

Arctic Fibre Submarine Cable System

**Project Description / Project Proposal
Plain Language Summary**



Arctic Fibre Inc.

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215 – 55 Wyndham Street North, Guelph, ON, N1H 7T8

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Project Description / Project Proposal Plain Language Summary

Prepared by:

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Project Number:

60297623

Date:

October, 2013

1. Introduction

Arctic Fibre Inc. (Arctic Fibre) has applied to Industry Canada for a submarine cable landing licence(s) under provisions of the *Telecommunications Act*, 1993. In accordance with the *International Submarine Cable Licences Regulations* and due the locations of the cable route and landing sites, this application will be subject to various Environmental Assessment (EA) regimes across Canada. As such, Arctic Fibre is submitting a Project Description/ Project Proposal to fulfill the EA information requirements of several Canadian jurisdictions and initiate the regulatory review of the Arctic Fibre Submarine Cable System Project (the Project) in a co-ordinated manner.

The plain language summary provides an overview of the information contained in the main Project Description / Project Proposal document. This main document is organized as follows;

1. *Section 1* provides an introduction to the Project, including its need and purpose, preliminary project schedule, the EA regimes applicable to the project, major licenses, approvals and permits, along with a discussion of anticipated project benefits;
2. *Section 2* provides a preliminary Project Description including the location and description of the Project infrastructure.
3. *Section 3* describes the Project works and activities that will be conducted during Project implementation.
4. *Section 4* describes the stakeholder engagement activities undertaken by Arctic Fibre and how community input and traditional knowledge was used in Project planning.
5. *Section 5* describes the existing environmental conditions for the areas likely affected by the Project. It considers the marine, terrestrial and socio-economic environments.
6. *Section 6* identifies and describes the potential positive and adverse effects of the Project and the mitigation measures to be applied by Arctic Fibre to avoid and minimize adverse effects.
7. *Section 7* considers cumulative and transboundary effects;
8. *Section 8* examines the effects of the environment on the Project and presents relevant risk and effects mitigation measures;
9. *Section 9* discusses potential accidents and malfunctions and present relevant risk and effects mitigation measures.
10. *Section 10* identifies the types of Environmental Management Plans to be developed for use during Project implementation.
11. *Section 11* provides Arctic Fibre's determination of the significance of the identified residual adverse effects of the Project (taking into account the identified mitigation measures);
12. *Section 12* provides Arctic Fibre's conclusions;
13. *Section 13* provides a list of references and acronyms.
14. *Appendices* provides the requisite Nunavut Impact Review Board Forms 1 and 2; a conformity table to Industry Canada and Public Works and Government Services Canada's information requirements; Arctic Fibre's Landing Site Feasibility Review and the August 2012 Community Visit Questions and Arctic Fibre Responses.

Please refer to the main Project Description / Project Proposal document for more detailed information regarding the Arctic Fibre Submarine Cable System Project.

1.1 General Description of the Project

Fibre optic is a modern telecommunications technology that allows tremendous amounts of digital information to be sent optically over long distances at very fast speeds (i.e., at the speed of light). Because of its immense capacity, low latency (speed), and reliability, fibre optic technology is the technology of choice for more than 98% of intercontinental telecommunications traffic. The Arctic Fibre Project will connect Tokyo, Montreal, New York, and London through its cable laid through the Northwest Passage and related terrestrial links. In its initial phase, the cable will provide bandwidth to a large (52%) portion of Nunavut's population and will also have landing sites in Nunavik and northern Quebec. Fibre optic technology is considered extremely safe. It is effectively inert or benign, such that there is negligible effect or adverse impact from the fibre optic cable on land or within the sea.

The Project involves the construction, operation, maintenance, decommissioning and abandonment of a cable system that transmits optical signals. It is comprised of submarine infrastructure, terrestrial crossing and cable landing infrastructure. This includes the optical fibres and cable, powered repeaters, line terminating equipment, power feeding equipment, and monitoring equipment.

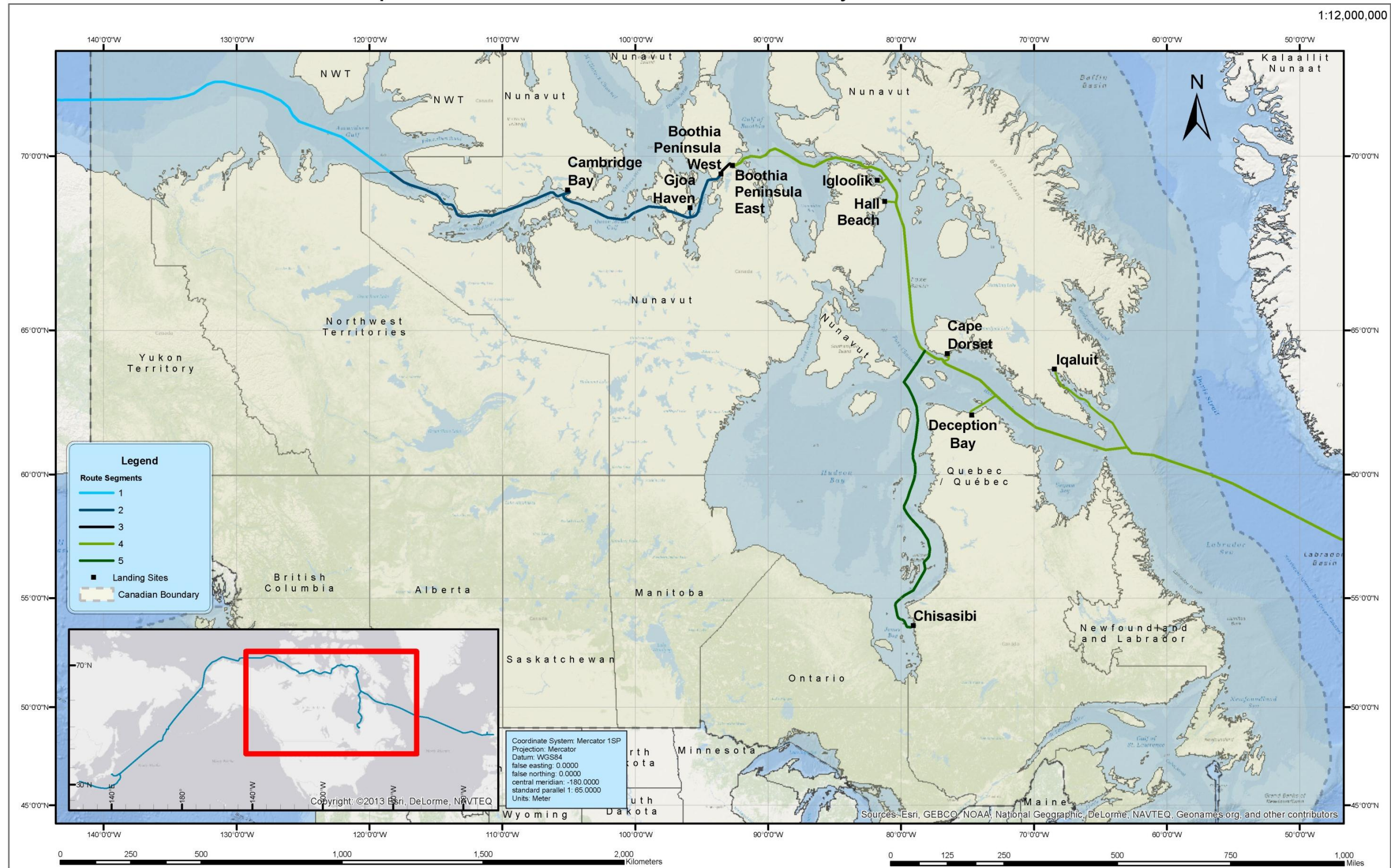
The route within Canadian territorial waters is shown on **Map 1** and has been divided into five segments as follows:

- **Segment 1 (Inuvialuit Settlement Region)** traverses the Beaufort Sea from the Canada-United States boundary up to the Northwest Territories (NWT) / Nunavut boundary. This segment is 1,168.9 km in length.
- **Segment 2 (western Nunavut – Coronation Gulf Segment)** traverses the western portion of the Northwest Passage from the NWT / Nunavut boundary up to the Boothia Peninsula West (Taloyoak) landing. This segment is 1,473.6 km in length.
- **Segment 3 (Boothia Peninsula Crossing)** links the landing at Boothia Peninsula West (Taloyoak) landing with the Boothia Peninsula East landing site (Felix Harbour) via the “Terrestrial Route”. This segment is 51.3 km in length.
- **Segment 4 (eastern Nunavut – Foxe Basin and Hudson Strait)** stretches from the Boothia Peninsula East landing site (Felix Harbour) to the limits of Canadian waters in the east, including a segment into Iqaluit. This segment is 2,507.5 km in length.
- **Segment 5 (Foxe Channel, Hudson Bay and James Bay)** is a spur southwards from the Cape Dorset branching unit (BU), through Hudson's Bay to the Chisasibi, Quebec landing site on the eastern shore of James Bay. This segment is 1,142.7 km in length.

At the present time, cable landings are proposed at the following locations: Cambridge Bay, Gjoa Haven, Boothia Peninsula West (Taloyoak), Boothia Peninsula East (Felix Harbour), Igloodik, Hall Beach, Cape Dorset, and Iqaluit in Nunavut, at Deception Bay (Nunavik) and near Fort George (west of Chisasibi), Quebec. The main cable or system 'Backbone', plus these landing sites are included in Phase 1 of the Project.

Later phases (Phase 2) may provide for expansion to communities on both the western and eastern shores of Hudson Bay, around Ungava Bay, as well as the eastern shore of Baffin Island. Some of these routes are contingent on external funding as they are not economic on their own. To this end, Arctic Fibre's marine infrastructure includes BUs along the main cable to allow connections to several other communities in Nunavut and Quebec. These connections and cable landings are not considered part of the current Project proposal and will require further assessment should Arctic Fibre decide to proceed with Phase 2.

Map 1. Arctic Fibre Submarine Cable System – Overview



1.2 Project Proponent

Arctic Fibre Inc. is the project proponent for the Project. It is an Ontario incorporation firm that manages two subsidiaries: Arctic Fibre Canada Inc., which is a federally-incorporated company owning the Canadian assets, and Arctic Fibre Bermuda to be incorporated to own international assets. The company's contact information is:

- **ARCTIC FIBRE INC.**
 3 Otter Crescent, Toronto, ON, M5N 2W1
 Phone:(416) 613-6263
 Fax:(905) 842-6966
 Email:doug@arcticfibre.com

The company's primary contact is:

- Douglas G. Cunningham
 Chief Executive Officer
ARCTIC FIBRE INC.
 3 Otter Crescent, Toronto, ON, M5N 2W1
 Phone:(416) 613-6263
 Fax:(905) 842-6966
 Email:doug@arcticfibre.com

Arctic Fibre is not an Internet Service Provider (ISP) and will not provide telecommunication services directly to end-users, except possibly to the governments and large mining companies or other developers. Arctic Fibre will operate as a wholesaler (i.e., a carriers' carrier) selling bandwidth on its fibre optic network to existing ISPs, cable television and telecommunications companies like NorthwestTel, SSI Micro (Qiniq) and Northern Co-Operative stores. These companies, if they choose to purchase fibre optic bandwidth from Arctic Fibre, will determine the services and speeds they will provide to their customers.

Arctic Fibre will be responsible for the ongoing technical management of the entire end-to-end network as well as all marketing and financial functions from offices located in Toronto, Ontario, Canada. In accordance with normal industry practice, certain network management functions at cable landing stations located in the United Kingdom and Japan will be outsourced to the operators of those cable landing stations. At various landing points and collocation facilities across Nunavut, technical functions will be outsourced to third parties.

From a subsea maintenance perspective Arctic Fibre will become members of international consortia in the Atlantic and Pacific for repair operations in international waters. The company will enter into private support arrangements with other Canadian-licensed vessel operators.

1.3 Need For and Purpose of the Project

Fibre optic technology has existed for over 50 years. It is proven technology which excels when large amounts of information have to be transmitted quickly. While at one time it would have not have been feasible to install fibre optic cables across the Arctic, the cost of installing a fibre optic network has come down over time, and with other developments (like the reduction in sea ice cover) this type of Project is now possible.

The Arctic Fibre network is being constructed to:

- Provide the lowest latency (i.e., lowest signal delay) route from Japan to the United Kingdom and northern Europe and competitive routes to the United States northeast.
- Displace costly and sometimes unreliable satellite service to the Canadian Arctic thereby bridging the digital divide between the Canadian Arctic and the rest of Canada. The Arctic Fibre network will also facilitate improved intra-regional communications in the North. A similar situation exists in Alaska.
- Provide opportunities to reduce governmental cost of providing distance health care, education, national security and justice administration in the Canadian North and Alaska.
- Create physically diverse routes to avoid physical cable breaks plaguing other carriers.
- Avoid potential interference to data crossing politically-unstable or monitored terrestrial routes.

1.4 Preliminary Schedule

The preliminary schedule for the Canadian portion of the Project is as follows:

- Submission of Project Description / Project Proposal Fall 2013
- Terrestrial Crossing Feasibility Verification Winter 2013 / Winter 2014
- Environmental Review and Approval Winter 2013 / Winter 2014
- Marine Route Survey Permitting Spring 2014
- Marine Route Survey Summer 2014
- Terrestrial / Archaeological Field Studies Spring / Summer 2014
- Environmental Permitting Summer / Fall 2014
- Mobilization Winter 2014 / Spring 2015
- Terrestrial Component Construction Winter 2014 / Spring 2015
- Marine Component Construction Summer 2015
- System Commissioning Fall 2015 / Winter 2016

1.5 Environmental Regimes Applicable to the Project

As noted above, this Project Description / Project Proposal is intended to fulfill the information requirements of several Canadian jurisdictions. It is intended to initiate the EA and regulatory review processes in a co-ordinated manner. This report is intended to meet the initial information requirements set out by:

- The Government of Canada in relation to its responsibilities under the Canadian *Environmental Assessment Act* (2012);
- The Nunavut Impact Review Board (NIRB) and the Nunavut Planning Commission (NPC) in relation to their responsibilities under the Nunavut Land Claims Agreement (NLCA);
- The Nunavik Marine Region Impact Review Board (NMRIRB) and the Nunavik Marine Region Planning Commission (NMRPC) in relation to their responsibilities under the Nunavik Inuit Land Claims Agreement for project proposals in the Nunavik Marine Region.

- Eeyou Marine Region and the Grand Council of the Crees (Eeyou Istchee) in relation to their responsibilities under the Eeyou Marine Region Agreement;
- The Environmental Impact Screening Committee (EISC) (in the Inuvialuit Settlement Region (ISR) of the NWT and the North Slope Region of the Yukon) in relation to its responsibilities under the Inuvialuit Final Agreement (IFA) and its enabling legislation the western Arctic (Inuvialuit) *Claims Settlement Act*; and
- The COMEV and/or COMEX and KEQC in relation to their responsibilities under the James Bay Northern Quebec Agreement and the Province of Quebec’s Environment Quality Act for projects located south of the 55th parallel and north of the 55th parallel (respectively).

Apart from EA approvals, **Table 1** provides a list of other approvals and permits that **may be required** for the Project to proceed. Because of the unique nature of this Project, there remains some uncertainty regarding the applicability of some approvals and permits. A final list of approvals and permits shall be confirmed in consultation with the relevant government agencies.

Table 1. Major Approvals and Permits

Approval / Permit	Agency	Primary Activity
Class “A” Land Use Permit	AANDC	Terrestrial Crossing of the Boothia Peninsula
Type “A” Water Licence	Nunavut Water Board (NWB)	Use of Water, Snow and Ice; Waste Disposal; Access Infrastructure and Operation for Camps; Drilling Operations; Spill Contingency Planning; Abandonment and Restoration Planning
Water Lot Lease	AANDC	Submarine Cable and Landing Site Approaches
Commercial Lease	Kitikmeot Inuit Association (KIA)	Terrestrial Crossing of the Boothia Peninsula
Fisheries Authorization	Fisheries and Oceans Canada (DFO)	Submarine Cable and Landing Site Approaches
Explosives Transportation Permit (if required)	Natural Resources Canada (NRCan)	Transport of Blasting Agents and Explosives for the Terrestrial Crossing of the Boothia Peninsula (if required)
Navigable Waters Permit	Transport Canada	Submarine Cable and Landing Site Approaches
Nunavut Archaeologist Permit	GN Department of Culture and Heritage	Submarine Cable, Landing Sites and Terrestrial Crossing of the Boothia Peninsula.
Research Permit	Nunavut Research Institute (NRI)	Marine Route Survey, Archaeological and Ecological Studies, and Post-Lay Burial Assessment
Commissioner’s Land Lease	GN Community and Government Services	Development within 100 ft. of Ordinary High Water Mark
Hamlet Development Permit	Hamlets	Beach Manhole (BMH) and Community Tie-ins
Hamlet Land Lease / Easement	Hamlets	BMH and Community Tie-ins
Airport Land Lease / Easement (Cambridge Bay)	To be determined	BMH and Community Tie-ins (Cambridge Bay)

Other approvals and permits may also be required in accordance with the following legislation should they be applicable to the project.

Table 2. Potentially Applicable Legislation

Potentially Applicable Legislation	Agency	Primary Activity
<i>Arctic Waters Pollution Prevention Act</i>	AANDC	Marine Vessel Use and Operations
<i>Territorial Land Act</i>	AANDC	Terrestrial Crossing of the Boothia Peninsula
<i>Canadian Environmental Protection Act</i>	Environment Canada (EC)	Entire Project
<i>Canada Shipping Act</i>	Transport Canada	Marine Vessel Use and Operations (Ballast Water Control and Management, Oil Pollution Prevention)
<i>Canada Marine Act</i>	Transport Canada	Harbour Navigation and Use
<i>Navigable Waters Protection Act</i>	Transport Canada	Submarine Cable and Landing Site Approaches
<i>Transportation of Dangerous Goods Act</i>	Transport Canada	Entire Project
<i>Canada Wildlife Act</i>	EC	Entire Project
<i>Migratory Birds Convention Act</i>	EC	Entire Project
<i>Species at Risk Act</i>	EC	Entire Project
<i>NLCA</i>	GN, NIRB, NPC, NTI, Regional Designated Inuit Organizations	Entire Project
<i>Nunavut Waters and Nunavut Surface Rights Tribunal Act</i>	AANDC and NWB	BMH and Community Tie-ins, Terrestrial Crossing of the Boothia Peninsula
<i>Emergency Medical Aid Act of Nunavut</i>	GN – Department of Health & Social Services	Entire Project
<i>Transportation of Dangerous Goods Act of Nunavut</i>	GN – Department of Environment	Entire Project – Spills Contingency Planning and Reporting
<i>Environmental Protection Act of Nunavut</i>	GN – Department of Environment	Entire Project – Spills Contingency Planning & Reporting
<i>Wildlife Act</i>	GN – Department of Environment	Entire Project
<i>Explosives Use Act of Nunavut</i>	Nunavut Workers Compensation Board (NWCB)	Terrestrial Crossing of the Boothia Peninsula
<i>Scientists Act</i>	NRI	Marine Route Survey, Archaeological and Ecological Studies, and Post-Lay Burial Assessment
<i>Quebec Environmental Quality Act</i>	Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs	BMH and Tie-ins

1.6 Conformity to Land Use Plans

As of, September 2013, two (2) regions have approved land use plans, the North Baffin and the Keewatin regions. Based on the proposed location of the fibre optic cable and landing sites, Phase 1 of the Project would not be subject to these plans.

1.7 Project Benefits

The benefits from the Project are more indirect than direct. Arctic Fibre's fibre optic network will provide tremendous amounts of bandwidth for a fraction of the cost of satellite services. This will enable ISPs to provide very stable and faster digital telecommunications with more bandwidth available for transmitting data.

This increase will allow customers to access the same kinds of internet services enjoyed by customers in southern Canada including watching full length videos, TV shows, and movies, using Skype, and playing online games with others across the community, region, territory, nationally or internationally without delays or interruptions. Much will depend on the local ISPs and what they choose to provide customers; however, fibre optic broadband ought to offer significant improvement over the status quo and permit the offering of such services at affordable prices.

Government, non-governmental organizations (NGOs) and businesses operating in Nunavut are often hampered in their ability to send and/or receive large digital files or information over the Internet. Delays uploading/downloading data from the Internet lead to delays in work productivity for employees and their clients. Enhanced broadband Internet services ought to greatly improve internal and external communications within communities, within territory, and with the rest of Canada and the world.

Fibre optic bandwidth could also permit these institutions to use real videoconferencing, thereby potentially reducing the amount of money spent on travel within and outside of the territory. Extra savings from travel could be spent on other operational or organizational costs, programs or services.

Mining companies and other developers within the region would also be able to get their operations connected to the Arctic Fibre network. This would provide these companies with all the benefits of a fibre optic connection for their own internal/external communications and operations.

In summary, the direct and indirect benefits of the Project are:

- reduces the cost of bandwidth relative to satellite by 85% at the outset with additional savings from increased economies of scale being passed through to carriers and customers;
- reaches a substantial portion of Nunavut demand on backbone without need for government subsidy;
- improves cable television quality and scope of programming;
- provides sufficient bandwidth for video streaming and all internet applications;
- facilitates intra-territorial communication and cultural exchange through creation of an Inuktitut-language internet hub in Iqaluit;
- provides opportunities to reduce overall cost of government through extension of tele-health programs, distance education, as well as remote administration of justice;
- provides opportunities for government to attract and retain medical and information technology (IT) professionals;
- provides opportunities to enhance and support Canadian Arctic sovereignty policies and manage resources;
- helps to facilitate improved weather forecasting and potentially, aviation safety, through provision of increased bandwidth to NAV Canada;
- eliminates economic, social paralysis when satellite is off-line;
- enhances business communications, internally and with customers;
- enhances economic development prospects from resource development;
- creates direct employment in Iqaluit, Taloyoak and Cambridge Bay; and
- helps to stimulate increased telecommunications market entry by new carriers and extends cellular coverage.

2. Preliminary Project Description

2.1 Project Infrastructure

The Project infrastructure consists of marine infrastructure, terrestrial crossing infrastructure and cable landing infrastructure.

2.1.1 Marine Infrastructure

A submarine cable system is made up of several major components including the cable and joints, branching units, repeaters (powered by shore based power feeding equipment), shore based line terminating equipment and system monitoring equipment. These components work together to transmit optical signals over thousands of kilometres.

A submarine fibre optic cable comprises a central tube containing a number of loose fibres. This tube is then surrounded by two layers of helically lapped steel wires, which is then encased in a welded copper tube. The steel and copper provide a pressure and hydrogen barrier and the electrical path through the cable. The copper tube is covered in a layer of medium density polyethylene to insulate and protect it. This comprises what is called the lightweight (LW) cable. LW cable is used in water depths in excess of 2,000 m. For shallower waters various additional layers can be applied to further protect the cable. In water depths less than 1,000 m, layers of helically lapped steel wires are applied over the LW cable. The number of wires, diameter of wires, lay length and number of layers can be different depending on the water depth and the external risk. However, armouring types can be grouped into two main categories; Single Armour (SA) and Double Armour (DA). A typical DA cable is approximately 4 cm in diameter.

The majority of the Arctic Fibre cable route is expected to be SA cable with DA cable being utilized for nearshore approaches and in irregular subsea terrain. It can be installed by conventional cables ship equipment without the need for any significant modifications. In nearshore applications the DA cable is trenched into the seabed to a depth of 1 to 3 m to prevent damage from ice scour and tidal action.

Figure 1. Typical Submarine Cable Components

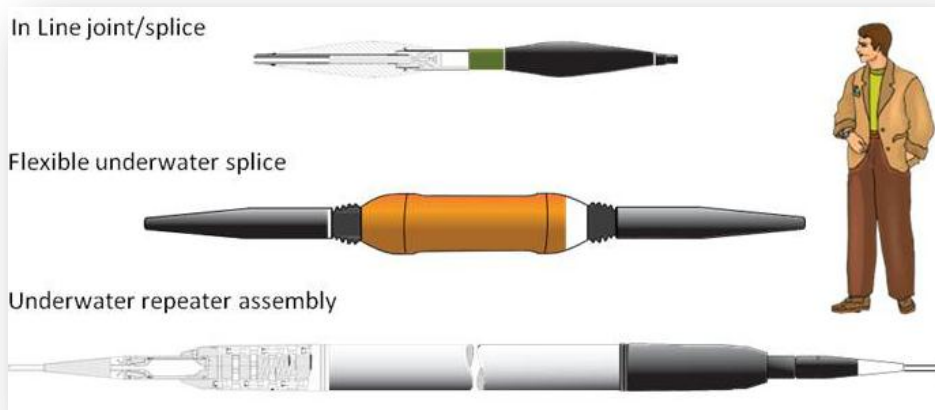
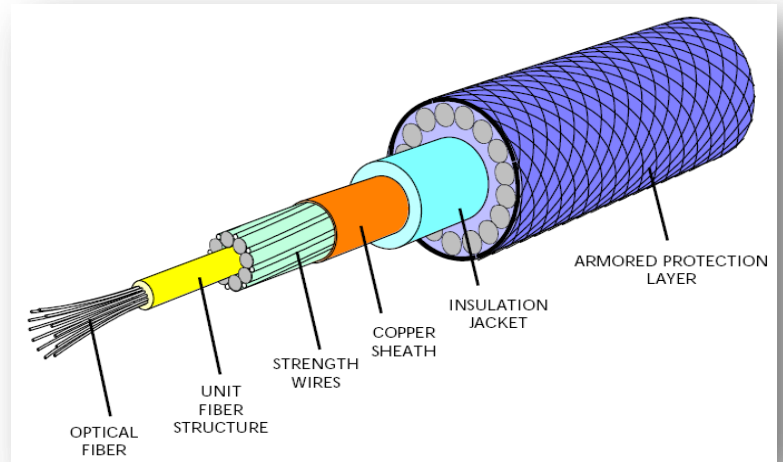
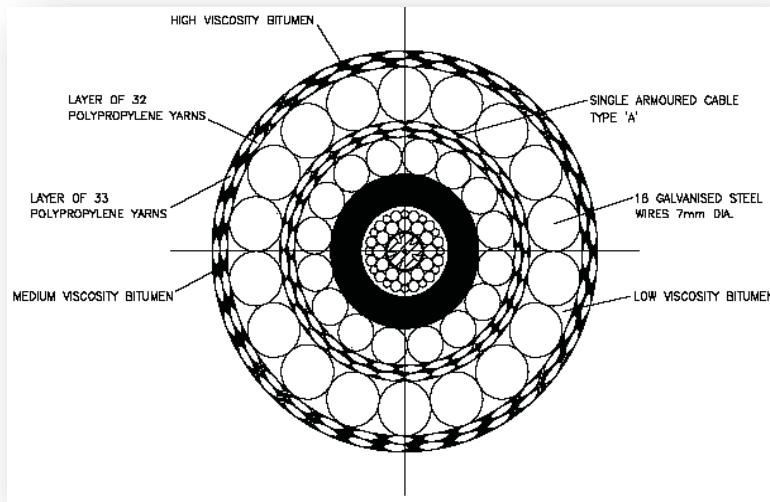


Figure 2. Marine Cable Infrastructure – Cable Joints and Repeaters

Figure 3. Cross-Section (Enlarged) of a Double Armour Cable



Cable segments are joined together by various types of joints and couplers. Typically, there are no more than one (1) joint per 15 km and they are spaced no less than every 10 km. They are designed for operation in both deep and shallow water. Repeaters are required on the seabed to amplify the optical signal at suitable intervals along the cable; typically this is on the order of once every 53 to 60 km. The repeaters are designed to be benign to the subsea environment and do not contain any liquids or other material that could leak out of the protective coating in the event of a break in the cable. No measureable electromagnetic radiation is emitted by the cable.

Branching Units (BUs) are required such that the fibres pairs within the cable can be split to serve more than one destination or, alternatively, wave lengths can be added or dropped from a spur to the main backbone path. BUs can be installed in the main cable path where a landing site is anticipated but not available at the time of the main installation. The BUs are designed to be benign to the subsea environment and do not contain any liquids or other material that could leak out of the protective coating in the event of a break in the cable.

The cables, joints, BUs, and repeaters are very robust and capable of being laid, buried, de-buried, recovered, re-laid and reburied. The approximate design life of the marine infrastructure is 25 years.

Line terminating equipment is located onshore in a Cable Station. This station sends and receives the optical signals, which travel through the submarine cable. Power Feed Equipment (PFE), also in the Cable Station, generates the electrical current that is required to power the submerged repeaters. In this case, the Arctic Fibre backbone system will be powered between two Cable Stations at Cambridge Bay and Iqaluit.

Figure 4. Marine Cable and Repeater



Photograph Courtesy of TE SubCom

2.1.2 Terrestrial Crossing Infrastructure

The terrestrial cable is also a small diameter cable and is rated to withstand -50°C temperatures. It does not generate any measurable ambient heat and no measurable electromagnetic radiation.

2.1.3 Cable Landing Infrastructure

The main cable landing infrastructure consists of a concrete vault designated as the Beach Manhole (BMH). The BMH provides an anchor point that connects the marine cable to the seaward side, and the land cable to the landward side. The typical BMH is approximately 2 m x 2 m x 2 m (W x D x H). It will have adequate grounding (earthing) and be sealed from water / soil intrusion. Typically the land route between the BMH and the community cable station will be on the order of 3 km in length and in most instances much shorter.

Figure 5. Typical BMH



Photograph Courtesy of TE SubCom

2.2 Materials and Equipment

A variety of materials and equipment will be required to install the Project infrastructure. These include marine vessels and equipment; terrestrials installation materials and equipment; and human resources.

Depending on the route to be surveyed and survey needs, different classes of vessel and survey equipment may be required. These are generally mid-sized vessels that are common in Canadian waters. Several main lay vessels or cablesips will likely be required. Overall, Arctic Fibre’s contractors will likely utilize one cablesip in the Atlantic Ocean, one in the Pacific Ocean and one in Canadian Arctic waters. Depending on nearshore conditions, and generally from the 15 m contour out to the edge of the continental shelf, the cable will be laid by the main lay vessel(s). Beyond the edge of the continental shelf, typically 1,000 m water depth, the cable will be laid on the sea bed. The cablesip(s) will operate during the open water season and will not normally require ice breaking assistance during the August-September 2015 installation window. For this Project, Arctic Fibre may request ice breaking support from the Canadian Coast Guard in unusual or unsafe circumstances near shore landing sites.

Depending on the operations to be undertaken, the crew of the cablesip will comprise approximately 40 to 80 personnel including: the cablesip master, chief mate, and chief engineer. The crew shall include medically-trained personnel. Staffing will allow all planned work to be carried out continuously over a 24 hour per day basis for the offshore activities, and on a 12 hour per day basis for alongside activities.

In Canadian waters the TE SubCom vessels will utilize Canadian pilots with the necessary ratings to operate in ice-prone waters. Marine and habitat observers will be on board to ensure no interference with fisheries or mammals.

Two or more shallow draft vessels or barges may be required for shore end cable installation at a number of the landing sites and for cable installation to and from the two Boothia Peninsula BMHs. The type of vessel to be used will depend on the installation methodology and this will only be determined post marine survey.

Figure 6. Reliance Class Cables Ship



Figure Courtesy of TE SubCom

On all vessels to be used, the operator shall operate International Safety Management (ISM) and Environment, Health and Safety (EHS) systems. All vessels shall comply with the latest International Maritime Organization (IMO) and Safety of Life at Sea (SOLAS) requirements for their classification and with all national requirements. Prior to mobilization, operators shall ensure that safety audits are carried out in accordance with the International Marine Suppliers Association (IMCA) standards or equivalent for all vessels. All equipment to be used shall be approved, where appropriate, by an independent authority or classification society as being fit for the intended use.

The vessels' officers and crew shall comply with the relevant merchant shipping legislation. All personnel shall be made aware of their obligations under the ISM and EHS regulations, and shall possess and be properly trained in the use of the appropriate protective clothing and safety equipment.

2.2.1 Terrestrial Installation Materials and Equipment

The crossing of the Boothia Peninsula will require 51.3 km of cable and the use of at least one wheeled trencher and at least one Sno-Cat; along with several snowmobiles and/or all-terrain vehicles, horizontal directional drilling equipment, three pre-fab buildings, plus a variety of hand equipment. Installation will take place during the March-May 2015 freeze-up interval to minimize damage to the terrain.

The installation of the cable at the landing sites and from the BMH to a cable station will require heavy machinery such as backhoes, bulldozers, bobcats. Horizontal Directional Drilling (HDD) or directional boring equipment may be required to provide a trenchless method of installing the cable from shore to off-shore. At each landing site, up to one of each may be required. Hand machinery will also be used for general construction purposes.

Figure 7. Wheeled Trencher for Terrestrial Crossing



Photograph Courtesy of Leducor

Figure 8. Mobilization Equipment and Sno-Cat for Terrestrial Crossing



Photograph Courtesy of Leducor

2.2.2 Human Resources and Contracting

The human resources required for Project construction are highly skilled and specialized. For the most part, workers will be existing employees of the contractors retained for project construction. Contracting opportunities exist for the supply of various materials and equipment, fuel, materials storage and inspection services. Local contractors and residents would be hired to help install the cable across the Boothia Peninsula, build and install the BMHs and community tie-ins. During operations, Arctic Fibre will outsource its technical support functions to a third party. It is anticipated that this will create 1 to 2 full-time positions. Contracting opportunities exist for materials storage and inspection services.

2.2.3 Waste Disposal and Treatment Methods

Waste produced from the cable laying and support vessels including grey and black water, bilge water, deck drainage, discharges from machinery spaces, and hazardous and non-hazardous waste material will be managed in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL), domestic and international requirements, and with the Contractor's EHS Policy. Vessels will be self-sufficient and self-contained regarding wastes, chemical and hazardous materials storage and use. A licensed waste contractor will be used for any waste returned to shore for treated and disposed at a licensed / approved site.

Wastes produced from construction activities in the terrestrial environment, including waste water, discharges from machinery, and hazardous and non-hazardous waste material will be managed in accordance with applicable domestic and international requirements. Only minor volumes of wastes, chemical and hazardous materials will be required to power heavy equipment and hand machinery needed for the terrestrial crossing of the Boothia Peninsula and construction at landing sites and community tie-ins. All such all materials will be transported and stored in standard commercial and approved container at least 30 m from a water body. All materials will be removed from these sites. No wastes will be generated that will need to be disposed out on the land. Wastes will be removed, treated and disposed at a licensed / approved site.

3. Project Works and Activities

International submarine cable projects involve the construction, operation, maintenance, decommissioning, recovery, and abandonment of submarine cable systems that transmit optical signals, including the optical fibres and cable, BUs, powered repeaters, line terminating equipment (i.e., manhole / vault), PFE, and monitoring equipment. The Arctic Fibre Project includes a marine component, a land route component, terrestrial crossing component, and shore landing component. The project works and activities are described in the following sections.

3.1 Marine Component

Because only a preliminary route has been identified, a marine route survey and/or a burial assessment (if required) would be completed. These surveys are used to confirm or amend the preliminary cable route proposed and to determine the optimum route for cable and cable design. The marine route survey is typically undertaken using a variety of techniques, including remote surveys, small boat, and diver swims. Remote surveys are undertaken in deep waters and in the nearshore, using side scan sonar equipment. This equipment searches and detects objects on the floor of the ocean. A separate Burial Assessment (BA) may be necessary to assess the possibility of burial (i.e., how deep can or should the cable be buried), equipment type to be used, the wear-rate of

the plough share and to determine the type of cable required. The BA survey is undertaken during or immediately after the marine route survey.

Prior to installation, a pre-lay grapnel run is performed along the cable route to clear debris and obstacles that may be present. A heavy grapnel is dragged along the bottom, disturbing a narrow strip of sediment. These obstacles are cleared from the route or recovered.

Cable installation will most likely occur by plough burial with a tethered sea-plough over the majority of the route down to the 1,000 m contour. Beyond this point the cable will be laid on the surface of the sea bed. Jetting is used to bury the cable in those areas where cable burial by plough is not possible due to seabed conditions or the presence of other pipelines or cables. The cable would not be buried in rock or other unsuitable seabeds.

A sea-plough is a submarine burial tool that is capable of target burial depths of 1 to 3 m in most seabed conditions. During cable installation, the plough temporarily displaces a wedge of soil to allow the plough share to pass. The cable passes through the gap between the cheek plates that make up the plough share, and places the cable into the trench. As the plough share passes the soil closes on the furrow.

Cables are equipped with global positioning systems (GPS), and progress very slowly (approximately 2 km/hr) during plough burial installation. The slow speed significantly reduces the potential for the cable laying and ploughing-in process to impact the marine environment.

3.2 Terrestrial Crossing Component

The terrestrial cable needed for the 51.3 km crossing of the Boothia Peninsula will be air freighted into Taloyoak airport on four or five reels. With the assistance of local contractors, these reels will be mounted onto sleds and transported across Middle Lake to two staging points and across Angmaluktok Lake to a third staging point. The trenching and rocksaw equipment will also be towed to these points in similar fashion. A pre-fab building (approximately 8 feet by 20 feet) would also be put into place near the north end of Angmaluktok Lake to serve as storage and a temporary day shelter.

Depending on the condition of the terrestrial crossing route, some vegetation removal may be required. Fuel will be used by heavy and hand machinery. It is anticipated that fuel would be brought in from the nearest community for BMH construction, and that fuel caches would be established along the Boothia crossing route. In all cases, re-fuelling and storage of fuel will occur at a minimum of 30 m from a water body. No fuel storage is required for the ongoing operation of the fibre optic cables system.

The preferred cable installation and tie-in method is to employ a wheel trencher to excavate a 30 cm (12") trench into which the two cables can be placed. The cables are then covered with loose fill which allows some expansion during freeze-thaw cycles. Concrete or other sealant are not likely to be used.

The construction of the Boothia crossing is performed while the ground is frozen and snow cover is present to minimize environmental impact and facilitate mobilization by snowmobile. This method has been used successfully in Alaska.

Once buried, the land in the right-of-way for the cable route, including any Hamlet roads will be restored, as much as reasonably possible, to its previous condition. All wastes would be removed and disposed of as per Arctic Fibre's waste management plan. It would be Arctic Fibre's intention to leave one of pre-fab building in place near the north end of Angmaluktok Lake to serve as a shelter for hunters in the area.

3.3 Shore Landing Component

For the shore landing component, a concrete vault or BMH will be constructed approximately 10 to 30 m inland from the mean High Water tide level. A winch of sufficient strength is set up and securely anchored on the beach adjacent to the location of the vault. A trench is excavated during low tide to a depth of approximately 2 to 3 m with a rubber-tired backhoe from the BMH over the exposed beach to the low tide mark. The cable is paid out from the cables ship with floats identifying the location in the water. A small barge, boat or divers can be used to assist in placing the cable on the ocean bed and beach trench. Once in place, the beach trench is backfilled to the original elevation.

Cable burial to 1 to 3 m on the beach is performed with an excavator and limited to the depth of loose sediment over underlying rock. Rock cutting may be required. If required, Horizontal Directional Drilling (HDD) will be undertaken to connect the marine cable to the

BMH. Arctic Fibre will place terrestrial markers at each landing site to remind residents and boaters of the presence of the cable. Once buried, the land in the right-of-way for the cable route will be restored to its previous condition. All wastes would be removed and disposed of as per Arctic Fibre’s waste management plan.

Figure 9. Connecting the Marine Cable to the Landing Site



Photograph Courtesy of TE SubCom

3.4 Project Operations

Once in operation, the fibre optic cable is used to transfer digital communications data along the cable. Digital data includes voice conversations, drawings, photographic pictures, text, and video. This telecommunication technology is used for data packages, Internet, telephone and cable television. Once placed in service, operation of the cable will require minimal marine activity, either from ships, submersibles, or divers. Should damage to the submarine cable occur, a maintenance vessel will be dispatched to the area of the damage to repair the fault, when reasonably possible. The cable would be cut close to the fault, either by ROV or utilizing a cutting grapnel. An additional length of cable would then be spliced on to the line cable and re-buried by an ROV. Without weather delays repairs will typically take in the range 3 to 7 days (24 hour periods).

It is not anticipated that cable repairs would need to be undertaken during seasons with ice cover or would require icebreaking. If a cable section is damaged on the terrestrial crossing of the Boothia Peninsula, the damaged section would be cut out and replaced. The repaired cable is then reburied.

3.5 Decommissioning

The cable's design life is 25 years. However industry experience is suggesting that the actual lifespan often extends to 30+ years. It is current industry practice to abandon the cable in-place, that is, the existing cable would be left on the seabed so as to minimize environmental impacts. Should the removal of the cable be deemed desirable in the future, it is most likely that the same project works and activities would be undertaken as for cable replacement / splicing (see above).

4. Stakeholder Engagement

Arctic Fibre has undertaken extensive government, public and telecommunications industry engagement activities regarding the Project since 2011. Through these events and meetings Arctic Fibre engaged with approximately 480 people during the past two years. During August and September, 2013, Arctic Fibre undertook visits to landing site communities in Nunavut and met with approximately 160 people, including Hamlet and Territorial government officials, Inuit organizations, Hunters and Trappers organizations, community leaders, business operators and community members. Their questions and comments, along with Arctic Fibre's response have been recorded. The various suggestions, community and traditional knowledge shared with Arctic Fibre have been incorporated into the Project.

Arctic Fibre has established a Project website at arcticfibre.com. Over the past two years Arctic Fibre has issued a number of communications (e.g., press releases) and has been the subject of numerous media stories. These are available for review on Arctic Fibre's website. Arctic Fibre Inc. is committed to ongoing communications and consultation through stakeholder and community meetings, presentations, the Project website and discussions with regulators and Inuit organizations, as required. Community and stakeholder communications via email, phone calls and meetings (as required) will continue. Other meetings and events will likely be held at key Project milestones (e.g., marine route survey and/or construction).

5. Existing Conditions

The Project traverses the Canadian Arctic from the western extent of the Canadian Beaufort Sea at the Yukon-Alaska border to the northern reaches of the North Atlantic, east of Baffin Island, and south into Hudson Bay and James Bay. The vast majority of the cable route is set within the marine environment.

The main Project Description / Project Proposal document describes the existing marine environmental conditions along the cable route in terms of its physical conditions related to: oceanography (i.e., circulation, tides, and waves), sea ice, seabed and marine sediments, marine acoustics and marine water quality. The biological conditions along the cable route are described in terms of plankton, marine fisheries, marine mammals, marine and shore birds, and invertebrates and benthic species

Although the vast majority of the cable route is marine, a single relatively short traverse overland is anticipated across the Boothia Peninsula at Taloyoak, Nunavut. The main Project Description / Project Proposal document describes the existing terrestrial environmental condition typical to the Inuvialuit, and western and eastern Canadian Arctic regions in terms of climate and air quality, noise, terrain, surficial geology and permafrost, surface water, groundwater, vegetation, wildlife, birds, freshwater fish and other biota

The description of existing conditions relevant to the socio-economic environment is focused largely on Nunavut and the seven Arctic Fibre landing site communities, currently proposed for Phase 1 of the Project and considers: population and demographics; employment, income and business activity; protected areas and tourism; ocean bed uses; commercial fishing; traditional activities and economy; housing and municipal infrastructure; health and safety facilities and social services; educational facilities and services; transportation infrastructure and services; communications infrastructure and services; community culture and cultural; and heritage Resources

6. Potential Effects, Mitigation and Significance

The main Project Description / Project Proposal identifies a variety of potential adverse and positive effects. Arctic Fibre has proposed numerous mitigation measures to avoid or minimize adverse effects. Overall, Arctic Fibre identified the following types of adverse effects:

- Changes in seabed bathymetry
- Disruption of surficial seabed sediments and burial of existing surficial seabed
- Increased turbidity in the vicinity of the cable trench
- Increased underwater noise
- Mortality of some invertebrates and benthic species
- Disruption to some invertebrate and benthic species
- Changed behaviour of fish due to sensory disturbance
- Increased risk of injury and mortality of marine mammals
- Changed behaviour of marine mammals near operating vessels
- Increased risk of injury and mortality of marine and shorebirds
- Changed behaviour of marine and shorebirds due to sensory disturbance
- Decreased ambient air quality near operating vessels and construction equipment
- Increased ambient noise and vibration near operating construction equipment and from occasional blasting
- Disturbance of soils and ground surface
- Changed wildlife behaviour due to sensory disturbance
- Changed bird behaviour due to sensory disturbance
- Disruption of commercial fishing activity
- Constraint to ongoing commercial fishing activity and future ocean bed uses

Arctic Fibre is committed to obtaining all required authorizations and permits such, the adverse effects on cultural, archaeological and paleontological resource sites do not occur.

Arctic Fibre took into account the magnitude, geographic extent, duration, frequency and permanence of these effects along with the ecological importance of the environment component affected. Arctic Fibre concluded that none of these adverse effects were significant. In fact, most were rated as negligible or minor adverse effects.

The following positive socio-economic effects of the Project were also identified

- Increased direct and indirect employment opportunities resulting from Project construction and operation;
- Increased business activity related to Project purchasing of goods and services;

The Project will result in improved communication infrastructure and services for residents of Nunavut, Nunavik, and northern Quebec. The positive, but indirect effects of this are:

- Enhanced economic development potential due to increased employment and business opportunities associated with the availability of more reliable telecommunication services and greater available bandwidth;
- Increased opportunities for government to provide more efficient and better health, safety and emergency care, attract and retain medical and (IT) professionals.
- A new component to the existing education system, enabling a vast number of new educational opportunities for students and educators alike.

The Project will also enable greater internet use that may serve to improve community culture through enhanced civic engagement and community participation and potentially greater language retention.

The key potential for cumulative effects are related to effects on marine navigation, marine acoustics and construction at landing sites. In each case, the cumulative effects of the Project in combination with those of other projects and activities are considered to be unlikely, low in magnitude and largely mitigable.

Although the Project is transboundary in nature, spanning several oceans and jurisdiction, its effects are generally of low magnitude, very localized and short term in duration. Significant adverse transboundary effects are not considered likely.

A variety of environmental conditions will likely be encountered during the life of the Project that require consideration to mitigate risks of cable and infrastructure damage and potential environmental harm. Overall, damaged cable infrastructure will not result in significant environmental harm because there are no harmful emissions associated with cables or infrastructure. Rather, damage to the cable or infrastructure may serve to disrupt service to customers and generate a need to repair the damaged cable or other infrastructure. Similarly, the risks to the environment, worker and public safety from accidents and malfunction are considered low, primarily because of their extremely low likelihood of occurrence during construction.

Effects of the environment on the Project and from accidents and malfunctions have been largely mitigated through cable design (i.e., armouring), routing and the selection of BMH locations at landing sites. Further opportunities to mitigate effects are afforded by the marine route survey and burial assessment that will help determine the optimal cable armour type, burial depths and other necessary measures for protection of the cable along the proposed route. Effects will be mitigated by the selection of suitable vessels and equipment designed and maintained for the offshore environment, personnel trained to work offshore safely, adherence to relevant EHS regulations, standards and policies.

7. Environmental Management Plans

Arctic Fibre and its contractors are committed to conducting their operations in a manner that is protective of the environment and the health and safety of its employees, sub-contractors, vendors, customers, visitors, the local community and general public. Arctic Fibre will develop Environmental Management Plans (EMPs) relevant to the following components of the Project:

1. Marine construction and cable replacement and splicing activities;
2. The terrestrial crossing of the Boothia Peninsula; and
3. BMH construction and community tie-ins.

The purpose of the EMPs is to provide a framework for Arctic Fibre and its contractors for achieving regulatory compliance and best industry practice. In general the EMPs will:

- Document legislative requirements, standards and guidelines applicable to the Project, and the applicable regulatory approvals obtained by Arctic Fibre;
- Identify key environmental issues;
- Identify environmental protection requirements and commitments;
- Serve as a reference document for Project personnel when planning and/or conducting specific activities for managing environmental issues and ensuring the appropriate mitigation measures are in place;
- Specify required environmental management responsibilities of the contractor;
- Establish framework for environmental incident reporting; and
- Provide a mechanism to communicate revisions and modifications to the EMPs due to changes in site conditions and work methods.

Based on these EMPs, the contractors will be responsible for providing Arctic Fibre with details for planned work procedures, environmental mitigation and control procedures to be implemented during construction and operations to achieve compliance with the EMP and regulatory requirements. Where relevant, each EMP will contain the following specific management plans:

1. Waste management plans;
2. Emergency and spill contingency plan;
3. Vessel use and operation management plan, including considerations for marine mammals;
4. Explosives management plan;
5. Terrestrial wildlife management plan;
6. Aquatic habitat management plan;
7. Cultural and heritage resources management plan; and
8. Community benefits plan.

Following construction, a post-lay burial assessment (if required) would be completed to provide sufficient data to allow a determination to be made regarding the extent to which cable burial objectives had been accomplished and to locate areas where target burial depths might not have been achieved. This survey would be similar to the marine route survey undertaken at the outset of the Project. Remedial measures may need to be undertaken.

Arctic Fibre will also undertake period surveillance of the terrestrial crossing of the Boothia Peninsula. This would be a visual inspection by locally hired staff. The inspection would assist in identifying any areas where the cable might have been exposed, areas of high erosion or sedimentation. It is anticipated the landing site infrastructure and community tie-ins would also be periodically inspected by local staff.

8. Conclusions

Arctic Fibre has prepared this Project Description / Project Proposal to fulfill the EA information requirements of several Canadian jurisdictions and initiate the regulatory review of the Project (the Project) in a co-ordinated manner. Arctic Fibre has also made a preliminary determination of the significance of the residual adverse effects of the Project and have concluded that taking into account proposed mitigation, the Project is not likely to result in significant adverse residual effects. The Project is anticipated to result in several positive direct and indirect effects. Arctic Fibre acknowledges that AAs will make a final determination on the significance of the adverse effects of the Project taking into account any factors they considered relevant.