CANADA-NUNAVUT GEOSCIENCE OFFICE
BUREAU GÉOSCIENTIFIQUE CANADA-NUNAVUT
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KANATAMI-NUNAVUMI GEOSCIENCE TITIGAKVIIT

Appendix A

Fury and Hecla Regional Geoscience Project

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1. Introduction

The Fury and Hecla Geoscience Project is a multi-disciplinary mapping initiative led by the Canada-Nunavut Geoscience Office (CNGO) in partnership with Laurentian University, McGill University and Université du Québec á Montréal. The 3-year project involves bedrock and surficial geology mapping, and thematic research covering the area north of the Fury and Hecla Strait, northwestern Baffin Island, including parts or all of NTS 37B and F, 47D, E, F, G, and H, and 48A. Field components of this work are planned over two years (2018–2019), while the third year (2020) will only include analytical and desktop research.

The Fury and Hecla Geoscience Project will use new geophysical survey data collected in 2017 and 2018, as well as high-resolution satellite imagery to plan mapping targets, minimize impacts, and streamline efficiency in the field. In 2018 and 2019 up to 5 weeks of field work will be conducted in the southern and northern halves of the study area, respectively, and field operations will be based in temporary camps. Mobilization and demobilization will be staged from Igloolik, and every effort will be made to use local Inuit-owned businesses to support this work.

The long-term outcome of this work is to reduce risks for exploration, resource development, and land-use planning in the northwestern Baffin Island area. The project will provide framework geoscience information and address regional geological problems through bedrock and surficial geology mapping, and thematic studies. All results of this work will be made publicly available using the latest in GIS and data dissemination technologies, and will include new bedrock maps, geochemical and geochronological databases, field and thematic reports, peer-reviewed journal papers, conference presentations (oral and poster), and PhD and MSc theses.

1.1 Scientific Research Themes:

The main scientific questions that will be investigated fall within the following research streams:

1. The (presumed) Archean basement geology has never been sufficiently mapped. However, based on bedrock mapping to the east (Mary River area) and south (Melville Peninsula), there is a high probability that Archean greenstone belts (possibly including iron formation and/or base- and precious-metal occurrences) and Phanerozoic kimberlite deposits may be present in the study area. The basement rocks need to be characterized and delimited to identify areas with economic potential, and provide fundamental geological information that will help reduce future exploration risks. A thematic PhD research project will include some of this work (see next section).
2. The Mesoproterozoic Fury and Hecla Group sediments are exposed along the Fury and Hecla Strait. The stratigraphy and economic potential of these rocks were evaluated in 1979, and limited work in the easternmost part of the basin in 2010 followed-up on the earlier findings. The basin rocks contain local uranium anomalies, which have been the focus of some mineral exploration in the 1990's. Given the uranium mineralization potential, low-density data coverage, and the mostly vintage published data, a thorough reinvestigation of the Fury and

Hecla Group is warranted using modern tools and methods. Three PhD projects will tackle independent thematic research projects that focus on different aspects of the basin rocks (see below).

3. Portions of the study area preserve Paleozoic marine carbonate and siliciclastic rocks. These exposures have never been adequately mapped, leaving the stratigraphy, stratigraphic correlations, and potential for oil-shale units unconstrained. The CNGO will constrain these aspects of the Paleozoic rock exposures, which will add valuable new insights into their depositional history and economic potential.
4. Much of the Quaternary surficial-material coverage in the study area has already been interpreted from air photos and limited ground observations collected in the 1960's. To compliment and add value to that work, field work will focus on collecting new ground observations of ice-flow and marine limit indicators, and till samples for analysis of kimberlite indicator minerals, and base- and precious-metals. These data will help constrain the glacial history and ice-flow patterns in the area to reduce future mineral exploration risks. An MSc research project will focus on a component of this work (see next section).

1.2 Student Involvement:

The Fury and Hecla Geoscience Project requires the involvement of at least five graduate-level students to assist with field mapping and data collection for the various thematic research projects. Three of four PhD-level positions have been granted full funding through a Strategic Partnership Grant for Projects awarded by the Natural Science and Engineering Research Council of Canada. This grant was applied for by Dr. Galen Halverson of McGill University, Dr. Alessandro Ielpi of Laurentian University, and Dr. Ross Stevenson of the Université du Québec á Montréal in partnership with the Canada-Nunavut Geoscience Office. One PhD research project at each university will be funded by this grant, and the research will focus on the following aspects of the Fury and Hecla Group sediments:

1. Update the stratigraphic framework of the basin through bedrock mapping;
2. Analyze and interpret the sedimentology of sandstone units to constrain their depositional environment;
3. Geochemistry and micropaleontology of black shale and carbonate units;
4. Elemental and isotopic characterization of volcanic rock units;
5. Constrain the maximum depositional ages of rock units using U-Pb and Re-Os geochronology methods;
6. Compare the stratigraphy of the Fury and Hecla Group with other Mesoproterozoic basin-rocks.
7. Identify and assess the mineralization potential, genesis, and characteristics throughout the basin.

The fourth PhD research project will focus on the plutonic, metamorphic, and deformational histories of the (presumed) Archean basement rocks. This work will be supervised by Dr. Douglas Tinkham of

Laurentian University, and involve regional geochemistry, geochronology, pressure-temperature studies, and structural analysis of the study area.

An MSc project that assesses the Quaternary glacial history of the study area will be initiated with a Canadian university that is yet to be determined. The aspects of the post-glacial marine limit, ice-flow history, and application of drift prospecting in the study area will be evaluated as part of this project.

All students will be in their first year of study during the 2018 field season. Students will be expected to contribute to the mapping project throughout both field seasons, and will be given dedicated time and support to collect field data and samples specifically for their respective projects. Each student's respective university supervisor will visit the field camp for approximately 2 weeks to support the thematic research.

2. Schedule of Activities

In 2017 a fuel order comprising drummed Jet-A, gasoline, and diesel, as well as large propane canisters, was shipped by sea-lift to Igloolik and has been stored in a fuel-containment berm with a local business until such time that fuel caching to the field can commence. Also in 2017, the first half of the CNGO's Fury and Hecla Regional Geophysical Survey was initiated to begin collection of regional magnetic and radiometric data sets over the Fury and Hecla area. That project is permitted separately from this Fury and Hecla Geoscience Project application, yet the data resulting from the geophysical survey is critical to planning out field mapping targets. The second half of the geophysical survey will commence in the fall of 2018, following a new competitive bid process.

In preparation for the 2018 Fury and Hecla Geoscience Project field work, all field party members must complete safety training and certification requirements. These include Wilderness and Remote First Aid, standard CPR, Canadian Firearm Safety Training, Firearm Possession and Acquisition License, Hands-on Firearm Shooting Practice, and Polar Bear Awareness. Support staff who are hired on a contract locally from Igloolik will not be required to possess the same training, although such training will be viewed as an asset when applicants are screened. Additionally, everyone who is required to travel to the field camp will receive safety briefings from aircraft pilots prior to boarding, as per Transport Canada regulations.

Field equipment will be shipped from Ottawa to Igloolik via air cargo in June and early July 2018. Fuel and equipment required to build the Gifford River Camp, and Ivisarak and Neergaard Lake caches, will be mobilized from Igloolik July 5th–12th using Twin Otter aircraft on tundra tires. A contracted company will build a turn-key camp at the Gifford River site July 8th–11th. Field crews will arrive in Igloolik by July 9th, and be mobilized to the field on July 10th. Field work via helicopter will commence on July 11th. On July 17th, a second helicopter will arrive to support the Paleozoic and Surficial geology crews, and will be used to conduct crew changes and supply runs to/from Igloolik on July 24th, August 1st, and August 8th. Both helicopters will provide dedicated support until August 16th, when all field crews should be returned to Igloolik. Camp demobilization will be assisted by the contracted company that built the

camp from August 16th to 18th. Twin Otter aircraft on tundra tires will be used to move empty fuel drums and all camp equipment back to Igloolik by August 19th. Full fuel drums will remain at the camp or cache sites in fuel containment berms for use during the 2019 field season.

The 2019 field season will be designed in a similar format (number of personnel, camp design and infrastructure, work duration and timeframe, and scientific goals), but will have a camp situated further to the north, likely on the Jungersen River, to access the northern half of the study area. It is also expected that a team of 2 to 4 people will likely spend up to 10 days accessing the outcrops exposed on northern Melville Peninsula to collect data for some of the thematic research projects. It is expected that this area will be accessed using a helicopter from Igloolik, and that the field crew will be housed within the community throughout the duration of the work.

3. Location and Environment of Undertaking

The study area covers all or parts of nine NTS map sheets (37C and F, 47C, D, E, F, G, and H, and 48A; see the map in Section 17) over northwestern Baffin Island and northern Melville Peninsula. This area includes Inuit Owned Land parcels with both surface and subsurface rights belonging to the hamlets of Igloolik and Arctic Bay. Some of the Inuit Owned Land parcels are known to host seasonal camps and settlements, and these areas will be avoided during field work to minimize disturbance to anyone who uses these sites.

The physical geography of the study area is quite diverse. Coastal areas around the Fury and Hecla Strait have >80% bedrock exposure, some streamlined glacial till deposits, and extensive raised beaches indicating the drop in local sea-level since the last glacial maximum. On northwestern Baffin Island the coastal exposures become hilly and rise to extensive glacial till-covered plateaus to the north. The topographic relief is locally quite steep in this transitional zone, and the area hosts many small, isolated lakes and fast-flowing streams. The plateau-type landscapes cover most of the study area and are characterized by extensive glacial till deposits with sparse bedrock exposures localized around brittle fault zones where fiord and river incisions have preferentially developed. The study area also includes areas underlain by carbonate rocks. In coastal, low-lying areas, these rocks are deeply weathered to produce thick carbonate rock-dominated till deposits and low hills. In the interior part of northwestern Baffin Island, the carbonate rocks are preserved in their own plateaus with deeply and steeply incised streams that expose bedrock in sheer cliffs.

4. Description of Undertaking, Camp Infrastructure and Equipment

The CNGO plans to initiate mobilization into the Fury and Hecla study area July 5th–12th, 2018. At this time a Twin Otter on tundra tires will move 10 drums (205L) of Jet-A fuel to each of the fuel cache sites (Ivisarak Lake and Neergaard Lake; See the map in Section 17) from Igloolik, and 70 drums of Jet-A, 4 drums of diesel, 2 drums of gasoline, and 4 100lb-canisters of propane to the Gifford River Camp. All sites will have fuel-containment berms where all drums will be stored.

On July 8th–12th a contracted company will mobilize into Gifford River Camp along with all the materials and equipment needed to set up the infrastructure for the camp. The camp will consist of canvas gable tents (12'x14' and 8'x10') for the kitchen, office, dry storage/shower house, engineer/rock storage tent, and sleeper tents for the helicopter pilots/engineers, camp cook and cook assistant, and wildlife monitors (all considered VIP's). The geology crews will have individual small dome tents for sleeping.

The kitchen, office, dry storage/shower house, and VIP tents will be outfitted with electricity to power lighting, kitchen appliances, computer equipment and satellite communications. Power will be generated using a 3000W gasoline-powered Honda generator. The generator will be turned off at night. Satellite communications will consist of a small satellite dish set up next to the office tent to provide satellite internet and VOIP phone. Kitchen stoves and refrigerators will be propane-powered. Each of the Office, dry storage/shower house, and VIP tents will be outfitted with 32,000btu GeoStoves that use diesel.

The dry storage/shower house will host water storage barrels and a hot-water tank, and will have plumbing to provide water to the shower, the wash basin, and the sink in the kitchen tent. Water will be pumped from the Gifford River using a small water pump with a 10' intake hose outfitted with a mesh cover into two 205L rain barrels. It is expected that <1000 L (<1 m^3) of water will be pumped and used per day. Greywater from the shower and wash basin will drain into a pit, while greywater from the kitchen sink will be directed through a grease-trap before being deposited into a pit. An outhouse will be constructed and placed over a waste pit. All greywater and waste pits will be dug >50m away from the high-water mark of nearby waterbodies (namely the Gifford River). Garbage will be collected daily and stored in animal-proof containers until such time that it can be incinerated in a small, portable industrial incinerator. The resulting ash, as well as non-combustible materials such as metal and glass, will be contained in buckets and shipped back to Igloolik to be disposed of in the municipal landfill.

On July 10th the bedrock geology field crew and a Bell 206 LR helicopter will be moved from Igloolik to Gifford River to help complete camp set-up and prepare for the first day of field work, which is planned for July 11th. Bedrock geology mapping will consist of daily traverse set-outs and pick-ups of teams of two mappers. Each team will have a pre-designed traverse route that is chosen the previous day and based on accessing bedrock geology targets while considering daily weather conditions in different parts of the study area.

On July 18th a second Bell 206 LR helicopter will be moved from Igloolik to Gifford River camp and be used by the surficial and Paleozoic geology teams. Both helicopters will be used to visit locations that are isolated, too remote, or difficult to access by field traverse teams so that observations and samples can be collected. The helicopters will also be used to make crew changes and pick up supplies periodically in Igloolik.

This will continue through August 15th, at which time the field work will wrap up, and the contracted company hired to mobilize and demobilize camp will return to start camp tear-down. A Twin Otter

aircraft will return to Gifford River camp to begin demobilization. All field equipment, samples, crew and empty fuel drums will be removed from the study area. Full fuel drums may be left onsite (camp or cache) to be utilized in 2019 and will be stored in fuel containment berms on their side and rotated so the bungs are in a horizontal orientation. The camp and cache sites will be cleaned of all loose debris, greywater and waste pits will be refilled, and any signs of disturbance will be returned to a natural state, as best as possible.

Back in Igloolik, field crews will check, organize and repack field equipment for shipment to Ottawa. Sample buckets will be shipped separately via air cargo. Any remaining perishable and non-perishable food and supplies will be donated to the local soup kitchen and/or shelters in Igloolik. Any remaining drums of fuel will be returned to the storage facility, and empty drums will be crushed in preparation for shipment south and recycling in 2019.

The 2019 camp and workflow will be conducted with similar timelines, equipment, contracted support, and field personnel. At the end of the 2019 field seasons, however, all field equipment and empty fuel drums will be shipped via sealift to Montreal where crushed fuel drums will be recycled, and field equipment will be transported to Ottawa for return. Any remaining fuel in Igloolik will likely be offered to other government research crews or donated to the community.

5. Fuels to be Used

The following fuels are already placed in a fuel containment berm in Igloolik for use during the 2018 and 2019 field seasons:

- 180 drums (205L each) of Jet-A for aircraft use;
- 8 drums (205L each) of diesel for GeoStove and incinerator use;
- 4 drums (205L each) of gasoline for water pump and power generator use;
- 8 tanks (100lbs each) of propane for cook stove and refrigerator use.

5.1. Petroleum Storage, Inventory and Transfer:

At camp sites Jet-A fuel drums will be stored in a large fuel containment berm. Insta-berms (4'x4') will be used to contain Jet-A fuel drums at the Neergaard Lake and Ivisarak Lake cache sites. Drums will be stored on their side with bungs rotated in a horizontal position, and secured so they do not roll. Electrical pumps supplied by the helicopter contractors will be used for the transfer of fuel from the drums into the helicopter. Smoking, sparks, or open flames are prohibited in fuel storage and fuelling areas at all times. A manual pump will also be available if necessary.

At Gifford River camp, diesel drums connected to GeoStoves will be placed on drum mounts inside of Insta-berms (4'x4'). Gasoline drums and portable jerry cans will be stationed in a separate Insta-berm (4'x4'). Transferring of fuel will be contained within a berm to minimize the impacts of potential spills

or leaks. Smoking, sparks, or open flames are prohibited in proximity to these fuel containers and storage areas, and these areas will be inspected daily.

Propane tanks will be connected to cooking stoves and refrigerators with standard rubber tubing and brass fittings. The tank valves will be closed when stoves are not in use. Tanks will be placed outside the kitchen tent to minimize concentration of fumes in a confined space should there be a leak.

Empty fuel drums will be returned to Igloolik to be crushed and stored in an empty sea container. At the end of the survey, the container will be loaded on the next available sealift destined for Montreal, where the empty drums will be recycled. Any full fuel drums will be removed from the field area and stored in Igloolik for use on other research projects or donated to the community.

6. Spill Contingency Plans

6.1. Risk Assessment and Mitigation of Risk:

Petroleum products and other fuels

1) **Drummed products**: Leaks or ruptures may affect storage containers of petroleum products.
2) **Fuel containers**: Leaks or ruptures could affect plastic jerry cans containing gasoline or diesel.
3) **Propane cylinders**: Propane leaks may occur at the valves of propane containers.

Regular inspection and maintenance in accordance with recognized and accepted standard practices at the camp will reduce any risks identified above.

Tanks will be stored and secured in an upright position. Valves will be checked regularly and sealed with Teflon tape, where required.

Spill response training will be provided to all personnel in camp, with particular attention to those individuals who will regularly be handling fuels. The training will include a presentation, mock spill, review of spill kit contents and their use, and reporting.
Spill kits will be positioned at all refueling station. A description of the contents and configuration of the fuel spill kits is provided in section 6.4.

6.2. Responding to Failures and Spills

6.2.1 Spill Response Contact List

24 hour Spill Report Line
(867) 920-8130
http://env.gov.nu.ca/node/66

INAC Water Resources Inspector

Iqaluit, NU
(867) 975-4295

Environment Canada
Iqaluit, NU
(867) 975-4644
24-hour pager (867) 766-3737

Government of Nunavut – Department of Environment
(867) 975-7700
Manager of Pollution Control and Air Quality
(867) 975-7748

Qikiqtani Inuit Association – Lands Department
PO Box 1340
Iqaluit, NU X0A 0H0
Phone: (867) 975-8400
Toll Free: 1-800-667-2742
Fax: (867) 979-3238

6.2.2 Basic Steps – Spill Procedure

In the case of any spill or other environmental emergency, it is necessary to react in the most immediate, safe and environmentally responsible manner. No spill or incident is so minor that it can be ignored and every spill must be reported.

The basic steps of the spill response plan are as follows:

1. *Ensure* the safety of all persons at all times.
2. *Identify* and find the spill substance and its source, and, if possible stop the process or shut off the source of the flow.
3. *Inform* the on-site coordinator or his/her designate at once, so that he/she may take the appropriate actions. Appropriate action includes the notification of the spill to the 24-hour Spill Line and INAC Water Resource Officer, and compilation of a Spill Report Form (Addendum I, separate document).
4. *Contain* the spill or environmental hazard, as per its nature, and as per the advice of the Spill Line and the AANDC Water Resource Officer as required.
5. *Implement* any necessary cleanup and/or remedial action.

6.2.3 Basic Steps – Chain of Command

1. *Immediately* notify and report to the 24-hour Spill Line at (867) 920-8130, and the Water Resource Officer at (867) 975-4295, Environment Canada personnel at (867) 766-3737, Qikiqtani Inuit Association Land Use Inspector at (867) 975-8400

2. *A Spill Report Form (Addendum 1, separate document)* is filled out as completely as possible before or after contacting the 24-hour Spill Line.

6.2.4 Other Contacts for Spill Response/Assistance and Further Reporting

Nunavut Water Board..... (867) 360-6338
Fisheries and Oceans Canada, Habitat Impact Biologist..... (867) 979-8007
Government of Nunavut, Department of Environment..... (867) 975-5910
Qikiqtani Inuit Association, Land Use Inspector..... (867) 975-8400

6.3. Taking Action:

6.3.1 Spill Response Actions for Gasoline, Diesel and Aviation Fuel

Act only if safety permits. Stop the source flow if safe to do so and eliminate all ignition sources. ***Never smoke*** *when dealing with these types of spills.*

On Land
Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill after all vapors have dissipated.
Remove the spill by using absorbent pads or excavating the soil, gravel or snow.
Remove spill splashed on vegetation using particulate absorbent material.
Contact regulatory agencies for approval before commencing with the removal of any soil, gravel or vegetation.

On Muskeg
Do not deploy personnel and equipment on marsh and vegetation.
Remove pooled fuel with absorbent pads and/or skimmer.
Flush with low pressure water to herd fuel to collection point.
On advice from regulatory agencies, burn only in localized areas e.g., trenches, piles or windrows.
Do not burn if root systems can be damaged (low water table)
Minimize damage caused by equipment and excavation.

On Water
Contain spill as close to release point as possible.
Use containment boom to capture spill for recovery after vapors have dissipated
Use absorbent pads to capture smaller spills.
Use skimmer for larger spills.

On Snow and Ice:
Build a containment berm around spill using snow.
Remove the spill using absorbent pads or particulate sorbent material.

The contaminated ice and snow must be scraped and shoveled into plastic buckets with lids, 205 liter drums, or polypropylene bags

Storage and Transfer
All contaminated water, ice, snow, soil, and clean up supplies will be stored in closed, labeled containers. All containers will be stored in a well-ventilated area away from incompatible materials.

Disposal
Any contaminated material will be shipped to an appropriate and approved facility. The Department of Environment monitors the movement of hazardous wastes from generators, carriers to receivers, through a tracking document (Waste Manifest). A waste manifest will accompany all movements.

6.3.2 Spill Response Actions for Propane

Take action only if safety permits. Gases stored in cylinders can explode when ignited.
***Never smoke** when dealing with these types of spills.*

On Land:
Do not attempt to contain the propane release
On Water
Do not attempt to contain the propane release
On Snow and Ice:
Do not attempt to contain the propane release

General
It is not possible to contain vapors when released.
Water spray can be used to knock down vapors if there is no chance of ignition.
Small fires can be extinguished with dry chemical or CO_2 fire extinguishers.
Personnel should withdraw immediately from the area unless the leak is small and can be stopped immediately upon being detected.
If tank is damaged, gas should be allowed to disperse, and no recovery attempt should be made.
Personnel should avoid touching release point on containers since frost forms very rapidly.
Keep away from tank ends.

Storage and Transfer
It is not possible to contain vapors when released

Disposal
Any contaminated material will be shipped to an appropriate and approved facility.
The Department of Environment monitors the movement of hazardous wastes from generators, carriers to receivers, through a tracking document (Waste Manifest). A waste manifest will accompany all movements.

6.4. Spill Equipment:

Spill kits will be on site at all designated refuelling stations. Spill kits consist of:

- heavy PVC tarp (12'x14'), impermeable to aviation, diesel, and gasoline spills
- aluminum stakes to secure impermeable tarp to ground
- particulate absorbent
- petroleum absorbent pads
- 2 pairs PVC gloves
- 2 pairs safety goggles
- disposable bags
- 1 shovel
- fire extinguisher

7. Water Use and Rights

7.1. Quantity of Water Involved

Maximum daily water use is estimated at <1000L per day (1.0 m^3/day), from the Gifford River for personal hygiene, drinking, cooking and cleaning. Used water will be disposed in greywater or waste pits and is estimated at <1000L per day (1.0 m^3/day).

7.2 Water Rights of Existing and Other Users of Water

The project will not affect the quality, quantity, or flow of water in the area. No other water rights user is known for the proposed camp areas.

7.3. Inuit Water Rights

The project will not affect the quality, quantity, or flow of water flowing through Inuit Owned Lands.

8. Waste and Disposal Methods

Sewage:

- For a maximum of 15 people, sewage is estimated at 100L per day (0.10 m^3/day).
- Holes will be dug in the ground at least 50m from the nearest water source and downstream from the main camp and water intake pump. A wooden structure will be used as a toilet facility and the holes will be filled as necessary.

Greywater:

- Greywater will be produced from washing dishes, washing clothes, and personal hygiene.
- All detergents used will be environmentally friends and biodegradable.

- For a maximum of 15 crew, greywater is estimated at 900L per day (0.90 m^3/day).
- Holes for greywater disposal will be dug in well-drained, sandy soil at least 50m from high-water mark of the nearest water source. These holes will be filled in as necessary.

Other:

- Combustible waste will be kept in wildlife-resistant containers until such time that it can be incinerated in a small, portable industrial incinerator.
- Incinerator ash and non-combustible materials, such as metal and glass waste, will be kept in buckets, returned to Igloolik, and disposed of in the municipal landfill.
- All empty fuel drums will be crushed, stored in a sea container, and shipped in 2019 by sealift to Montreal for recycling.

9. Methods of Transportation

A Twin Otter aircraft on tundra tires will be used to fly field equipment, personnel, and fuel to and from Gifford River camp and the fuel caches during camp mobilization (July 5th-12th) and demobilization (August 15th-19th).

One Bell 206 LR helicopter will be dedicated to the bedrock mapping crews from July 10th to August 15th. It will be used to drop off and pick up mapping crews at the beginning and end of each day. Once dropped off, crews will walk across the land along ~10-12 km transects to their helicopter pick-up destination. The helicopter may also be used to make targeted site visits in areas where traverses would be too difficult or unsafe, or where bedrock outcrops are sparse.

A second Bell 206 LR helicopter will be dedicated to the surficial and Paleozoic geology crews from July 18th to August 15th. It will be used to make targeted site visits in areas where till sampling is required, or where Paleozoic rock outcrops are well exposed. This helicopter will also be used to conduct crew changes from Gifford River camp to Igloolik, and pick up groceries and supplies on a weekly basis.

10. Components of the Environment

10.1 Sensitive and Historical Sites

Several archeological or spiritual sites, such as tent rings and inuksuit, are known to occur within the proposed map area. There are also areas frequently used as camping sites for hunting and fishing. The proposed survey will not result in any disturbance to historical sites or frequently used areas.

10.2 Wildlife

The Fury and Hecla area is known to support habitats for polar bears, walrus, whales, caribou, birds of prey and migratory birds. Advice and information on the types of wildlife and specific sensitivities has

been collected from government biologists, the local Hunters and Trappers Organizations, the people in Igloolik and Arctic Bay, and publicly available reports on the ecologically and biologically significant areas in the northern Foxe Basin and up to Admiralty Inlet (e.g., Paulic et al., 2014; Draft Nunavut Land Use Plan, Nunavut Planning Commission, http://www.nunavut.ca/en/draft-plan; Important Areas for Birds in Nunavut, Environment Canada, https://www.ec.gc.ca/nature/default.asp?lang=En&n=D8F8F357-1).

The northern shore of the Fury and Hecla Strait on Baffin Island is identified as a popular denning area for polar bears. The northern part of Baffin Island is identified as having relatively low caribou populations that are beginning to increase again following a hunting moratorium. The waters and shores around Kapuiviit (Jens Munk Island; NTS 47D) are identified as a walrus habitat and haul-out area. The Fury and Hecla Straight and Fury and Hecla Channel are identified as migratory routes for several whale species, including bowhead, orca, beluga, and narwhal.

Many rivers and lakes are indicated as important and abundant fish habitats. Bird populations are typically concentrated around coastal or wetland areas. Berlinguet Inlet (NTS 47G) is designated as an Important Bird Area as it hosts breeding sites for approximately 7% of North America's snow geese population and nesting sites for cackling geese, and is a popular summer retreat area for polar bears.

10.2.1 Mitigation Measures to Minimize Impacts on Wildlife:

Caribou and other land animals:
Project activities during the critical timing window for caribou calving and post-calving activities (May 15-August 15) are unavoidable as our work cannot be conducted on snow-covered ground. Thus, to minimize the potential impacts of our proposed activities on caribou, other land animals and their habitat, we propose to undertake the following actions and programs to mitigate and manage impacts:

- Visual and noise disturbances at the Gifford River camp will be kept to a minimum.
- Staff will be guided on how to avoid interactions with wildlife.
- Helicopter and fixed-wing aircraft pilots will maintain minimum flight altitudes of 650m, except when landing.
- Areas with observed concentrations of caribou will be strictly avoided. In the event of encounters, flight altitudes will be increased to 1000m and a lateral distance of 1500m will be maintained. If required, alternative field sites will be chosen.
- During foot traverses, noise disturbances (ex. rock sampling) will be kept to a minimum and will cease if caribou are encountered. Regular wildlife checks will be conducted on the ground.
- During helicopter traverses, the helicopter will shut down at each sampling site to minimize noise disturbances.

Migratory Birds and Raptors:
To minimize impacts and potential encounters with migratory birds and raptors:

- We will refrain from approaching nesting migratory birds or raptors during the critical nesting period (May – July 15) to minimize the risk of destroying active nests, birds or their eggs.
- Crews will maintain a minimum distance of 100m from nest sites during the last weeks of nesting (when chicks fly from the nest).
- Nesting birds of any kind will not be disturbed, particularly during conditions of poor weather (rain, snow, high winds) which can stress the chicks.
- Flight plans will avoid known concentrations of birds. Areas where birds are known to concentrate will be avoided by a lateral distance of at least 1500m.
- As the work is concentrated over land, flights over open water will be minimal.

10.2.2 Monitoring:

We will monitor and report on any wildlife sightings in the study area during the time of operation. The reports will include information such as: locations and dates of any wildlife sightings, behaviours or actions taken by animals when encountered, and actions taken to avoid contact or disturbance. The reports will be sent to the Ecosystems Biologist, Wildlife Research Section, Box 209, Igloolik, Nunavut, X0A 0L0.

11. Predicted Environmental Impacts and Proposed Mitigation Measures

No long-term environmental impacts are expected. The proposed work will have minimal impact on wildlife or major habitats that support wildlife in the study area. Twin Otter landings will be restricted to the airstrip at the Gifford River camp, and Neergaard Lake and Ivisarak Lake cache sites. Helicopter landings have minimal physical disturbance to the ground, and helicopters will be shut down in cases where observation and sample collection requires more than 3 minutes on the ground. Helicopter flying will be done in a responsive manner to minimize any disruption of the wilderness, particularly the wildlife.

All gasoline, diesel, and Jet-A fuels will be stored in fuel-containment berms, and fuel transferring into portable containers will be conducted in berms. Fuel storage and transfer sites will be outfitted with spill kits to minimize potential impacts of leaks or spills.

12. Proposed Reclamation Plan

Demobilization of the 2018 Gifford River camp and 2019 camp (location TBD) will entail removal of all field equipment and garbage to Igloolik for proper storage, disposal or shipping back to its source. Any disturbed ground will be restored to its original state, as best as possible, and the site will be thoroughly cleaned of loose debris following demobilization.

Full Jet-A drums at the 2018 Gifford River camp, and Neergaard Lake and Ivisarak Lake cache sites will be stored in fuel-containment berms for use during the 2019 field season. Empty and partial fuel

drums, including all gasoline, diesel, and propane, will be hauled back to Igloolik. Following the 2019 field season, the camp and cache locations will be similarly reclaimed. All fuel drums (full and empty) will be removed from the whole study area, and empty drums will be crushed, loaded into a sea container, and shipped to Montreal for recycling in the Fall of 2019. Any remaining full fuel drums will be given to other research projects operating out of Igloolik, or donated to the community.

13. Consultation and Local Hiring

The Fury and Hecla study area includes Inuit Owned Land parcels belonging to the communities of Arctic Bay and Igloolik. Community engagement meetings were held in January/February 2017 prior to the commencement of the CNGO's Fury and Hecla Airborne Geophysical Survey, and the CNGO has planned to hold annual engagement meetings in both communities until the geoscience project wraps up in 2020. At each meeting, the status of the project and yearly results will be presented. Translated project summaries and simplified maps will be provided for each visit.

The field camps for the regional geoscience work will be mobilized from Igloolik in both 2018 and 2019. This will require numerous contracts with businesses and organizations in the community, specifically for groceries and supplies, expediting services, commercial flights, and accommodations and meals for field crew during layovers. Furthermore, the camp will require up to two wildlife monitors and a camp-cook assistant, who will be hired locally.

The project will produce new 1:100 000 bedrock maps and provide the first comprehensive geological history of the Fury and Hecla area. Datasets, field reports and maps will be published through the CNGO's Geoscience Data Series, Summary of Activities and Open File Map Series, respectively. Student research will be published as peer-reviewed journal articles in accordance with university requirements. All results will be freely available to the public, and translated summaries of the work will be presented at annual community engagement meetings.

The results from the Fury and Hecla Geoscience Project will increase the level of geoscience knowledge for the territory by finally providing the fundamental geological framework that has been lacking in this area. The project aims to review the area's potential for base- and precious-metals, iron ore, uranium, carving stone, diamond-kimberlites, and aggregate occurrences and deposits. Cumulatively, this project will allow stakeholders, including the public, government and regulatory organizations, mineral exploration companies, environmental advocates and land-use planners to make informed decisions regarding potential future investments in this part of the territory.

14. Permits and Licences

The project proponent has prepared the necessary applications for Land Use and research permits or exemptions, and has uploaded them to the Nunavut Planning Commission's Project Portal website. The applications include:

- Research License from the Nunavut Research Institute;

- Application for Access to Inuit-Owned Land from the Qikiqtani Inuit Association;
- Application for Land Use Permit from Indigenous and Northern Affairs Canada;
- Application for Approval for the Use of Water or Deposit of Waste Without a License from the Nunavut Water Board.

15. Contact Information

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16. References

Paulic, J.E., Cleator, H., and Martin, K.A. 2014: Ecologically and biologically significant areas (EBSA) in northern Foxe Basin: identification and delineation. Department of Fisheries and Oceans, Canadian Science Advisory Secretariat, Research Document 2014/042, 40 p.

17. Location map