**2013 Nunavut Research Licence Renewal Application: Wayne Pollard**

**2012 Scientific Research Licence #02 013 12R-M (multiyear)**

**Project Title:** An investigation of the sensitivity of high Arctic permafrost to climate change

**Principal investigator:** Dr. Wayne Pollard, Professor, McGill University

**2013 Research Team**: Wayne Pollard, Michael Becker (Ph.D.), Jared Simpson (M.Sc.) Miles Ecclestone, Chris Omelon (Post Doc) and a student field assistant from McGill

**2013 Fieldwork:** Planned fieldwork includes April 5-17, and June 28-July 10.

**2013 Field sites:** The Eureka area on the Fosheim Peninsula, Ellesmere Island (80º00'N 85º95'W), and the Expedition Fiord area, Axel Heiberg Island (79º25'N; 90º45'W).

**Funding source**: Natural Science and Engineering Research Council (NSERC) and ArcticNet

**Introduction.**
This is a long-term project that examines how climate change is affecting high Arctic permafrost conditions and high arctic landscapes. The main aims of this project are unchanged: (1) to monitor climate conditions for different landscape (e.g. tundra, mountains, coasts, wetlands ...) and assess local climate variability and how much the climate is changing, (2) to evaluate the nature and extent of ground ice in permafrost, (3) to determine the amount and rate of landscape change caused by warming and melting permafrost (thermokarst), and (4) to map these changes on a decadal scale. Aims 2 & 3 are particularly important given the dramatic increase in melting permafrost observed in 2011 and 2012. The information collected in this study will improve our general understanding of how climate and permafrost interact which will allow for the better prediction of future changes. Through our case studies we are providing new information about climate, permafrost, ground ice and thermokarst.

**Progress Report – 2012 Fieldwork.**
In 2012 fieldwork focussed on 3 sites located near Eureka on Slidre Fiord. I was based at the Eureka weather station for 10 days during which I surveyed and sampled 17 new thaw slumps located within 3 kilometers of the Environment Canada weather station. Ice samples were collected to determine ground ice origin and to obtain a better estimate of ice content. The pattern of thawing permafrost and associated collapse of the ground surface (called thermokarst) is directly related to the type and amount of ground ice in permafrost. The Eureka area is extremely sensitive to melting permafrost because of the widespread occurrence of massive ground ice. Massive ground ice refers to thick (3-10m) layers of nearly pure (80-90% by volume) ice beneath 1-4 m of marine sediments. My work in the Eureka Sound Lowlands over the past 20 years has identified at least 10 areas each covering several kilometers where ground ice represents a significant part of the near surface permafrost. Aerial reconnaissance in 2012 revealed an unprecedented level of thermokarst, for example the area surrounding Slidre Fiord and the Southern Fosheim Peninsula (within 40 km of Eureka) contained 250+ thaw slumps, and most were newly formed. The previous record number of slumps observed in this area was 91 back in 1998. In response to this we initiated a remote sensing-based monitoring program. We obtained high resolution satellite images

from July 2012 and July and September 2011, these images will be used to map the location of thermokarst activity and estimate rates of change.

In 2012 I was in the field from April 4-11 and June 25 - July 7. April fieldwork involved ground penetrating radar mapping of ground ice and ice wedges in at Expedition Fiord and Eureka areas, the collection of climate data and the collection of frozen sediments and ground ice. In July my fieldwork was included more ground penetrating radar surveys of ice wedges and massive ice deposits, sampling of ground ice and aerial surveys. In 2011 we identified ice wedge subsidence as a potentially important area of climate change related disturbance, however in 2012 we confirmed this by discovering catastrophic subsidence of several ice wedge polygons. In this study we used different survey tools like radar and electrical profiling to assess the subsurface conditions. The impact of climate change on ice wedges documented a 10-15 cm deepening of ice wedge troughs and the development of new areas of subsidence in the past 2-3 years.

**2013 Field Program.**

Climate change is the most significant environmental challenge facing the North today. I have just begun a new cycle of NSERC funded research which places greater emphasis on measurement of processes associated with climate change than simply detecting change. The aim of my 2013 field program is to investigate how climate change will affect ice-rich permafrost and in particular how rates of thermokarst may change. The proposed research will be divided in to two complementary themes: (1) the analysis of the meta-stable relationship between continuous permafrost and the active layer, and (2) ice wedges as a quasi-stable complex system. A major focus of both studies is the measurement of changes occurring in the active layer and identifying connections between the atmosphere, active layer and permafrost. Fieldwork will be conducted in the Expedition Fiord on Axel Heiberg Island (79º25N;90º43'W) and The Eureka **area** on Ellesmere Island (79º59'N; 85º49'W). These sites were selected in 2012 because they are representative of common ecosystems, because of their accessibility, availability of baseline data, and existing research facilities. My long term field programs at these sites provide a strong basis for comparison. I will assess the sensitivity of key permafrost systems to warming by defining the surface energy balance, and measuring mass and energy fluxes in the active layer and at the active layer permafrost interface. This study will identify critical thresholds of change and potential feedbacks. In this study are asking 4 questions: (1)*:* How is climate change already causing significant changes to the high arctic permafrost regime? (2) Can the active layer buffer the permafrost system through complex feedbacks linked to the way energy interacts with soil and thawing? (3) How much change can occur in the active layer depth before melting ground ice can occur? And (4) what are the mechanisms that cause ice wedge polygons to collapse so rapidly? Three sets of activities are planned for 2013, including: (a) the detailed measurement of changes in the ground surface using a high resolution gps system coupled with ground penetrating radar. These data will be included in the remote sensing data base and will be used to correct the position of satellite images from 20122 and 2012, (b) a detailed study of active layer processes and the measurement of temperature and moisture changes in mid-summer. This will involve the collection of sediment and ice samples from the active layer an top of permafrost, and (c) continued aerial surveys of changes throughout the Fosheim Peninsula.

**Significance**:

This research has made significant inroads into the understanding of permafrost in the high Arctic. It is providing new insights into the origin and age of permafrost systems, rates of change and the potential vulnerability of ice cored landforms. The magnitude of warming projected for the high Arctic will have significant effects on both the ecology and geomorphology of the region. This work is even more important given the increased level of mineral exploration being conducted in this area.

## 2013ᒥ ᓄᓇᕗᕐᒥ ᑭᓕᓯᓂᐊᓂᒧᑦ ᐱᔪᓇᐅᑎᒧᑦ ᓄᑕᐅᓕᕆᑎᒧᑦ ᑐᒃᓯᕋᐅᑎᒃ: ᕗᐃᓐ ᐹᓗᑦ

**2012ᒥ ᑭᓕᓯᓂᐊᓂᒧᑦ ᐱᔪᓇᐅᑎᐅᑉ ᓇᓴᐅᑖ 02 013 12R-M (ᐊᕋᒍᓄᑦ ᐊᒥᓱᓄᕐ)**

**ᐱᓕᕆᐊᑕ ᑕᐃᔭᐅᔪᓯᐊ:** ᖃᐅᔨᓴᕐᑯᑕ ᖃᓄ ᓱᓂᕐᑕᐅᓴᕋᐃᑎᒥᒪᖔᑦ ᕐᑯᐊᖑᐃᓇᕐᑐᑦ ᓯᓚᐅᑉ ᐊᓯᔨᕐᓂᖓᓄ

**ᖃᐅᔨᓴᕐᑎᒧᐊᑕᖅ:** ᑕᒃᑕ ᕗᐃᓐ ᐹᓗᑦ, ᐃᓕᓴᐃᔨᒪᕆᒃ, ᒪᑭᐅᓪ ᓯᓚᑐᓴᕐᕕᒃᔪᐊᖓ

**2013ᒥ ᑭᓕᓯᓂᐊᑐᓕᕆᔩᑦ:** ᕗᐃᓐ ᐹᓗᑦ, ᒪᐃᑯᓪ ᐱᑯᕐ (ᒍᒃᑖᖅ), ᐳᐊᕆᑦ ᓯᒻᓴᓐ (ᒍᒃᑖᖅ ᑭᓕᓯᓂᐊᕐᑎ) ᒪᐃᐅᓪᓴ ᐃᑭᓕᔅᒎᓐ, ᑯᕆᔅ ᐆᒥᓖᓐ (ᐊᓂᐊᕕᐅᖏᑐᕐᒥ ᒍᒃᑖᖅ) ᐃᓕᓂᐊᕐᑎ ᐃᔪᕐᑎ ᒪᑭᐅᓪᒥᑦ.

**2013ᒥ ᐱᓕᕆᓂᕆᓂᐊᕐᑕᕗᑦ:** ᐸᕐᓇᒃᓯᒪᔪᒍᑦ ᐊᐃᕆᓕ 5ᒥᑦ 17ᒧᑦ, ᐊᒪᓗ ᔪᓂ 28ᒥ ᔪᓚᐃ 10ᒧᑦ.

**2013ᒥ ᐱᓕᕆᕕᒋᓂᐊᕐᑕᕗᑦ:** ᔪᕆᑲᕐᐸᓯᒥ ᕘᓴᐃᒻ ᑲᖏᓱᖓᓂ, ᐃᐅᓪᔅᒥᐊ ᕿᑭᑕᖓᓂ ᓄᓇᖑᐊᑎᒍᑦ (80º00’N 85º95’W), ᐊᒪᓗ ᐃᒃᐱᑎᓴᓐ ᓯᔭᕆᒃᑐᕐᐸᓯᒥ, ᐊᑯᓪ ᕼᐊᐃᐳᒃ ᕿᑭᑕᖓᓂ (79º25’N; 90º45’W).

**ᑭᓇᐅᔭᖃᑎᓯᔩᑦ:** ᓱᓂᕐᓯᒪᖏᑐᓂ ᑭᓕᓯᓂᐊᕐᑐᓕᕆᔩᑦ ᒐᕙᒪᑐᖃᑯᓗ ᑭᓇᐅᔭᖃᑎᓯᔨᖏᑦ ᓯᓚᑐᓴᕐᕕᔪᐊᒥ ᖃᐅᔨᓴᕐᑎᐅᔪᓄᑦ ᐊᒪᓗ ᖃᐅᔨᓴᕐᑐᓄ ᓯᓚᐅᑉ ᐊᓯᔨᕐᓂᖓᓄᑦ ᓱᓂᑕᐅᔪᓄᑦ ᑲᓇᑕᐅᑉ ᐅᐊᓇᐸᓯᐊᓂᕐᒥᐅᓄᑦ ᓯᒃᔭᕐᐸᓯᒥᑐᓄᑦ ᑭᓇᐅᔭᖃᑎᓯᔩᑦ.

**ᑭᓱᒨᒪᖔᑦ.**
ᐱᓕᕆᐊᕗᑦ ᕿᓚᒥᑯᓗᒃ ᐱᔭᕆᔭᖏᑕᕗᑦ ᖃᐅᔨᓴᕋᑕ ᖃᓄ ᓯᓚᐅᑉ ᐊᓯᔨᕐᓂᖓ ᓱᓃᒪᖔᑦ ᕐᑯᑎᒃᑑᑉ ᐅᑭᐅᑕᕐᑐᖓᑕ ᕐᑯᐊᖑᐃᓇᓂᖏᓂᒃ ᐊᒪᓗ ᕐᑯᑎᒃᑑᑉ ᓄᓇᖓᑕ ᖃᓄᐃᓕᖓᓂᖏᓂᒃ. ᑐᕋᒐᓗᐊᑕᕆᔭᕗᑦ ᓱᓕ ᐊᓯᔨᖏᑐᑦ (1) ᐅᐊᓯᓗᑕ ᓯᓚᐅᑉ ᖃᓄᐃᑐᓂᖓᓂᒃ ᐊᔨᒋᖏᑐᓂ ᓄᓇᓂ (ᓲᕐᓗ ᓇᑎᕐᓇᒥᑐᑦ, ᖃᖃᐃᑦ, ᓯᔭᕐᐸᓯᖏᑦ, ᐃᒪᕐᓱᓚᐃᓗ) ᖃᐅᔨᓴᕐᓗᑕ ᑕᐸᓂ ᐊᔨᒌᖏᓂᖏᓂᒃ ᓄᓇᖏᑦ ᒪᓕᒃᓗᒋᑦ ᐊᒪᓗ ᖃᓄᑎᒋ ᓯᓚᖓ ᐊᓯᔨᕐᑎᒥᒪᖔᑦ, (2) ᓇᓗᓇᐃᓗᒋᑦ ᓱᓂᕐᓯᒪᖏᑐᑦ ᐊᒪᓗ ᓄᓇᒥ ᓯᑯᐃᑦ ᕐᑯᐊᖑᐃᓇᕐᑐᑦ, (3) ᓇᓗᓇᐃᓗᒋᑦ ᖃᓄᑎᒋ ᓱᑲᓂᖓᓗ ᓄᓇᖓᑕ ᐊᓯᔨᕐᓂᖓ ᐅᕐᑯᓯᕙᓕᐊᓂᖅ ᐱᓪᓗᒍ ᐊᐅᒃᐸᓕᐊᓂᖏᓗ ᕐᑯᐊᖑᐃᓇᕐᑐᑦ ᐊᒪᓗ (4) ᓄᓇᖑᐊᑎᒍᑦ ᓇᓗᓇᐃᕐᓗᒋᑦ ᑕᑯᐊ ᐊᓯᔨᕐᑐᑦ ᐊᕋᒍ ᕐᑯᓕ ᑖᒪᑦ. ᑐᕋᒐᕗᑦ 2ᒥ 3ᒥᓗ ᐱᒪᕆᐅᓗᐊᖑᐊᕐᑎᑕᕗᑦ ᐱᔪᑎᒥᓗᒍ ᕐᑯᐊᖑᐃᓇᕐᑐᑦ ᐊᐅᒃᐹᓕᕐᓯᒪᔫᓗᒃᒪᑕ ᐅᐃᕆᔭᑎᓂ 2011ᒥ 2012ᒥᓗ. ᑐᓴᕈᑏᑦ ᓄᐊᑕᕗᑦ ᑕᕙᓂ ᖃᐅᔨᓴᕐᓂᑎᓂ ᐃᑲᔪᕐᓂᐊᕐᑐᑦ ᑐᑭᓯᓇᓱᒍᑎᑎᓂᒃ ᖃᓄ ᓯᓚᐅᑉ ᐊᓯᔨᕐᓂᖓ ᐊᒪᓗ ᕐᑯᐊᖑᐃᓇᕐᑐᑦ ᐊᒃᑐᐃᓯᒪᒪᖔᑕ ᑕᒪᓇ ᐃᑲᔪᓂᖃᓂᐊᕐᒪᑦ ᓯᕗᓂᑎᓂ ᖃᓄ ᐊᓯᔨᓂᐊᕋᓱᒋᓇᐃᓂᐊᕐᒪᖔᑕ. ᑕᑯᓇᓂ ᖃᐅᔨᓴᕐᑕᑎᓂ ᓄᑕᕐᓂᒃ ᑐᓴᕈᑎᓂᒃ ᐊᑐᐃᓇᕈᑎᓯᔪᒍᑦ ᐱᔪᑎᓕᓂᒃ ᓯᓚᐅᑉ ᖃᓄᐃᑐᓂᖓᓂᒃ, ᕐᑯᐊᖑᐃᓇᕐᑐᑦ, ᓄᓇᒥ ᓯᑯᐃᑦ ᐊᒪᓗ ᐊᐅᒃᐸᓕᐊᔪᑦ ᕐᑯᐊᖑᐃᓇᕐᓂᑯᐃᑦ.

**ᖃᓄᐃᓕᖓᓕᒪᖔᑕ ᐅᓂᑳᖓ - 2012ᒥ ᑕᐸᓂ ᐱᓕᕆᓂᕆᓚᐅᑕᕗᑦ.**
2012ᒥ ᑕᐸᓂ ᐱᓕᕆᓗᑕ ᐱᓕᕆᐊᕆᓗᐊᑕᓚᐅᑕᕗᑦ ᐱᖓᓱᐃᑦ ᓄᓇᐃᑦ ᖃᓂᒋᔮᓂ ᔪᕆᑲᒥ ᓯᓚᐃᑕ ᓯᒃᔭᕆᒃᑕᕐᒥ. ᐅᕙᖓᓕ ᔪᕆᑲᐅᑉ ᓯᓚᓂᐊᕐᕕᖓᑕ ᑐᖃᑕᕐᕕᖓᓂᓚᐅᑐᖓ ᐅᓗᓂ ᕐᑯᓕᓂᒃ ᑕᐃᑲᓂᓗ ᕿᖑᒥᓕᕐᓗᖓ ᓄᓇᒥ ᐊᒪᓗ ᖃᐅᔨᓴᕈᑎᒃᓴᓂᒃ 17ᓂᒃ ᓄᑖᓂᒃ ᐊᐅᒃᐸᓕᐊᔪᓂᒃ ᐱᓪᓗᖓ 3 ᑭᓛᒥᑕᓂᒃ ᐅᖓᓯᖕᓂᓕᒃ ᐊᕙᑎᓕᕆᔨᑦ ᓯᓚᓂᐊᕐᕕᖓᑕ. ᓂᓚᓂᒃ ᖃᐅᔨᓴᕐᑕᐅᔪᒃᓴᓂᒃ ᓄᐊᑕᐅᔪᖃᓚᐅᑐᖅ ᓇᓗᓇᐃᑕᐅᕐᑯᓗᒍ ᓄᓇᒥᑑᑉ ᓂᓚᐅᑉ ᐱᒋᐊᕐᕕᕕᓂᖓ ᐊᒪᓗ ᖃᓄᑎᒋ ᓯᑯᖃᑎᒥᒪᖔᑦ. ᐊᐅᓚᔪᓯᖓ ᓄᓇᒥ ᓯᑯᖏᓇᕐᑐᖅ ᐊᒪᓗ ᐊᒃᑐᐊᓂᖓ ᑲᑕᐸᓕᐊᖃᑕᕐᑐᑦ ᓄᓇᐅᑉ ᖄᖓ ᐊᒃᑐᐊᓂᖃᓚᕆᒃᑐᖅ ᖃᓄᐃᑐᓂᖓᓂᒃ ᖃᓄᑎᒋ ᐊᖏᑎᒋᒪᖔᑦ ᓂᓚᒃ ᓄᓇᒥᑐᖅ. ᔪᕆᑲᕐᐸᓯᒃ ᓱᓂᕐᑕᐅᓴᕋᐃᒪᑦ ᐊᐅᐸᓕᐊᔪᑦ ᕐᑯᐊᖑᐃᓇᕐᑐᑦ ᐱᔪᑎᒥᓗᒍ ᐅᓄᕐᒪᑕ ᐊᖏᔪᓗᑎᒃᓗ ᓄᓇᒥᑐᑦ ᓂᓚᐃᑦ. ᓄᓇᒥᑐᑦ ᓂᓚᐃ ᐃᔪᓂᖃᑐᑦ (3ᒥᑦ 10ᒦᑕᓄᑦ) ᐊᑕᖏᐸᓗᑲᓴᑎᐊᕐᓗᓂ (80ᐳᓴᒥᑦ 90ᐳᓴᒧᑦ) ᓯᑰᔪᖅ 1ᒥᑦ 4ᒥᑕᓄᑦ ᑕᕆᐅᒥᐅᑕᐅᓂᖃᑐᖅ. ᐱᓕᕆᐊᕋ ᔪᕆᑲ ᓴᐅᓐ ᓇᑎᕐᓇᖓᓂ ᐊᕋᒍᔪᓂ ᐊᕙᑏᑦ ᐅᖓᑖᓄᑦ ᓇᓗᓇᐃᓯᓯᒪᔪᖅ ᐅᓄᖏᓛᑦ ᕐᑰᑦ ᐊᑐᓂ ᐊᖏᔪᑲᓚᕈᓗᒥ ᓄᓇᒥᑐᓂᒃ ᓂᓚᖕᓂᒃ ᑕᒪᓇ ᓇᓗᓇᐃᓯᔪᖅ ᐱᒪᕆᐅᓂᖓᓂᒃ ᖃᖓᑕ ᖃᓂᒌᔮᕐᓂᑐᑦ ᓯᑯᐃᑦ. ᐃᓄᖃᖏᑐᕐᒥᑦ ᖃᖓᑕᕐᑎᑕᐅᓯᒪᔪᑯᑦ ᕐᑯᓖᓂᑦ 2012ᖑᑎᓗᒍ ᓇᓗᓇᐃᓯᓚᐅᑐᖅ ᖃᐅᔨᒪᔭᐅᖏᑐᑦ ᕐᑯᐊᖑᐃᓇᕐᓂᑯᐃᑦ ᐊᐅᖕᓃᑦ, ᓲᕐᓗ ᐊᕙᑎᓕᒫᖓ ᓯᓚᐃᑕ ᓯᒃᔭᕆᒃᑑᑉ ᐊᒪᓗ ᓯᕿᓂᕐᐸᓯᐊᓂ ᕘᓴᐃᒻ ᓄᕗᐊᓂ (40 ᑭᓛᒥᑕᒥᒃ ᐅᖓᓯᖕᓂᓕᒃ ᔪᕆᑲᒥᑦ) ᐱᑕᖃᓚᐅᑐᖅ 250 ᐅᖓᑖᓂᑐᓂᒃ ᐊᐅᒃᓂᑯᓗᑎᒃ ᐃᓗᑐᕐᓯᒪᔪᑦ ᐊᐅᕋᑖᕐᓂᑯᐃᑦ. ᐅᓄᓛᖑᓗᐊᑐᑦ

ᐊᐅᓂᑯᐃᑦ ᑕᐸᓂ 91ᖑᓚᐅᓯᒪᔪᑦ 1998ᒥ. ᑕᒪᓇ ᐱᓪᓗᒍ ᐱᒋᐊᕐᑎᓯᓕᓚᐅᑐᒍ ᐅᐸᒃᑕᐅᓯᒪᖏᑐᕐᒥᒃ ᐅᐊᓯᔪᑎᒥᒃ ᐊᕿᓯᓗᑕ. ᐱᔭᓇᓯᓚᐅᑐᑦ ᖃᖓᑦᑎᑕᐅᓯᒪᔪᑯᑦ ᐊᔨᖑᐊᓂᒃ ᔪᓚᐃ 2012ᖑᑎᓗᒍ ᐊᒪᓗ ᔪᓚᐃᖑᑎᓗᒍ ᓯᑎᐱᕆᒥᓗ 2011ᖑᑎᓗᒍ, ᑕᑯᐊ ᐊᔨᖑᐊᑦ ᐊᑐᕐᑕᐅᓛᕐᑐᑦ ᓄᓇᖑᐊᑎᒍᑦ ᓇᓗᓇᐃᓗᒋᑦ ᓯᑯᐃᑦ ᐊᐅᒃᐸᓕᐊᔪᑦ ᑲᔪᓯᒪᖖᑕ ᐊᒪᓗ ᓱᑲᓂᖓᓂ ᐊᓯᔾᕐᐸᓕᐊᓂᖓᑕ ᓇᓚᐅᕝᕐᓗᑕ.
2012ᖑᑎᓗᒍ ᑕᐸᓂᓚᐅᑐᖓ ᐊᐃᕆᓕ 4ᒥᑦ 11ᒧᑦ ᐊᒪᓗ ᔪᓂ 25ᒥᑦ ᔪᓚᐃ 7ᒧᑦ. ᐊᐃᕆᓕᒥ ᐱᓕᕆᐊᕋ ᑕᐸᓂ ᑕᐳᑖᑦ ᓯᑯᑦ ᓄᓇᖓᓂ ᓄᓇᖑᐊᓄᖃᐃᓗᖓ ᓯᑯᓂᒃ ᐊᒪᓗ ᑰᖑᕐᓂᑯᓂᒃ ᐃᒃᐱᑎᓴᓐ ᓯᒃᔭᕆᒃᑐᕐᒥ ᐊᒪᓗ ᔪᕆᑲᕐᐸᓯᒥ, ᓄᐊᑎᓂᑦ ᓯᓚᐅᑉ ᖃᓄᐃᑐᓂᖓᑕ ᑎᑎᕋᓯᒪᔪᓂᒃ ᐊᒪᓗ ᓄᐊᑎᓂᕐᐳᑦ ᓂᓚᒥᑦ ᑐᐊᐸᖕᓂᒃ ᐊᒪᓗ ᒪᓂᕋᒥᑦ ᓯᑯᓂᒃ. ᔪᓚᐃᒥ ᐱᓕᕆᐊᕋ ᐃᓗᓕᖃᓚᐅᒥᔪᖅ ᑕᐳᑖᑦ ᓯᑯᑦ ᓄᓇᖓᑕ ᕿᖑᒥᒐᕐᓂᒃ ᑰᕝᐱᐅᔪᓂᒃ ᐊᒪᓗ ᐊᖏᔪᑎᐅᔪᑦ ᓯᑯᖃᓂᐅᔪᑦ, ᖃᐅᔨᓴᕐᑕᐅᔫᒃᓴᓂᒃᓗ ᓄᓇᒥᑦ ᓯᑯᓂᑦ ᐊᒪᓗ ᖃᖓᑦᑎᑕᐅᓯᒪᔪᑯᑦ ᕿᖑᒥᒐᕐᓗᑕ. 2011ᖑᑎᓗᒍ ᓇᓗᓇᐃᓯᓚᐅᑐᑦ ᓯᑯᑦ ᑰᖕᓂᒃ ᐱᒪᕆᐅᓇᓱᒥᓗᒥᑦ ᓯᓚᐅ ᐊᓯᔾᕐᓂᖓᓄᑦ ᐊᐅᒃᑎᑕᐅᓇᓱᒥᓗᒥᑦ, ᑭᓯᐊᓂ 2012ᖑᑎᓗᒍ ᓇᓗᓇᐃᓚᐅᑕᕗᑦ ᖃᐅᔨᒐᑕ ᑰᒃᑐᓖᓗᓂᒃ ᓯᑰ ᖃᖓᒍᑦ ᐅᓄᕐᑐᓂᒃ. ᑕᕝᕙ ᖃᐅᔨᓴᕐᑕᑎᓂ ᐊᔨᒋᖏᑐᓂᒃ ᖃᐅᔨᓴᕈᑎᓂᒃ ᐊᑐᓚᐅᑐᑦ ᓲᕐᓗ ᑕᐳᑖ ᖃᐅᔨᓴᕈᑎᓂᒃ ᐊᒪᓗ ᑰᒃᑐᓂᒃ ᓇᓗᓇᐃᓯᓗᑕ ᑎᑎᕋᕐᓗᒥᑦ 10ᒥᑦ 15ᒧᑦ ᐅᒃᑐᑎᑯᓗᓂᒃ ᓯᓐᑎᒥᑕᓂᒃ ᐃᑎᓂᓕᓂᒃ ᑰᒃᓂᒃ ᓯᑯᑦ ᐊᒪᓗ ᓄᑖᕐᓂᒃ ᑯᓕᕐᓂᑯᓂᒃ ᐊᓂᒍᕐᑐᓂ ᐊᕋᒍᓂᒃ ᒪᕈᓂᑦ ᐱᖓᓱᓄᑦ.

**2013ᒥ ᐱᓕᕆᐊᕆᓛᕐᑕᕗᑦ.**
ᓯᓚᒧᑦ ᐊᓯᔾᕐᐸᓕᐊᓂᐅᔪᖅ ᐱᒪᕆᐅᓂᕐᐹᖑᕗᖅ ᐊᕙᑎᒧᑦ ᐊᓯᔾᕈᑕᐅᔪᓂᒃ ᐅᐊᖕᓇᕐᐸᓯᕐᒥᒃ ᐅᓪᓗᒥ. ᓄᑖᕐᒥᒃ ᑲᔪᓯᑎᓯᕙᓕᐊᓕᕐᒥᔪᖓ ᑭᓕᓯᓂᐊᑐᓕᕆᔨᑯᑦ ᑭᓇᐅᔭᕐᑕᕝᕕᖏᓂᑦ ᑭᓇᐅᔭᖃᑎᑕᐅᓗᑕ ᑕᒪᓇᓗ ᑕᐃᒪᐃᑐᓂᖓᓄᑦ ᓴᕿᑎᓯᔭᕆᐊᖃᓂᕗᑦ ᐊᖏᓂᕐᓴᐅᕗᖅ ᐅᒃᑐᖃᑕᕆᐊᖃᓂᖅ ᓱᓂᕐᑕᐅᓯᒪᔪᓂᒃ ᓯᓚᐅ ᐊᓯᔾᕐᓂᖓᓄᑦ ᐅᔨᕆᑐᐃᓇᖏᓗᒥᑦ ᑕᒪᑯᐊ ᐊᓯᔾᕐᓂᐅᔪᑦ. ᑐᕋᖓᓗᐊᑕᕆᔭᕋ 2013ᒥ ᐱᓕᕆᓂᕋ ᑕᐸᓂ ᖃᐅᔨᓴᕈᒪᓗᖓ ᖃᓄ ᓯᓚᐅ ᐊᓯᔾᕐᓂᖓ ᓱᓃᒪᖖᑦ ᓄᓇᖓ ᓯᑯᓕᓛᓗᖕᒥ ᐊᒪᓗ ᐱᓗᐊᕐᑐᕐᒥᒃ ᖃᓄᑎᒋ ᐊᐅᐸᓕᐊᔪᑦ ᓯᑯᐃᑦ ᓱᑲᑎᒋᔪᕐᒥᒃ ᐊᓯᔾᕐᑐᐃᓇᕆᐊᖃᒪᖖᑕ. ᑭᓕᓯᓂᐊᕈᑎᒋᔪᒪᔭᕗᑦ ᒪᕈᐃᓕᖃ-ᖓᓂᐊᕐᑐᖅ ᐅᑯᐊᒃ ᖃᐅᔨᓇᓱᓗᐊᑕᕐᓗᒥᒃ: (1) ᖃᐅᔨᓴᕐᓗᒥᑦ ᑕᐃᒪᐃᓕᖓᔪᑐᖃᕕᓃᑦ ᐊᓯᔾᕐᐸᓕᐊᓂᖏᑦ ᖃᓄ ᐊᒃᑐᐊᓂᖃᒪᖖᑕ ᖁᐊᖑᐃᓇᕐᑐᓂᒃ ᐊᒪᓗ ᐊᐅᐸᓕᐊᔪᕐᓂᒃ, ᐊᒪᓗ (2) ᓯᑰᑉ ᖃᖓᒍᑦ ᑰᒃᑐᑦ ᐊᓯᔾᕐᐸᓕᐊᓂᖓ ᐱᑐᐃᓇᐅᖏᓂᖓ. ᐃᔨᒋᓗᐊᑕᕐᓂᐊᕐᑕᕗᑦ ᑕᒪᐃᓂ ᖃᐅᔨᓴᕐᓂᕆᔭᑎᓂ ᐅᒃᑐᕐᓗᒥᑦ ᐊᓯᔾᕐᐸᓕᐊᔪᑦ ᐊᐅᒪᓂᐅᔪᕐᓂ ᓇᓗᓇᐃᕐᓗᒥᓗ ᐊᒃᑐᐊᓂᖏᑦ ᓯᓚᒧᑦ, ᐊᐅᒪᓂᖅ ᖁᐊᖑᐃᓇᕐᑐᓗ. ᑕᐸᓂ ᐱᓕᕆᐊᕗᑦ ᐃᒃᐱᑎᓴᓐ ᓯᔭᕆᒃᑐᕐᒥᓂᐊᕐᑐᖅ ᐊᑯᓪ H ᐊᐃᐳᒃ ᕿᑭᑕᖓᓂ ᓄᓇᖑᐊᑎᒍᑦ (79º25’N; 990º43’W) ᐊᒪᓗ ᔪᕆᑲᕐᐸᓯᒥ ᐃᐅᕐᓴᒥᐊ ᕿᑭᑕᖓᓂ ᓄᓇᖑᐊᕐᑎᒍᑦ (79º59’N; 85º45’W). ᑕᑯᐊ ᓂᕈᐊᕐᑕᐅᓚᐅᓯᒪᔪᑦ 2012ᒥ ᐱᔪᑎᒋᓗᒍ ᐊᔨᐸᓱᒋᒪᒋᑦ ᐊᓯᖏᑕ ᐊᕙᑎᖓᑕ, ᐅᐸᒐᕐᓂᕙᓗᑎᒃᓗ, ᐱᒋᐊᕐᕕᕕᓂᖏᓗ ᖃᐅᔨᓴᕐᑕᐅᓂᖏᑕ ᐱᔭᒃᓴᐅᓗᑎᒃ, ᐊᒪᓗ ᑕᐃᑲᓂᓗ ᖃᐅᔨᓴᕐᕕᓄᖓᔪᓂᒃ ᐊᑐᐃᓇᐅᔪᖃᕙᓂ. ᐊᑯᓂ ᐱᓕᕆᐊᕋ ᑕᐸᓂ ᑕᑯᓇᓂ ᓄᓇᓂ ᐅᒃᐱᓇᕐᑐᕗᑦ ᖃᐅᔨᒋᐊᕈᑕᐅᔪᓇᕙᓗᑎᒃ ᖃᓄᐃᓂᓴᐅᓚᒫᖓᑦ. ᖃᐅᔨᓴᓂᐊᕐᑕᕋ ᓇᓗᓇᐃᓯᒪᔭᑲ ᖁᐊᖑᐃᓇᕐᑐᑦ ᓱᓂᑕᐅᓴᕋᐃᓂᖏᑦ ᐅᖁᓯᕙᓕᐊᔪᕐᒧᑦ ᓇᓗᓇᐃᓗᒋᑦ ᖄᕐᐸᓯᐊᓂᑐᖅ ᐊᐅᐸᓕᐊᓂᖓᑕ ᖃᓄᐃᑐᓂᕆᓕᕐᑕᖓ ᐱᑐᐃᓇᐅᖏᑐᑯᑦ ᖃᐅᔨᓴᕈᑎᒋᓗᒋᑦ ᓄᓇᖓᑕ ᐊᐅᒃᐸᓕᐊᓂᖓ? (3) ᖃᓄᑐᒋ ᐊᓯᔾᕐᑎᒋᔭᓇᕐᒪᖖᑦ ᐊᐅᒪᓂᖓᑕ ᐃᑎᓂᖓ ᐊᐅᒃᐸᓕᐊᔪᖅ ᓄᓇᒥᑐᖅ ᓯᑯ ᑲᔪᓯᔭᓇᒪᖖᑦ? ᐊᒪᓗ (4) ᖃᓄ ᓯᑰᑉ ᖃᖓᒍᑦ ᐅᓄᕐᓯᓱᖑᒪᖖᑕ ᑰᒃᑐᑦ ᓱᑲᔪᐊᓗᒥᒃ ᐊᐅᒃᑐᐃᓇᐅᔭᓇᒪᖖᑦ? ᑕᑯᐊ ᐱᖓᓱᐃᑦ ᐱᓕᕆᐊᒃ ᐸᕐᓇᒍᑎᒋᓯᒪᔭᕗᑦ 2013ᒥ, ᐃᓗᓕᖃᕆᓗᓂ (ᐃ) ᑎᑎᕋᓯᒪᑎᐊᕐᑐᓂᒃ ᖃᐅᔨᓴᕈᑎᕕᓂᕐᓂᒃ ᐊᐅᒪᓂᐅᔪᑉ ᖃᓄᐃᑐᑯᖃᑦᑕᕐᓂᖓᓂᒃ ᐊᒪᓗ ᐅᕐᑯᓂᖓᑕ ᓇᓴᐅᑎᖏᓂᒃ ᕿᑎᖓᓂᓗ ᐊᐅᔭᐅᑉ ᐃᒪᕈᔪᐃᑦ ᐊᓯᔾᕐᓂᕆᖃᑦᑕᖏᓂᒃ. ᑕᒪᓇ ᐃᓗᓕᖃᓂᐊᕐᒥᔪᖅ ᐅᔭᕋᒃᓂᒃ ᓄᐊᑎᓂᖅ ᐊᒪᓗ ᓯᑯᐃ ᖃᐅᔨᓴᕐᑕᐅᔫᒃᓴᐃᑦ ᐊᐅᒪᓂᕐᒥ ᖃᖓᓂᑦ ᓂᓚᐃᑦ, ᐊᒪᓗ (ᑎ) ᑲᔪᓯᓗᑕ ᖃᖓᑦᑎᑕᐅᓯᒪᔪᑯᑦ ᕿᖑᒥᒐᓂᐅᔪᖅ ᐊᓯᔾᕐᐊᓕᐊᔪᓂᒃ ᕗᓴᐃᑉ ᓄᕗᐊᓂ.

**ᐱᒪᕆᐅᓂᖓ:**
ᑕᒪᓇ ᑭᓕᓯᓂᐊᕈᑎᒋᔭᕗᑦ ᐱᒪᕆᐅᓗᓂ ᐊᕐᑯᓯᐅᕆᕙᖅ ᑐᑭᓯᐅᒪᓂᕐᒥᒃ ᖁᐊᖑᐃᓇᕐᑐᓂᒃ ᖁᑎᒃᑐᕐᒥ. ᐱᕕᖃᑎᓯᔪᖅ ᓄᑖᕐᓂᒃ ᖃᐅᔨᔭᐅᕙᓕᐊᔪᓂᒃ ᓇᑭ ᐱᒋᐊᕐᓂᒪᖖᑕ ᐊᒪᓗ ᖃᓄ ᓄᑕᐅᖏᑎᒋᒪᖖᑕ ᑕᒪᑯᐊ ᖁᐊᖑᐃᓇᕐᑐᑦ, ᓱᑲᓂᖓᓗ ᐊᓯᔾᕐᐸᓕᐊᓂᐅᑉ ᐊᒪᓗ ᐊᑦᕐᓇᑐᑐᐃᓇᕆᐊᖃᓂᖏᑦ ᓯᑯᒥᒃ ᑐᖓᕕᓖᑦ ᓄᓇᐃᑦ. ᐊᖏᔪᓂᖓ ᐅᖁᓯᕙᓕᐊᓂᐅᑉ ᖁᑎᑐᕐᒥ ᐱᒪᕆᐅᓗᓂ ᓱᓂᓂᐊᕐᔾᕐᔫ ᑕᒪᐃᓂᒃ ᐊᕙᑎᖓᓂᒃ ᐊᒪᓗ ᑭᓕᓯᓂᐊᓂᕐᒧᑦ ᖃᐅᔨᓴᕐᓂᒧᑦ ᓄᓇᐃᑦ ᐊᕿᓯᒪᓂᖏᓂᒃ ᖁᑎᒃᑐᕐᑲᓯᒥ. ᑕᒪᓇ ᐱᓕᕆᐊᕗᑦ ᐱᒪᕆᐅᓂᕐᓴᐅᕗᖅ ᐱᔪᑎᒋᓗᒍ ᐅᔭᕐᖃᓯᐅᕐᑏᑦ ᕿᓂᕈᒪᔪᑦ ᐱᔪᑎᒋᓗᒋᑦ ᑕᐸᓂ ᖁᑎᒃᑐᕐᑲᓯᒥ.