# NIRB Uuktuutinga Ihivriuqhikhamut #125456

# Peat Expansion in Arctic Tundra (Baffin Island)--Pattern, Process, and the Implication for the Carbon Cycle

**Uuktuutinga Qanurittuq:** New

**Havaap Qanurittunia:** Scientific Research

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# QANURITTUT

**Tukihiannaqtunik havaariyauyumayumik uqauhiuyun**

Qablunaatitut: Peat Expansion in Arctic Tundra (Baffin Island)Pattern, Process, and the Implication for the Carbon Cycle(Non-technical summary)The following document has been submitted to the Nunavut Impact Review Board (NIRB) and is a nontechnical summary of a research proposal submitted previously to the Nunavut Planning Commission (NPC).Individual/institution proposing project:This project will be directed by Philip Camill, who is a professor at Bowdoin College (Brunswick, Maine, USA). Institutional support is provided by Bowdoin College, and funding for this project is through the (U.S.) National Science Foundation. Research objectives and need:Climate is warming worldwide and is most rapid in the polar arctic north. This warming is a result of the emissions of greenhouse gases to the atmosphere. The most important gas contributing to warming is carbon dioxide, which comes mainly from the burning of fossil fuels for energy. Because plants use carbon dioxide as they grow, and this carbon is stored in soils when plants die, there is interest in learning whether vegetation and soils might be able to take up some of the fossil fuel carbon dioxide released to the atmosphere. The plant uptake of carbon may increase in the future as climate warms and landscapes become more vegetated, as areas that are open tundra now become more like the spruce forests and bogs to the south. Scientists refer to this process as a greening of the arctic. Arctic greening may possibly help to slow the rise of greenhouse gases in the atmosphere and, therefore, climate warming. This proposed research is part of a project to understand how arctic ecosystems may respond to warming, including plant and soil uptake of carbon. If arctic greening is happening, this could possibly slow the rise in atmospheric greenhouse gases. The goal of this work is to improve our understanding of these processes. Proposed research study locations:The proposed research would be located on Baffin Island, Nunavut, Canada, in study sites located within approximately 400 km of Iqaluit (a map was included in the application to NPC). The NIRB indicates that the study sites are located in the South Baffin Region, including Inuktitut (Iqaluit, Kimmirut, Cape Dorset, and Pangnirtung) and French-speaking (City of Iqaluit) communities.Proposed transportOur work will be based out of Iqaluit, and air travel will be by helicopter. We plan to fly to each of the proposed sites and carry out the field tasks below depending on the suitability of each site. Once on site at each field location, all travel will be by foot. We will only be using handheld equipment.Proposed field research tasks:The research team carrying out this work consists of 2-4 people.(1) Sampling soils to measure the amount of carbon storedWe are particularly interested in wetland soils, or peat patches, dominated by peatmosses because they store the most carbon in arctic landscapes. At each site, we will collect multiple soil cores (likely fewer than 10 per site). The cores would be approximately 5 cm in diameter and sampled to the depth of the soil (most likely 20-75 cm deep). (2) Collection of weather dataAt each site, we will use a small weather station to measure air and soil temperatures and soil moisture. These will log data for several days, and we will return to the sites to retrieve the weather station. This information will help us assess the extent to which the peat patches are dependent on certain soil temperatures or moisture conditions.(3) Mapping of surface topography and vegetation To assess the area of the peat patches and the potential environmental factors controlling them, such as local topography and drainage, we will use global positioning system (GPS) units to take multiple measurements of topography and peat patch areas. At each site, we will use small (1-x-1-m) sampling plots to identify different plant species and quantify their areal coverage. (4) Imaging surface vegetation At each site, we will collect aerial imagery to help us map the peat patches and their potential environmental controls, like topography. We will deploy a drone over a ~20-hectare area to a height of ~250 m. This instrument produces a photo-like image of the vegetation. These images will be used alongside satellite-based remote sensing images of the region to help us determine the spatial scales of the peat patches and their potential environmental controls. Timeframe of proposed activities:The research would take place for a fixed period (2-3 weeks) during the summer of 2019. Long-term implications Because the field work will involve limited collection of soil cores, topography, vegetation samples, and weather information over the span of a few days per site, there will be little environmental impact. No permanent structures will be constructed.A summary of the results of this work will be translated and made available to the local communities in Nunavut to help them understand the potential changes in their landscapes as climate warms.

Uiviititut: Expansion tourbière dans la toundra arctique (Terre de Baffin). Modèle, processus, et implication pour le cycle de carbone(Résumé non-technique)Le document çi-dessous a été soumis au Nunavut Impact Review Board (NIRB). C’est un résumé non-technique d’une proposition de recherche soumise précédemment au Nunavut Planning Commission (NPC).Individu/Institution responsable du projet:Ce projet sera dirigé par Philip Camill, professeur à Bowdoin College (Brunswick, Maine, États-Unis). Le soutien institutionnel est fourni par Bowdoin College, et le projet est financé par (U.S.) National Science Foundation.Besoin et objectifs de rechercheLe réchauffement climatique de la planète est global et se produit le plus rapidement dans l’arctique polaire du nord. Ce réchauffement est dû aux émissions de gaz à effet de serre dans l’atmosphère. Le dioxyde de carbone est le gaz le plus important contribuant à ce réchauffement, et provient principalement de la combustion d’énergie fossilVu que les plantes utilisent le dioxyde de carbone pendant leur croissance, et qu’à leur mort ce carbone se stocke dans la terre, il y a

tout intérêt à apprendre si la végétation et la terre peuvent absorber une partie des combustibles fossiles du dioxyde de carbone émis dans l'atmosphère. L'absorption de carbone par les plantes pourrait augmenter à l'avenir à mesure que le climat se réchauffe et que la végétation de paysage augmente, à mesure que les régions de la toundra claire ressemblent plus à des forêts d'épinettes et à des tourbières au sud. Les chercheurs parlent de "verdissement" arctique pour décrire ce processus. Le verdissement arctique pourrait éventuellement ralentir la montée dans l'atmosphère des gaz à effet de serre, et donc ralentir le réchauffement climatique.La recherche proposée fait partie d'un projet pour comprendre comment l'écosystème arctique, y compris l'absorption du carbone par les plantes et le sol, peut réagir à ce réchauffement. S'il y a un verdissement arctique, ceci pourrait éventuellement ralentir la montée dans l'atmosphère des gaz à effet de serre. Le but de ce travail est d'améliorer notre savoir sur ces processus.Sites de recherche proposésLa recherche proposée serait située à la Terre de Baffin, Nunavut, Canada, dans environ sites de recherche situés approximativement à 400 km d'Iqaluit (une carte a été remise dans l'inscription au NPC). Le NIRB indique que les sites de recherches sont situés dans la région du sud de Baffin, y compris Inuktitut (Iqaluit, Kimmirut, Cape Dorset, et Pangnirtung) et des communautés francophones (la ville d'Iqaluit).Transport ProposéNotre travail sera basé à Iqaluit, et le transport aérien sera effectué par hélicoptère. Nous envisageons de voyager à chacun des sites proposés et de réaliser les tâches sur le terrain mentionnés çi-dessous selon les convenances de chaque site. Une fois sur le terrain à chaque site, tout déplacement sera effectué à pied. Nous utiliserons seulement du matériel portable.Tâches sur le terrain proposéesL'équipe de recherche est constituée de 2 à 4 personnes. (1) Échantillonage de sol pour mesurer la quantité de carbone stockéNous sommes particulièrement intéressés par les sols de zones humides, ou par des zones de tourbes dominés par la mousse parce qu'elles stockent le plus de carbone dans les paysages arctique. A chaque site, nous prélèverons des carottes de sol multiples (probablement moins de 10 par site). Les carottes seraient approximativement 5 cm de diamètre et les échantillons seraient pris à la profondeur du sol (probablement de 20 à 75 cm de profondeur).(2) Collecte de données météorologiquesA chaque site, nous utiliserons une petite station météorologique pour mesurer les températures de l'air et du sol, et l'humidité du sol. Ces stations enregistreront des données sur plusieurs jours, et nous retournerons à chaque site pour récupérer les stations. Ces informations nous aideront à évaluer dans quelle mesure les zones de tourbes dépendent d'une certaine température du sol ou de conditions d'humidité.(3) Cartographie de la topographie de surface et de la végétationPour évaluer la région des zones de tourbes et les facteurs environnementaux potentiels qui les contrôlent, tels que la topographie locale et le drainage, nous utiliserons des appareils GPS (Global Positioning System) pour prendre des mesures multiples de la topographie et des régions de tourbières. A chaque site, nous utiliserons des petites (1-x-1-m) parcelles d'échantillonage pour identifier les espèces différentes de plantes et mesurer leur couverture spatiale. (4) Imagerie de la végétation de surfaceA chaque site, nous recueillerons des imageries aériennes pour nous aider à cartographier les tourbières et leur contrôle environnementaux potentiels, telle la topographie. Nous déploierons des drones au dessus d'une zone de ~20 hectares à une hauteur de ~250 m. Cet instrument produit des images de végétation semblables à des photos. Ces images seront utilisées avec des images satellites de télédétection de la région pour nous aider à déterminer l'échelle spatiale des tourbières et leur contrôles environnementaux potentiels.Durée des activités proposée:La recherche aurait lieu pour une période fixe (2-3 semaines) pendant l'été 2019.Implications à long-termeVu que le travail de terrain nécessitera un prélèvement de carottes de sol, de topographie, d'échantillons de végétation, et d'informations météorologique durant plusieurs jours à chaque site, il y aura peu d'impact sur l'environnement. Aucune structure permanente ne sera construite.Un résumé des résultats de cette recherche sera traduit et mis à disposition aux communautés locales à Nunavut pour les aider à comprendre les changements potentiels de leur paysages à mesure que le climat se réchauffe.

Inuktitut: ᒪᓴᐅᓲᖅ ᐃᔾᔪᖓ ᐱᕈᓕᖅᑐᖅ ᐅᑭᐅᖅᑕᖅᑑᑉ ᓄᓇᐃᓐᓇᖓᓂ (ᕿᑭᖅᑖᓗᒃ)ᓴᖅᑭᐅᒪᓂᖓ, ᐱᕈᖅᐸᓪᓕᐊᓂᖓ, ᑕᒪᓐᓇᓗ ᐊᒃᑐᐃᓂᖃᓐᓂᐋ ᐆᒪᔪᕕᓃᑦ ᑲᐃᕙᓐᓂᕆᓲᖓᓄᑦ (ᐅᖃᐅᓯᖅᑐᓗᐊᙱᑦᑐᖅ ᐅᓂᒃᑳᓕᐊᖅ) ᐅᓇ ᑎᑎᕋᖅᓯᒪᔪᖅ ᑐᓂᔭᐅᓇᓱᒃᑐᖅ ᓄᓇᕘᒥ ᐊᒃᑐᐃᔪᓂᒃ ᕿᒥᕐᕈᐃᔨᑦ ᑲᑎᒪᔨᖏᓄᑦ (NIRB) ᑎᑎᕋᖅᓯᒪᔭᖅ ᐅᖃᐅᓯᖅᑐᕋᓂ ᐅᖃᓕᒫᒐᖅ ᖃᐅᔨᓵᖑᔪᒃᓴᒧᑦ ᑐᓂᔭᐅᓚᐅᖅᑐᖅ ᓯᕗᓂᐊᒧᑦ ᓄᓇᕘᒥ ᐸᕐᓇᐃᔨᒃᑯᑦ ᑲᒥᓴᙵᓄᑦ (NPC).ᐃᓄᖓ/ᑎᒥᖓ ᐊᑐᕈᒪᓂᖃᖅᑐᖅ ᖃᐅᔨᓴᐃᓂᕐᒥᒃ: ᐅᓇ ᖃᐃᔨᓴᐅᓂᖅ ᓯᕗᓕᖅᑎᖃᓐᓂᐊᖅᑐᑦ ᐱᓕᑉ ᑲᒥᐅᓪ, ᐃᓕᓴᐃᔨᒻᒪᕆᒃ ᑕᑲᓇᓂ ᐸᐅᑐᐄᓐ ᓯᓚᑦᑐᖅᓴᕝᕕᖓᓂᒃ (ᐳᕋᓐᓯᕝᒃ, ᒪᐃᓐ, ᒥᐊᓕᒐᑦ). ᑎᒥᐅᔪᑦ ᐃᑲᔪᖅᓱᖅᑕᐅᔪᖅ ᐸᐅᑐᐄᓐ ᓯᓚᑦᑐᖅᓴᕝᕕᖓᑕ, ᑮᓇᐅᔭᖃᖅᑎᑕᐅᓪᓗᑎᒡᓗ ᖃᐅᔨᓴᕆᔭᖓᑦ ᐊᖅᑯᑎᒥᔭᐅᓪᓗᓂ (ᒥᐊᓕᒐᑦ) ᓄᓇᓕᔾᔪᐊᖓᑕ ᖃᐅᔨᓴᕆᔭᓄᑦ ᑐᑦᑕᕝᕕᖓᑕ. ᖃᐅᔨᓴᕆᔭᑦᑕ ᑕᑯᒃᓴᕈᕋᓱᒃᑕᖏᑦ ᐱᑕᖃᕆᐊᖃᕈᑖᓗ: ᓯᓚᖓ ᓄᓇᔾᔪᐊᑉ ᓇᒥᓕᒫᖅ ᐅᖅᑰᓯᓂᕋᖅᑕᐅᓕᕐᒪᑦ ᓱᒃᑲᓛᖑᓪᓗᓂᓗ ᐅᖅᑰᓯᕙᓪᓕᐊᓂᖅ ᐅᑭᐅᖅᑕᖅᑐᓪᓚᑦᑖᑉ ᖁᑦᑎᓛᑉ ᓄᓇᖏᓐᓂ. ᑕᒪᓐᓇ ᐅᖅᑰᓯᓂᖅ ᐃᓱᒪᒋᔭᐅᕗᖅ ᓴᖅᑭᓯᒪᓂᐊᓄᑦ ᐅᖅᑰᓯᕙᓪᓕᐊᑎᑦᑎᔪᓂᒃ ᐳᓪᓚᐅᔭᓂᒃ ᐊᓂᐊᓂᖓᓄᑦ ᓯᓚᐃᓐᓇᐅᑉ ᕿᓚᖓᓄᑦ. ᐃᓱᒪᒋᔭᖓ ᖃᓪᓗᓈᑦ ᐅᖅᑰᓯᑎᑦᑎᓈᖅ ᑲᐅᐸᓐ ᑎᐋᒃᓴᐃᑦ, ᓴᖅᑭᓪᓗᐊᑕᓲᖅ ᐊᓂᖅᓵᖅᑐᓄᑦ ᐃᑯᐊᓪᓚᒃᑎᑕᐅᔪᓄᓪᓗ ᐆᒻᒪᖅᑯᓯᐅᕆᓇᓱᒃᑐᓂᒃ. ᑕᐃᒪᓕ ᐱᕈᖅᑐᐃᓐ ᓂᕿᖃᓲᖑᒻᒪᑕ ᑕᐃᒪᐃᑦᑐᒥᒃ ᐳᓪᓚᐅᔭᒥᒃ ᐱᕈᓕᖀᖓᒥᒃ, ᑖᓐᓇᓗ ᐊᑐᖅᑕᕕᓂᖓ ᐃᔾᔫᑉ ᐃᓗᐊᓃᖏᓐᓇᓲᖅ ᐱᕈᖅᑐ ᓄᓇᕋᐃᑦ ᑐᖁᔭᖀᖓᑕ, ᑕᐃᒫᒃᓗ ᐃᓕᓐᓇᓯᒧᑕᐅᔪᒪᓪᓗᓂ ᑕᒪᒃᑯᐊ ᓄᓇᕋᐃᑦ ᐱᕈᖅᑐᑦ ᐃᔾᔪᖏᓪᓗ ᐃᓚᖓᓂᒃ ᐊᑐᕈᓐᓇᕐᒪᖔᖏᑕ ᐃᓯᐊᕿᔭᐅᕙᓪᓕᐊᔪᒧᑦ ᐳᓪᓚᐅᔭᒧᑦ. ᑕᒪᓐᓇ ᐊᖏᓂᖅᓴᐅᔪᒥᒃ ᐱᕈᖅᑐᓄᑦ ᐊᑐᖅᑕᐅᒪᔭᓐᓂᖓ ᐱᕈᕈᒥᒥᔭᐅᕗᖅ

ᐱᓵᔪᑎᑦᓴᒍ ᐅᖅᓯᓂᓪᓕᐊᓂᕐᓂᓕᕆᓂ, ᓄᓇᖅᓴᓂ ᓄᓇᕐᖃᕐᓂᖅᓴᐅᓕᕆᓂ, ᑕᒪᑦᔨᐊ ᓄᓇᓵᐅᓐᓇᐸᑦ ᐅᑦᓴᒥ ᐱᕈᖅᑐᖅᓯᓕᕐᓂᓴᖅᑐᑦ ᓇᓗᓂᓴᖅᑐᑦᓵᓂ ᐃᓕᓴᖅᓯᓂᕐᑐᕐᕕᖅᓯᓂᒃ ᓇᖃᑦᓴᓂ ᓄᓇᖅᑐᓂ. ᖃᐅᔨᓴᖅᑎᑦ ᐃᓕᓐᓂᕐᒪᔪᑦ ᐊᓯᖏᓴᖅᖃᖅᓯᑦ ᑕᐃᒪᐃᖃᕕᓂ “ᑐᖓᔪᓴᖅᓂᔪᓴᖅ” ᐱᕈᖅᑐᖃᖅᓴᐅᓕᒥᑦ ᓄᓇᖅᑐᓂ ᐅᑎᕐᕕᖅᑐᑦ. ᐅᑎᐅᖅᑕᖅᑐᑦ ᐱᕈᖅᐸᓕᕆᓂᖓ ᐃᑲᔪᐃᔪᓇᕐᓂᕕᑎᓂᖅᓄᖅ ᐊᑐᓕᓇᓂᖅ ᐊᑐᓕᓂᖅᑐᑦ ᐅᖅᓯᓂᓪᓕᐊᓂᖅᓴᐅᓕᕆᓂᖓ ᐅᖅᓯᓂᕐᒥᓂᖅᑐᑦᓵᓂᓕᕆᓂᖓ ᐊᒻᒪᓗ, ᓱᖃᐃᓕᓐᓂᑎᑦᓂᖅᑐᖅᓴᖅᑐᑦ ᐅᖅᓯᓂᕐᓂᓕᕆᓂᖓᓂᖅ. ᖃᐅᔨᓴᓇᓕᐅᔪᒪᔪᖅ ᑕᓐᓇ ᐃᓕᓴᕐᖃᖅ ᖃᐅᔨᓴᖅᑎᑦ ᐱᓕᓇᓂᖓᓂᓕᒃ ᖃᓄᖅ ᐅᑭᐅᖅᑕᖅᑐᑦ ᐅᖅᓯᓂᕐᓂᓕᕆᓂᖓᓂᓕᒃ, ᐱᖃᓱᐅᑎᓪᓗᑎᑦ ᐱᕈᖅᑎᖅᑎᑦ ᐊᑐᓕᓂᖅᑐᑦ ᐃᓵᔪᑦ ᐊᐅᓚᓂᔪᓂᕐᒥᑦ ᐅᖅᓯᓂᕐᓂᓕᕆᓂᖓᓂᓕᒃ, ᐱᖃᓱᐅᑎᓪᓗᑎᑦ ᐱᕈᖅᑎᖅᑎᑦ ᐊᑐᓕᓂᖅᑐᑦ ᐃᓵᔪᑦ ᐃᓐᓇᑦ ᐃᓐᓇᖅᑐᑦᓵᓂᓕᕆᓂᖓᓂᓕᒃ ᐊᑐᓕᓂ

Days on site: 10
Total Person days: 30
Operations Phase: from 2019-07-07 to 2019-07-27

# Hulilukaarutit

| Inigiya | Hulilukaarut Qanurittuq | Nunannga Qanurittaakhaanik | Initurlinga qanuritpa | Initurlinga utuqqarnitat unaluuniit Ingilraaqnitat Uyarannguqtut akhuurninnga | Qanitqiyauyuq qanitqiamut nunallaat kitulluuniit ahiruqtailiyainnit nuna |
|---|---|---|---|---|---|
| proposed study sites | Scientific/International Polar Year Research | Crown | NA | NA | NA |

**Nunaliin Ilauyun, Aviktuqhimayuniitunullu Ikayuuhiarunguyun**

| Nunauyuq | Atia | Timiuyuq | Upluani Uqaqatigiyaungmata |
|---|---|---|---|
| Information is not available | | | |

# Angiuttauvaktunik

**Naunaiqlugu nunanga talvani havauhikhaq ittuq:**

South Baffin

**Angiuttauvaktunik**

| Munariniqmut Ayuittiaqtuq | Angirutinga Qanurittuq | Tadja Qanurittaakhaanik | Ublua Tuniyauyuq/Uuktuqtuq | Umikvikhaa Ublua |
|---|---|---|---|---|
| Nunavunmi Ihivriuqniqmut Timiqutigiyanga | Research license application | Applied, Decision Pending | | |
| Tingmiliqiyiitkut Kaanatami | We are awaiting information about he drone equipment to be able to apply for an exemption through Transport Canada. As described below, we may not need a SFOC.My research colleague who will be flying the drone provided this information:a) I was in communication with Transport Canada in January about applying for SFOC or getting an Exemption;b) Exemption might be possible if we fly more than 6 miles outside of Iqaluit.c) I am a Canadian Citizen and have passed Unmanned Vehicle Certification. | Not Yet Applied | | |

**Project transportation types**

| Transportation Type | Qanuq Atuqtauniarmangaa | Length of Use |
|---|---|---|
| Air | helicopter | |

**Project accomodation types**

Alaanut,

# Ihuaqutivaluin Atuqtauyukhan

**Hanalrutit atuqtaunahuat (ukuallu ikuutat, pampiutainnik, tingmitinik, akhaluutinik, hunaluuniit)**

| Hanalrutit Qanurittuq | Qaffiuyut | Aktikkulaanga – Qanurittullu | Qanuq Atuqtauniarmangaa |
|---|---|---|---|
| hand-held soil coring devices | 2 | 150 x 10 cm | to collect soils as described in the project description |
| drone | 1 | 50 x 50 cm | aerial imagery of landscape vegetation as described in the project description |
| helicopter | 1 | unknown | round trip transport to sites from Iqaluit |
| GPS unit | 1 | 100 cm x 20 cm | to map peat patches and topography as described in project description |
| meteroligcal station | 1 | 200 cm x 100 cm | measuring air and soil temperatures and soil moisture |

**Qanurittuq Urhuqyuaq unalu Qayangnaqtut Hunavaluit Aturninnga**

| Qanurittuq urhuqyuaq hunavaluit aturninnga: | Urhuqyuaq Qanurittuq | Qaffiuyut qattaryut | Qattaryuk Aktikkulaanga | Atauttimut Qaffiuyut | Ilanga | Qanuq Atuqtauniarmangaa |
|---|---|---|---|---|---|---|
| Information is not available | | | | | | |

**Imaqmik Aturninnga**

| Ubluq qanuraaluk (m3) | Aturumayain imavaluin utiqtittagaani qanuq | Atulirumayain imavaluin utiqtittagani humi |
|---|---|---|
| 0 | We will not use any field water. All drinking water will be brought in from Iqaluit. | We will not use any field water. All drinking water will be brought in from Iqaluit. |

# Iqqakuq

**Ikkakunik Munakgiyauyunik**

| Havauhikhaq Hulilukaarut | Qanurittuq Iqqakut | Ihumagiyauyuq Qanuraaluktut Atuqtait | Qanuq Iqqakuurniarmangaa | Halummaqtirarnirutikhan piyutin |
|---|---|---|---|---|
| Sampling sites | Anaagun (inuin anaaguin) | approximately 15-30 L (0.5-1 L/person/day) | Human urine would be disposed of in remote, vegetated locations in the field at least 100 m away from water bodies. if this is an unacceptable disposal method, we could carry 1-L bottles with us and pack out human waste. | NA |

**Avatiliriniqmut Ayurhautingit:**

We do not anticipate environmental impacts. Surface and bedrock geology and sediment and soil quality--A few soil cores will be sampled and soil temperature probes installed. All of the holes associated with these activities will be backfilled, so these potential impacts are minor and should not be noticeable. Noise--for brief periods of time from the use of a helicopter. Wildlife, including habitat and migration-- the helicopter may cause some animals to move temporarily.

# Additional Information

**SECTION A1: Project Info**

**SECTION A2: Allweather Road**

**SECTION A3: Winter Road**

**SECTION B1: Project Info**

**SECTION B2: Exploration Activity**

**SECTION B3: Geosciences**

**SECTION B4: Drilling**

**SECTION B5: Stripping**

**SECTION B6: Underground Activity**

**SECTION B7: Waste Rock**

**SECTION B8: Stockpiles**

**SECTION B9: Mine Development**

**SECTION B10: Geology**

**SECTION B11: Mine**

**SECTION B12: Mill**

**SECTION C1: Pits**

**SECTION D1: Facility**

**SECTION D2: Facility Construction**

**SECTION D3: Facility Operation**

**SECTION D4: Vessel Use**

**SECTION E1: Offshore Survey**

**SECTION E2: Nearshore Survey**

**SECTION E3: Vessel Use**

**SECTION F1: Site Cleanup**

**SECTION G1: Well Authorization**

**SECTION G2: Onland Exploration**

**SECTION G3: Offshore Exploration**

**SECTION G4: Rig**

**SECTION H1: Vessel Use**

**SECTION H2: Disposal At Sea**

**SECTION I1: Municipal Development**

**Qanurittuq Ittunik Avatinga: Avatingalluanga**

**Qanurittuq Ittunik Avatinga: Inuuhimayunut Avatinga**

**Qanurittuq Ittunik Avatinga: Inungit-maniliurutingit Avatinga**

**Miscellaneous Project Information**

**Naunaiyainiq ukuninnga Ayurhautingit unalu Piumayaat Ikikliyuumiutinahuarutit**

**Tamatkiumayunik Ihuikgutivaktunik**

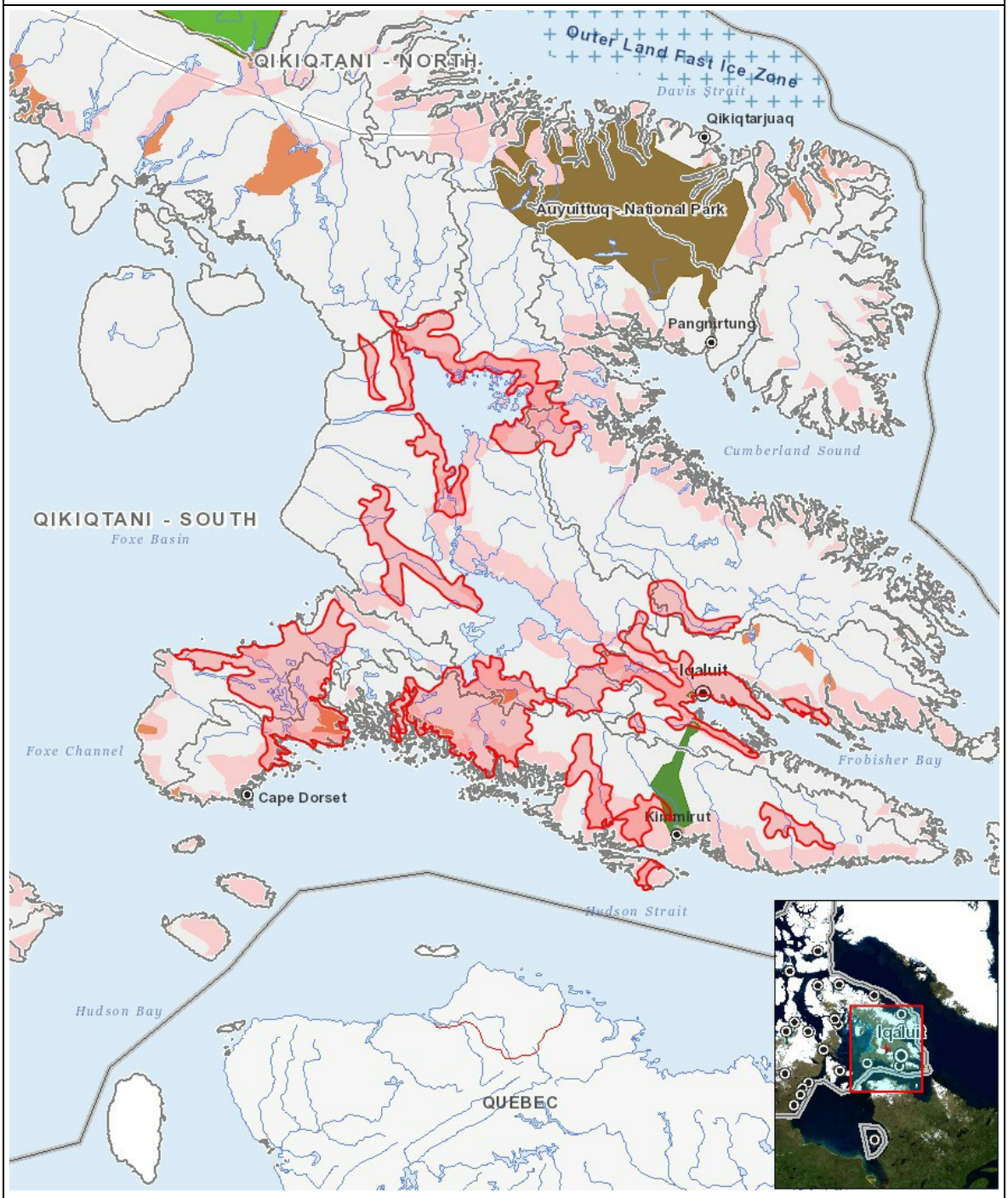
# Impacts

## Ilitariyauniq Avatiliriniqmut Ayurhautingit

| | PHYSICAL | Designated environmental areas | Ground stability | Permafrost | Hydrology / Limnology | Water quality | Climate conditions | Eskers and other unique or fragile landscapes | Surface and bedrock geology | Sediment and soil quality | Tidal processes and bathymetry | Air quality | Noise levels | BIOLOGICAL | Vegetation | Wildlife, including habitat and migration patterns | Birds, including habitat and migration patterns | Aquatic species, incl. habitat and migration/spawning | Wildlife protected areas | SOCIO-ECONOMIC | Archaeological and cultural historic sites | Employment | Community wellness | Community infrastructure | Human health |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Havakvinga** | | | | | | | | | | | | | | | | | | | | | | | | | |
| - | | - | - | - | - | - | - | - | - | - | - | - | - | - | | - | - | - | - | - | | - | - | - | - |
| **Aulapkaininnga** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Scientific/International Polar Year Research | | - | - | - | - | - | - | - | N | N | - | - | N | | - | N | - | - | - | | - | - | - | - | - |
| **Piiqtauniq** | | | | | | | | | | | | | | | | | | | | | | | | | |
| - | | - | - | - | - | - | - | - | - | - | - | - | - | | - | - | - | - | - | | - | - | - | - | - |

(P = Nakuuyuq, N = Nakuungittut unalu mikhilimaittuq, M = Nakuungittut unalu mikhittaaqtuq, U = Naluyauyuq)

Havaariyauyukhamut Nayugaa




List of Project Geometries

| | | |
|---|---|---|
| 1 | polygon | proposed study sites |