on-site to ensure that all construction work is accomplished in compliance with best practices.

SECTION D: Offshore Infrastructure: Facility Operation

Refer to previous section

SECTION D: Offshore Infrastructure: Vessel Use in Offshore Infrastructure

Not applicable

SECTION H: Marine Based Activities: Disposal at Sea

Not applicable

Description of Existing Environment: Physical Environment

WIND DATA The recorded wind speed and directions from 1953 to 2014 at Iqaluit Airport are shown in Figure 2 2. Results show that prevailing winds are from the southeast (SE) and northwest (NW) directions with maximum speeds in the order of 100 to 110 km/h (Environment Canada, 2016). TOPOGRAPHIC AND BATHYMETRIC SURVEYS Topographic and bathymetric data were collected by WSP in July 2015, on-land in the vicinity of the proposed approach lighting structure and off-shore in Koojesse Inlet. Combining both field surveys, the Coastal Environment Study map in Appendix D shows the bathymetric contours in the vicinity of the project site. The water depth refers to the HHWMT (Higher High Water Mean Tide) which corresponds to an elevation of 9.73 m Chart Datum and an elevation of 3.75 m relative to the Canadian Geodetic Vertical Datum (CGVD). WATER LEVELS The mean daily water level time series (Figure 2 3) was extracted at Iqaluit station (#4140) from the Canadian Hydrographic Survey (CHS) for the period of 1963 to 1977. During this period, the station ran intermittently. Water level fluctuations are confined within a range of 12 m (macro tidal conditions) and indicate that the mean water level is around 6.0 m above chart datum (CD). The maximum water level was recorded on November 21, 1964, with a value of 12.09 m (CD). Tidal information published by the CHS (2014) at Iqaluit station #4140 is provided in Table 2-1. The height reference system to the mean sea level (MSL) refers to the CGVD. A tidal harmonic analysis was undertaken based on the 1964, 1976, and 1977 tidal observations to reconstruct the hourly tidal predictions and provide estimation of storm surges at high water level in Iqaluit. This analysis confirmed that maximum water levels in Iqaluit are dominated by extreme high tides with a slight influence induced by storm surges under low barometric systems. Hatcher (2014) reached a similar conclusion that there are no significant storm surges in the Iqaluit area. ICE COVER The ice regime near the future breakwater in

Koojesse Inlet can be generally divided into three periods: freeze-up; mid-winter; and break-up. Freeze-up extends until about the end of December. The ice is thin and mobile during freeze-up. Horizontal ice movements occur due to winds and tidal flows. As well, vertical ice motions occur regularly in response to tides. The ice thickness generally does not exceed about 0.5 m during the freeze-up period. Mid-winter is considered to extend from about early-January to mid-to-late June. A stable ice sheet forms and the ice thickens due to thermal growth. The maximum annual ice thicknesses in the area were found to be 1.99, 2.03, and 2.05 m for 25-year, 50-year, and 100-year return periods respectively. Horizontal ice movements are not expected to occur. Vertical movements occur steadily in response to tides although the breakwater will be shielded from them due to the fact that it is in the intertidal zone. Thus, the mid-winter period is not considered to be hazardous to the causeway for ice encroachment or for the stability of the armour stones. Break-up generally occurs in July, although the break-up period is preceded by ice decay in May and June when the snow cover is removed, causing melting to occur. Ice decay typically starts at the shoreline as this area is the first to warm up, in response to solar radiation. As break-up progresses, the nearshore area becomes ice-free while sheet ice is still present offshore. Ice floes may drift into the intertidal area where the breakwater will be located. Later on, the ice in the intertidal zone, in the vicinity of the planned breakwater, is broken up, and consists of thick, but small, ice pieces. These ice pieces may be alternately floated and grounded as the tide comes in and goes out respectively. During the break-up period, the breakwater may be subjected to ice movements, in either the horizontal or vertical directions; however the armour stone will protect its integrity (G. Comfort Ice Engineering Ltd, 2015). Figure 2-4 and Figure 2-5 show ice blocks in the intertidal zone. WAVE CLIMATE OFFSHORE WAVE CLIMATE A wave hindcast model was used to generate an offshore wave climate, since no wave measurement data was available over a long period of time near the project's location. The wave climate data was derived from the wind measurements at the Iqaluit airport meteorological station and computed at a point representative of offshore wave exposure with maximal fetches in all directions. Offshore wave hindcast data at Iqaluit estimated a maximum significant wave height in the order of 4 m, with an extreme value of 4.2 m as observed in the early 60's. The wave height frequency distribution is summarized in Figure 2-6 (WSP, 2015). The extreme wave height was calculated based on a standard Extreme Value Analysis (EVA). The results are provided only for the incoming wave directions from ESE to SW, which correspond to the angles were maximal wave height would be expected (Table 2-2). NEARSHORE WAVE CLIMATE As the deep water waves propagate to the shore, various physical phenomena transform the waves as they interact with the seabed. To transform the offshore conditions near the proposed breakwater, a numerical model was used to obtain the conditions at its tip. The following physical processes are verified: Refraction and shoaling due to depth variations; Dissipation due to wave breaking; Dissipation due to bottom friction; Dissipation due to white-capping; Wave reflection on coastal structures. Input conditions to the model consisted of specific combinations of wave height, wave period and water level that represent design and overload storm scenarios that support the design of the proposed structure. To simulate worst-case situations, all wind directions were inputted to be from the SE. The modelling results confirm that a maximum wave height of 1.2 m is found at the tip of the proposed breakwater which is sufficient to ensure that the lighting structure will be above the water level intrusion (see Appendix D) (WSP, 2015). HYDROLOGY AIRPORT – CARNEY CREEK Airport – Carney Creek outflows through the urban waterfront of Iqaluit and meets the tidal flats in the same vicinity as the proposed new approach lighting structure (Figures 2-7 and 2-9). During the July 2015 site visit, a brief investigation of the river hydrology and hydraulics indicated that the waterway passes through the urban development of Iqaluit and is heavily altered and disturbed by human activities (Figure 2-8) (WSP, 2015). SOIL AND SEDIMENT CONDITIONS The proposed land-based lighting structure and its breakwater's footprints were examined during low tide periods by WSP (2015). The visit took place in July 2015. The description corresponds to the locations identified in Figure 2-9. TERRESTRIAL ZONE This zone is located between points 1 to 2. Point 1 is at the eastern extent of the current runway, and point 2 is at the approximate limit of the high-water level. The current lighting system is in this zone, which is about 230 m in length. The topography gradually slopes from points 1 to 2, with occasional steeper sections. Akilliq Drive crosses this section close to point 1, while a petroleum pipeline crosses the section parallel to the road, approximately in the middle between points 1 and 2. The surficial soil in this section mostly consists of loose gravelly sand, with a thin vegetation cover. Some erosion is evident in the steeper sections of the slope, while there is more dense vegetation in the less sloped areas. To the east side of this zone, soils become silty and gravelly sands, generally loose. The last 30 m of the zone to the east is more gravelly and blocky and more compact. At point 2, a rock outcrop is present. ROCK OUTCROP For a section of about 50 m from point 2 to point 3, a rock outcrop is present on the south side. The outcrop is elevated towards the south and dips below the surficial soils to the north towards the river. Some large detached boulders are also present in this section resting on the sandy surficial soils. Bedrock is slightly altered on the surface but some breaks show the rock is of granitic origins and is not altered below the surface. TIDAL ZONE WEST OF AIRPORT CREEK For a distance of about 150 m between points 3 and 5, the surficial soil mostly consists of silty and sandy sediments, along with large boulders that are erratically deposited on the surface. In addition to the ice blocks that were present on the surface during the investigation, occasional ice lens were present on the surface and lightly covered by the silty and sandy material. The soils are occasionally very loose, but overall seemed to be compact. CREEK CROSSING ZONE The proposed breakwater crosses the airport creek diagonally between points 5 and 6 for a distance of about 50 m. In that section, the stream is relatively shallow, the deepest point being about 0.3 m. The deposits in this area are mainly sand and gravel with some boulders. Immediately to the east of the stream between points 6 and 7 for about 30 m, the surface deposits consist mostly of very loose gravel and pebbles. TIDAL ZONE EAST OF AIRPORT CREEK To the east of point 7, towards point 8 for a distance of about 150 m, the surface can be described as silty with some sand, pebbles and occasional boulders. The soil is relatively compact. For about 80 m between points 8 and 9, a slightly higher surface elevation is observed that consists of a sandier soil along with a higher percentage of pebbles and boulders. At point 10, 60 m further to the east, a number of boulders are sitting on the surface, which could be a remnant of an ancient breakwater. These boulders can potentially be an obstacle to navigation when the tides are receding. The underlying surficial materials appear to be similar as described above. NIGHT LIGHT The day-night cycle varies throughout the year based on the season. In the summer, there is nearly 24h of daylight, while winter brings only 4h of sunlight per day.

Description of Existing Environment: Biological Environment

TERRESTRIAL VEGETATION According to the Circumpolar Arctic Vegetation Map (CAVM, 2003), the study area is located in the nontussock sedge, dwarf-shrub, and moss tundra. The study area includes zones of upper and lower littoral as well as dry rocky tundra, wet prairies, and ponds. These plant communities are dominated by sedges, grasses, and dwarf-willows. Usually, these communities have similar plant species composition, but species are present in different proportions, depending on drainage and water saturation. Snow beds are potentially present. They are generally located downwind in areas where topography favours the accumulation of snow. The plant community that colonizes this area is distinct and needs the snow cover's protection. The following species were identified during a field visit in July 2015: Papaver labradoricum, the Dwarf Fireweed (Chamerion latifolium), Seaside-sandwort (Honckenya peploides), Silverweed (Potentilla anserine), Arctic campion (Silene involucrata), Sea thrift (Armeria maritima subsp. Sibirica), and Field horsetail (Equisetum arvense). Species from the following genera were also present: Carex sp., Poa sp., Oxytropis sp., Pedicularis sp., Salix sp., Eriophorum sp., Ranunculus sp., Eriophorum sp., Stellaria sp., and Cerastium sp. MARINE VEGETATION This type of vegetation can be more or less dense, depending on the tides and the topography of the seabed. The number of observed taxa will vary according to the same criteria, although many other factors can come into play (e.g. sunshine, temperature, salinity). The study area is characterized by the low quantities of vegetation; only some algae is present. TERRESTRIAL MAMMALS Some species of land mammals are likely to be observed in the study area. Among these, one can identify the Ungava lemming (Dicrostonyx hudsonius), meadow voles (Microtus pennsylvanicus), Arctic fox (Alopex lagopus), caribou (Rangifer tarandus), Arctic hare (Lepus arcticus), stoat (Mustela erminea) and polar bears (Ursus maritimus). The polar bear has been identified by the COSEWIC as a species of special concern. In the local study area it is likely that only small mammals will be present. AVIFAUNA Several species are potentially present in the study area, including some species of waterfowl, birds of prey, so-called terrestrial species and waders. Among these include the peregrine falcon (Falco peregrinus), the golden eagle (Aquila chrysaetos), gyrfalcon (Falco rusticolus), Canada goose (Branta canadensis), the red-necked phalarope (Phalaropus lobatus) Common eider (Somateria mollissima), the American robin (Turdus migratorius), Lapland longspur (Calcarius lapponicus), Savannah sparrow (Passerculus sandwichensis), the horned lark (Eremophila alpestris), the tundra swan (Cygnus columbianus) and the raven (Corvus corax). The regional study area includes confirmed nesting areas for the peregrine falcon and gyrfalcon. The peregrine falcon is a species of special concern in Canada. There are no bird colonies in the vicinity of the work that will be undertaken. A raven was seen during a field visit in July 2015. ICHTYOFAUNA Among the potentially present species, Arctic char (Salvelinus alpinus), Greenland cod (Gadus ogac), Arctic cod (Boreogadus saida), sculpins (Cottoidea) and sticklebacks (Gasterosteidae) are the species most likely to be found in the bay. Frobisher Bay is an area where Arctic char is abundant. The tidal zone is characterized by a large mud flat, with little vegetation. For these species, the low abundance of shelter and the predominance of mud make this habitat better for foraging than reproduction or nursing. MARINE MAMMALS About a dozen marine mammal species are likely to be found in the extended study area, some of which are of interest because of their abundance, status and/or their use by the Inuit people. These are the beluga (Delphinapterus leucas), minke whale (Balaenoptera acutorostrata), ringed seal (Pusa hispida), harp seal (Pagophilus groenlandicus), bearded seal (Erignathus barbatus) and the bowhead whale (Balaena mysticetus). Nevertheless the western part of Frobisher Bay is not included in the Ecologically and Biologically Significant Areas (EBSAs) of the Canadian Arctic according to Fisheries and Oceans Canada. This does not mean that marine mammals do not use the regional study area from time to time during the year. However, the documents consulted do not report any seal haul out sites or marine mammal concentration zones. It is very unlikely that these species are present near the project's construction site. 2015 .

Description of Existing Environment: Socioeconomic Environment

CITY OF IQALUIT The project area is located in the city of Iqaluit. Iqaluit is the most populated community in Nunavut; in 2011 it was home to more than 6,699 individuals. It occupies an area of about 52 km2. It also boasts the highest population of Inuits (3,900) of all Canadian cities over 5,000 people. English and Inuktitut are commonly spoken; 92% of people speak English but only 45% identify it as their mother tongue. Inuktitut is the mother tongue of about 46% of its residents. The average age of residents is 30 years with 1.4 children per family on average. There are 2,930 housing units within the city with an average of 2.8 individuals per household. The average income of residents is $60,688. As for general infrastructure, there are six (6) schools, one (1) post-secondary education institution, five (5) daycares, one (1) hospital and three (3) gas stations. A quarry is also open in the city and is operated by Kudlik Construction Ltd. There are also eight (8) different places where to lodge. The city also houses the Legislative Assembly of Nunavut, it being the capital of Nunavut. There is a wide range of services offered in the capital city; it is the location of many northern head offices for many businesses and organizations. There are about 450 registered service and retail businesses in the city. LANDSCAPE The zone in which the lighting structure would be installed is within Koojesse Inlet near the downtown area. Views on the approach lighting system are likely to filter to the Downtown, Lower Base and Lower Iqaluit sectors. The local study area is relatively flat while topography increases gradually towards the northeast (downtown Iqaluit) and towards the northwest limiting views within the Inlet and directing them outwards towards the Bay. ARCHAEOLOGICAL AND CULTURALLY SIGNIFICANT SITES There are two parks located in the near vicinity of the city: Sylvia Grinnell Territorial Park and Qaummaarviit Territorial Park. The first is readily accessible, only a 30-minute walk (2 km) from the city, while the latter is located 12 km away. As for other culturally significant sites, the community of Apex is known to be more traditional than the larger city (4.5 km). It is important to note that the "Road to Nowhere" is a popular spot amongst campers as it travels through the tundra and many lakes can be viewed from it (3 km away). There is currently no information available on the archaeological potential in the areas where construction work would be undertaken. LANDUSE The city of Iqaluit is located in Koojesse Inlet and the Iqaluit International Airport right at its tip. One of the two main industrial sectors is found alongside the airport's infrastructure. In this zone, a pit and a quarry are in operation as well as industrial buildings associated with the airport's operations. The second industrial zone is located to the West of the downtown area, leading away from the city along Akilliq Drive. It is in this sector that the projected deep-water port is likely to be built. Closer to the city, four (4) large and eight (8) smaller reservoirs are found; a pipeline leaves the tank farm to supply the city. This pipeline crosses the projected construction area before making its way downtown. There is also an electrical distribution line that is located alongside the pipeline in the vicinity of the work area. The commercial and administrative activities are located in the heart of the Downtown area where the Legislative Assembly of Nunavut, the Iqaluit City Hall, Nunavut Arctic College, the RCMP, the governmental services and the main lodging/restaurant accommodations are found. The residential sectors are generally to the south-east of this downtown area located along the coast. A second smaller residential sector is found in Apex, located 4.5 km away to the east from the Downtown core. Iqaluit is the region's access point for individuals travelling to other communities on Baffin Island and it is therefore quite active with tourists. The city offers a variety of activities for its visitors from culture, art, to wilderness adventures. It also is home to the Nunatta Sunakkutaangit Museum which hosts Inuit artifacts, interpretive displays and art. Local artists hold kiosks inside the Museum and visitors can readily purchase items. From Koojesse Inlet, many outfitters offer marine adventures, from fishing trips, kayaking to whale and bird watching. Expeditions can also be arranged into the interior of the island for trekking, snowshoeing, northern light viewings, snowmobiling, ATV renting, skiing, dog sledding and hunting.

Identification of Impacts and Proposed Mitigation Measures

Table 2-3 identifies the main environmental impacts associated with the construction and operation of the approach lighting infrastructure. As mentioned previously, the approach lighting for the Iqaluit airport will need to be replaced. In order to do so, an access road will be built from the existing sewage lagoon road, which itself connects to Akilliq Drive, and extended to reach the site of the future breakwater. The land will need to be cleared and backfilled to meet the required road safety standards. Once the access road is completed, the breakwater will be built from the land by extending it into Koojesse Inlet with rubble provided by the Iqaluit quarry. Of the twelve (12) bars of approach lights, three (3) are currently on land and will be replaced. The remaining nine (9) will be located on the breakwater. The main permanent impacts of the construction phase include: the permanent loss of vegetation due to the access road's footprint and the first section of the breakwater which will begin on land; the local change to the bathymetry due to the addition of the breakwater, and; the presence of the breakwater which represents a potential obstacle for local navigation. All of these impacts are considered to be of low importance. Most of the other construction impacts on ground stability, water/soil/sediment quality, air quality, noise disturbance, terrestrial and aquatic fauna and on archaeological and cultural components can be easily controlled through general mitigation measures normally included in the tender documents, such as for: Ground stability: Limit the slopes steepness. Avoid machinery and vehicle circulation over unstable areas. Protect exposed soil surfaces in steep unstable areas to avoid initiating erosion. Restore vegetation cover of exposed areas as soon as work is completed. Water/soil/sediment quality: Keep machinery in good working order. Ensure that maintenance or refuelling is done over impervious surfaces and at least 60 m from the water. Protect the pipeline along the construction area to prevent accidents. Maintain spill prevention and recuperation material at the worksite, at all time. Air quality and noise disturbance: Keep machinery in good working order. Limit dust emission by spraying water on the work surface and at excavation sites during dry periods. Limit work, as much as possible, to day work hours (7AM to 7PM). At the moment, no known sensitive fauna and/or archaeological and cultural components are present at the work site, which would require general or specific mitigation. However, if such sensitive components are eventually identified mitigation measures will be developed at the execution phase. A Spill Prevention Plan will be elaborated by the contractor that is awarded the construction work for this project. The main components of a Spill Prevention Plan include: General information (company details, date of issue, date of last revision, distribution list, objectives and content, copy of the company's environmental policy, project and site information, product list of items that will be present on the site, preventive measures in place, etc.); Incident communication structure (flowchart); Action plan (possible impacts, proposed actions, etc.); Inventory of resources for interventions (on and off-site); Employee training register. Positive impacts will also occur, through the creation of local employment and through the improvement of the airport's security and accessibility in poor weather conditions. At the operation phase, the main impacts are associated with the maintenance requirements, the presence of the breakwater and the presence of the approach lighting system. For maintenance requirements, impacts will be essentially associated with access road maintenance which will require snow removal and occasional grading. The same mitigatable impacts will occur in operation due to machinery circulation and spill risks (to sediment, soil and water quality). Appendix E presents the pertinent sections of the airport's Emergency Response Plan that outline, amongst others, the appropriate actions in the event of spills. The breakwater will present a small modification to local landscape and a new component to be considered by local residents when boating in the area. The effect on landscape cannot be mitigated but it is not considered important. The effects on navigation include necessitating passage over an underwater obstacle (a residual section of an abandoned breakwater located to the east of the new breakwater) in order to reach the current sealift landing beach. This underwater obstacle could be removed in the course of the project, which would improve navigation in the area and limit the effect of the new structure. The operation of the approach lighting system could possibly interact with a navigation beacon of the CCG. This concern was identified in the consultations held with the federal governmental agencies. Discussions are underway to verify if boats entering the channel could misinterpret the airport lights for navigation beacons. In this scenario, a technical solution will be developed in cooperation with Coast Guards Canada. There are no transboundary and human health effects associated with this project.

Cumulative Effects

At this point in time, there are no significant negative impacts expected with the project's realization. However, this will need to be validated with the marine users in the area. Consequently, no cumulative effect study will be conducted.

IMPACTS

TABLE 1 - IDENTIFICATION OF ENVIRONMENTAL IMPACTS

CONSTRUCTION																									
Access Road		-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-		-	-	-	-	-
OPERATION																									
-		-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-		-	-	-	-	-
DECOMMISSIONING																									
-		-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-		-	-	-	-	-

(P = Positive, N = Negative and non-mitigatable, M = Negative and mitigatable, U = Unknown)