2010 Nunavut Research Licence Renewal Application: Wayne Pollard

Research Licence #0200809R-M (multiyear)

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

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

2010 Research Team: Wayne Pollard (McGill U.), Miles Ecclestone (Trent U.), Chris Omelon (McGill U.), Rebecca Ghent and Dave Leverington (U of Toronto) and 2 student field assistants from McGill

2010 Fieldwork: Two weeks of fieldwork are scheduled: April 7-15 and July June 1-10, 2010.

2010 Field sites: Eureka area on the Fosheim Peninsula, Ellesmere Island (80º 00'N 85º95'W), Expedition Fiord area, Axel Heiberg Island (79º 25'N; 90º 45'W).

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

Introduction.
This project examines how climate change is affecting high Arctic permafrost conditions and high arctic landscapes. The main aims of this project are: (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 from for the period 2007-2011. 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 conditions ground ice and thermokarst.

Progress Report – 2009 Fieldwork.
In 2009 field activities were undertaken from April 10-20 and July 1-5. April fieldwork involved geophysical mapping of ground ice in the Expedition Fiord and Eureka areas, collection of climate data at both sites and the collection of frozen sediments and ground for thaw sensitivity analyses. In July a small group of McGill researchers and students conducted additional dGPS , climate, stratigraphic and ground radar studies at Expedition Fiord on Axel Heiberg Island. We also conducted a short (3 day) survey of thaw sites near Eureka as well as detailed mapping of a site that we have been monitoring for the past 3 years. We continued our detailed study of melting permafrost near Eureka by monitoring summer conditions inside a thaw slump and comparing it with conditions outside. Our data showed significant melting of permafrost. An ongoing study of ice wedges in the Expedition Fiord area indicates that the pattern of ice wedge development is related to geology, ground ice content within permafrost and age of surface. In this study we used different survey tools like radar and electrical profiling to assess the subsurface conditions. Over the past 2 years we have documented a marked deepening of ice wedge troughs and areas of new subsidence. In 2009 this project involved a total of 60 field days (4 persons over 15 days).

2010 Field Program.
Climate change is the most significant environmental challenge facing the North. However, there remains uncertainty about the specific impacts it will have on polar landscapes and geomorphic processes. Despite reports that predict regional melting of ice-rich permafrost, there is currently insufficient information about the nature and distribution of ground ice to produce any realistic estimates of response. The primary aim for 2010 is to determine how climate change will affect ice-rich permafrost and in particular how rates of thermokarst may change. We plan to: (1) evaluate thaw vulnerability based on the analysis of surface conditions, ground ice contents and distribution, and summer temperature patterns, (2) relate massive ice distribution and ice-content profiles to paleo-environmental conditions (i.e. ice genesis, thaw unconformities) and (3) determine the role of microclimate in retrogressive thaw slump activity. Fieldwork will be undertaken at 5 sites near Eureka and will involve direct observation and analysis of the microclimate, active layer, permafrost temperatures, and ground ice conditions associated with 2 retrogressive thaw slumps. We will undertake detailed analysis of rates of retreat (dGPS) and develop numerical models based on microclimatic data from 2 Campbell automatic weather stations, one placed inside and the other outside the slump. Additional instrumentation (radiometers, RH-temperature sensors and wind monitors will be placed at the ice face. Permafrost and ground ice conditions will be mapped from natural exposures and using geophysical surveys. We will continue our study of the relationship between polygonal ground and geological conditions. By analysing polygon size and geometry for sites of different age and characterized by different geological and ice content conditions he will determine the primary controls on polygon formation. Another long-term study involves collecting data on the climate variation in the Expedition Fiord area based on data from a network of 7 automatic weather stations. These stations collect data for a range of topographic and geomorphic settings along an environmental gradient from the accumulation zone of the White Glacier to the mouth of Expedition Fiord (a 50km transect), including stations at the head and terminus of the White glacier, Colour Lake, sites in Expedition Valley and Finger Peninsula.

Significance:
We have made significant inroads into the understanding of permafrost and cryostratigraphy studies in the Eureka Sound Lowlands and Expedition fiord areas. This research has provided new insights into the origin and age of permafrost systems, rates of change and the potential vulnerability of ice cored landforms.. Our findings indicate a close relationship between ground ice and Holocene sea levels.

Translation by Susan Salluviniq, Resolute Bay

2010ᒥ ᓄᓇᕗᑦᑎ ᑭᓪᓯᓂᐊᓂᒧᑦ ᐱᔪᓇᐅᑎᒧᑦ ᓄᑕᐅᓕᕈᑎᒃ: ᑐᐃᓐ ᐹᓗᑦ

ᑭᓪᓯᓂᐊᓂᒧᑦ ᐱᔪᓇᐅᑎᖃᑕ ᓇᓴᐅᑖ 0200809R-M (ᐊᕐᒍᓄᑦ ᐊᒥᓱᓄᑦ)

ᐱᓕᕆᐊᒪ ᑕᐃᔭᐅᔪᓯᐊ: ᖃᐅᔨᓴᕐᓗᖓ ᓱᓂᕐᑕᐅᓴᕐᐃᑐᓂᖓ ᕿᑎᒃᑑᑉ ᕿᐊᖑᐃᓇᓂᖓ ᓯᓚᐅᑉ ᐊᓯᐅᕐᐸᓕᐊᓂᖓᓄᑦ

ᖃᐅᔨᓴᕐᑎᓗᐊᑕᖅ: ᓗᒃᑖᖅ ᑐᐃᓐ ᐹᓗᑦ, ᐃᓕᓴᐃᔨᒪᙳᒃ, ᒪᑭᐅᓪ ᓯᓚᑐᓴᕐᕕᔪᐊᖅ

2010ᒥ ᑭᓪᓯᓂᐊᕐᑎᐅᓂᐊᕐᑐᑦ: ᑐᐃᓐ ᐹᓗᑦ (ᒪᑭᐅᓪ ᓯᓚᑐᓴᕐᕕᔪᐊᖓ), ᒪᐃᐅᓪᓴ ᐃᑭᓪᓴᑐᓐ (ᑐᙳᑦ ᓯᓚᑐᓴᕐᕕᔪᐊᖅ) ᑯᙳᔅ ᐆᒥᓖᓐ (ᒪᑭᐅᓪ ᓯᓚᑐᓴᕐᕕᒃᔪᐊᖓ), ᙵᐱᑲ ᑮᐃᑦ ᐊᒪᓗ ᑕᐃᕙᑎ ᓕᑐᙵᖅᑖ (ᓯᓚᑐᓴᕐᕕᔪᐊᖓ ᑐᕐᓐᑐ) ᐊᒪᓗ ᒪᕉᒃ ᐃᓕᓂᐊᕐᑏᑦ ᑕᐸᓂ ᐃᑲᔪᑎᐅᓂᐊᕐᑐᖅ ᒪᑭᐅᓪᒥᖕᒐᕐᑑᒃ

2010ᒥ ᐱᓕᕆᐊᙳᓂᐊᕐᑕᑯᑦ ᑕᐸᓂ: ᒪᕈᓂ ᐱᓴᓱᐊᕈᓰᓂ ᐊᕿᓯᒪᔭᑯᑦ ᐃᒪᓇ: ᐊᐃᙳᓕ 7ᒥᑦ 15ᒧᑦ ᐊᒪᓗ ᔪᓚᐃᒥ ᔪᓂᒥᓗ 1ᒥᑦ 10ᒧᑦ, 2010ᒥ.

2010ᒥ ᐱᓕᕆᐊᒃᓴᑯᑦ: ᔪᙳᑲᕈᔪᒥ ᑐᓰᓐ ᓄᑐᐊᓂ, ᐃᐅᓪᓴᒥᐊ ᕿᑭᑕᖓᓂ (ᓄᓇᖑᐊᑎᒍᑦ 80º 00'N 85º95'Wᒥᑐᖅ), ᐃᒃᐱᑎᓴᓐ ᓯᔭᙳᑐᕐᐸᓯᐊᓂ, ᐋᒃᓱᓪ Hᐊᐃᐳᒃ ᕿᑭᑕᖓᓂ (ᓄᓇᖑᐊᑎᒍᑦ 79º 25'N; 90º 45'Wᒥᑐᖅ).

ᑭᓇᐅᔭᖃᕐᑎᓯᔨᐅᔪᑦ: ᐱᕈᑲᓂᕈᓇᑐᓄᑦ ᑭᓪᓯᓂᐊᑎᓄᑦ ᑭᓪᓯᓂᐊᕐᑎᒪᙳᓄᓗ ᑲᑎᒪᔨᐅᔪᑦ ᐊᒪᓗ ᐋᒃᑎᒃ ᑲᑐᔨᖃᑎᒋᑯᓂᑦ.

ᑭᓱᒎᖅᒪᖕᖓᑦ.
ᐅᓇ ᐱᓕᕆᐊᙳᔪᒪᔭᑯᑦ ᖃᐅᔨᓴᓂᐅᓂᐊᕐᑐᖅ ᓯᓚᐅ ᐊᓯᐅᕐᓂᙳᔭᖓᓂᒃ ᓱᓃᖅᒪᑦ ᕿᑎᑐᕐᒥᑐᐃᑦ ᕿᐊᖑᐃᓇᕐᑐᖓᓂᒃ ᐊᒪᓗ ᕿᑎᒃᑑᑉ ᓄᓇᖓᓂᒃ. ᑐᕋᖓᓗᐊᑕᙳᔭᑯᑦ ᐅᑯᐊᖑᔪᑦ (1) ᐅᐊᓯᓗᑕ ᓯᓚᐅ ᖃᓄᐃᑐᓂᙳᔭᖓᓂᒃ ᓄᓇᐃ ᐃᓱᒪᒋᓗᒋᑦ (ᓲᕐᓗ ᓄᓇᖓ, ᖃᖃᖏᑦ, ᓯᒃᔭᖏᑦ, ᐃᒪᕐᓱᖏᑦ) ᐊᒪᓗ ᖃᐅᔨᓴᕐᑕᑯᑦ ᑎᑎᕋᐅᓯᙳᓗᒋᑦ ᖃᓄᐃᓕᖓᓕᕐᓂᖏᑦ ᓄᓇᓕᖓᑕ ᓯᓚᖓᓄ ᐊᓯᐅᕐᓂᖏᑦ ᐊᒪᓗ ᖃᓄᑎᒋ ᐊᓯᐅᕐᑎᒋᒪᖔᑦ, (2) ᖃᓄᐃᓕᖓᓕᓂᖓ ᓱᓂᕐᓯᒪᖏᑐᖅ ᐊᒪᓗ ᖃᓄᑎᒋ ᒪᓂᕋᒥᑐᖅ ᕿᐊᖑᐃᓇᕐᑐᖅ, (3) ᖃᓄᑎᒋ ᐊᒪᓗ ᓱᑲᓂᙳᔭᖓ ᓄᓇᖓᑕ ᐊᓯᐅᕐᓂᖓ ᓱᓂᕐᑕᐅᔪᖅ ᐅᕿᓯᕙᓕᕐᓂᒧᑦ ᐊᒪᓗ ᐊᐅᒃᐸᓕᐊᓂᖓᓄᑦ ᕿᐊᖑᐃᓇᕐᑐᑦ, ᐊᒪᓗ (4) ᓄᓇᖑᐊᑎᒍᑦ ᓇᓗᓇᐃᓗᒋᑦ 2007ᒥᓂᑦ 2011ᒧᑦ. ᑕᑯᐊ ᑐᓴᕈᐃᑦ ᓄᐊᑕᐅᕙᓕᐊᔪᑦ ᑕᕙᓂ ᖃᐅᔨᓴᕐᓂᕐᒥ ᐃᑲᔪᕐᐸᓕᓂᐊᕐᑐᑦ ᐅᕙᑎᓂᒃ ᑐᑭᓯᐅᒪᓂᑎᓂᒃ ᖃᓄ ᓯᓚᐅ ᖃᓄᐃᑐᓂᖓ ᐊᒪᓗ ᕿᐊᖑᐃᓇᕐᑐᑦ ᖃᓄᐃᖃᑕᕐᒪᖕᖓᑕ ᑕᐃᒪᐃᒪᑯᑕ ᑕᒪᓇ ᐃᑲᔪᕐᐸᓕᕈᓇᑐᖅ ᓯᕗᓂᑎᓂ ᖃᓄᐃᓕᓂᐊᕐᓱᒋᔭᑎᓂᒃ ᐅᖃᕈᓇᓂᕐᓴᐅᕐᑯᓗᑕ. ᑕᑯᑎᒍᓇᖅ ᖃᐅᔨᓴᕈᑎᑎᒍᑦ ᐊᑐᐃᓇᕈᑎᓯᔪᒍᑦ ᓄᑖᓂᒃ ᑐᓴᕈᑎᓂᒃ ᖃᓄᐃᑐᓂᖓᓂ ᓯᓚᐅᑉ, ᕿᐊᖑᐃᓇᕐᑐᓗ ᓄᓇᒥ ᖃᓄᐃᒪᖕᖓᑕ ᐊᒪᓗ ᐊᐅᒃᐸᓕᐊᔪᑦ ᕿᐊᖑᐃᓇᕐᑐᑦ.

ᖃᓄᐃᓕᖓᓕᓂᕐᙳᔭᑕ ᐅᓂᑳᖓ - 2009ᒥ ᐱᓕᕆᐊᕗᑦ.
2009ᖑᑎᓗᒍ ᐱᓕᕆᓚᐅᑐᒍᑦ ᐊᐃᙳᓕ 10ᒥᑦ 20ᒧᑦ ᐊᒪᓗ ᔪᓚᐃ 1ᒥᑦ 5ᒧᑦ. ᐊᐃᙳᓕᒥ ᐱᓕᕆᐊᕗᑦ ᓄᓇᖑᐊᓕᕆᓂᐅᓚᐅᑐᖅ ᒪᓂᕋᒥ ᓯᑯᐃᑦ ᓇᓗᓇᐃᓗᒋᑦ ᐃᒃᐱᑎᓴᓐ ᓯᔭᙳᒃᑐᕐᒥ ᐊᒪᓗ ᔪᙳᑲᒥ, ᓄᐊᓗᒋᑦ ᓯᓚᐅ ᖃᓄᐃᓂᖓᓄ ᓱᓂᑕᐅᔪᑦ ᑎᑎᕋᓯᒪᓂᖏᑦ ᑕᑯᓇᖓᑦ ᐊᒪᓗ ᓄᐊᓗᒋᑦ ᓄᓇᔾᑦ ᕿᐊᖑᓂᖏᑕ ᑎᑎᖃᓯᒪᓂᖏᑦ ᐊᒪᓗ ᒪᓂᕋᒥ ᐊᐅᒪᓂᖏᑦ. ᔪᓚᐃᖑᑎᓗᒍ ᐅᓄᖏᑐᐃ ᒪᑭᐅᓪᒥᑦ ᑭᓪᓯᓂᐊᕐᑏᑦ ᐃᓕᓂᐊᕐᑏᓪᓗ ᖃᖕᓚᑦᕐᑎᑕᐅᓯᒪᔪᑎᒍ ᓄᓇᖑᐊᒧᖃᐃᓚᐅᑐᑦ, ᓯᓚᒨ ᐊᓯᐅᕐᓂᐅᔪᑦ, ᓯᕕᖓᓂᖓ ᓄᓇᐅᑉ ᐊᒪᓗ ᓄᓇᖓᑕ ᖃᐅᔨᓴᕐᑕᐅᓂᖓ ᐃᒃᐱᑎᓴᓐ ᓯᔭᙳᑐᕐᒥ ᐊᑯᓪ Hᐊᐃᐳᒃ ᕿᑭᑕᖓᓂ. ᖃᐅᔨᓵᔪᓚᐅᒥᔪᒍᑦ (ᐅᓗᓂ ᐱᖓᓱᓂᒃ) ᐊᐅᓂᐅᔪᓂ ᔪᙳᑲᐅᑉ ᖃᓂᒋᔫᓂ ᓄᓇᖑᐊᑎᒍᓗ ᓇᓗᓇᐃᑎᐊᓗᒋᑦ ᐅᐊᓯᓯᒪᓱᔭᕐᑕᑯᑦ ᐊᕐᒍᓂᒃ ᐱᖓᓱᓂᒃ. ᑲᔪᓯᑎᓚᐅᑕᑯᑦ ᖃᐅᔨᓴᕐᓂᙳᔭᑯᑦ ᐊᐅᒃᐸᓕᐊᔪᓂᒃ ᕿᐊᖑᐃᓇᕐᓂᑯᓂᒃ ᖃᓂᒋᔫᓂ ᔪᙳᑲᐅᑉ ᐅᐊᓯᖃᑦᕐᓗᒋᑦ ᐊᐅᔭᑯᑦ ᐊᐅᒃᐸᓕᐊᔪᕐᒥ ᓄᓇᔫᒥ ᐊᒪᓗ ᓯᓚᐅᑉ ᖃᓄᐃᓂᖓ ᐃᓱᒪᒋᓗᒍ. ᑎᑎᕋᕐᓯᒪᔪᕐᑯᑎᑐᑦ ᐅᐃᕐᓇᓚᑐᖅ ᐊᐅᒃᐸᓕᐊᓂᖓ ᕿᐊᖑᐃᓇᕐᑑᑉ. ᑕᒪᓇ ᑲᔪᓯᓂᖓ ᖃᐅᔨᓴᓂᐅᔫᑉ ᓯᑯᒥᒃ ᐃᒃᐱᑎᓴᓐ ᓯᕙᙳᑐᕐᒥ ᓇᓗᓇᐃᕐᓯᔪᖅ ᑕᐃᒪᐃᑐᖅ ᐱᔪᑎᒋᓗᒍ ᓇᓂᓂᙳᔭᖓ, ᒪᓂᕋᒥᓗ ᓯᑯ ᖃᓄᐃᑐᒃᓴᔪᕐᒥᒪᖕᖓᑦ ᐊᒪᓗ ᖃᓄ ᓄᑕᐅᖏᑎᒋᒪᖕᖓᑦ. ᑕᕙᓂ ᖃᐅᔨᓴᕐᓂᙳᔭᑎᓂ ᐊᑐᖃᑦᕐᑐᒍᑦ ᐊᔨᒋᖏᑐᓂ ᖃᐅᔨᓴᕈᑎᓂᒃ ᓲᕐᓗ ᖃᐅᒪᒃᑎᓯᒪᔪᒧᑦ ᐅᐊᔪᒧᕐᑐᕐᒧᓗ ᑎᑎᕋᕐᓯᒪᔪᕐᑯᑎᑎᒍᑦ ᓄᓇᐅᑉ ᐃᑭᐊᖓᓂᑐᖅ

ᖃᐅᔨᓴᕐᓗᒍ ᖃᓄᐃᑐᓕᒪᖕᖓᑦ. ᐊᕋᒍᓂ ᒪᕈᓂ ᐊᓂᒍᕐᑐᓂ ᑎᑎᕋᕐᓯᒪᔭᕗᑦ ᐃᑎᓕᕐᐸᓕᐊᓂᖓ ᓯᑰᑉ ᐊᐅᓂᖓ ᐊᒪᓗ ᓄᑖ ᐊᐅᒃᐊᓕᐊᔪᑦ. 2009ᖑᑎᓗᒍ ᑕᒪᓇ ᐱᓕᕆᐊᕗᑦ ᐱᓕᕆᐊᕆᓚᐅᑕᕗᑦ 60ᓂᒃ ᐅᓗᓂᒃ (ᑎᓴᒪᐃᑦ ᐃᓄᐃᑦ ᐅᓗᐃᑦ 15 ᐅᖓᑖᓄᑦ).

2010ᖑᑎᓗᒍ ᓄᓇᖓᓂ ᐱᓕᕆᓂᖅ.
ᓄᓇᐅᑉ ᐊᓯᔨᕐᓂᖓ ᓯᓚ ᐱᓪᓗᒍ ᐅᔨᓇᓂᕐᐹᖑᔪᑦ ᐊᕙᑎᒧᑦ ᐱᔭᕆᐊᑭᑐᖕᒋᑐᑦ ᓴᖓᔭᐅᑎᓗᒋᑦ ᐅᐊᖕᓇᕐᒥ. ᑭᓯᐊᓂᓕ, ᓱᓕ ᖃᐅᔨᒪᔭᐅᖕᒋᑐᑦ ᐱᖕᒪᑕ ᐱᔪᑎᓖᑦ ᓱᓐᓃᓂᐅᓂᐊᕐᑐᑦ ᓄᓇᖓᓂ ᖁᑎᑐᕐᐸᓯᖕᒥ ᐊᒪᓗ ᓄᓇᐅᑉ ᐊᓯᔨᕐᐸᓕᐊᓂᖓ. ᐅᓂᑳᓕᐅᖃᑕᕋᓗᐊᑎᓗᒋᑦ ᓄᓇᖓ ᐊᐅᐸᓕᐊᓂᖓᓂ ᐅᓂᑳᓯᒪᔪᑦ ᓯᑯᓖᓗᓗᓂ, ᒪᓇᐅᔪᖅ ᑐᓴᕈᑎᓂᒃ ᐱᑕᖃᖕᒋᓗᐊᕐᒪᑦ ᓱᓂᓯᒪᖕᒋᑐᑦ ᖃᓄᐃᑐᒪᖕᖓᑕ ᐊᒪᓗ ᖃᓄᐃᓕᓂᐊᕐᒪᖕᖓᑕ ᓇᓗᓇᐃᕐᔨᔪᑎᓂᒃ ᐱᑕᖃᖕᒥᒪᑦ. ᑐᕋᒐᓗᐊᑕᕗᑦ 2010ᒥ ᖃᓄ ᓱᓃᓂᓂᐊᕐᒪᖕᖓᑦ ᓯᓚᐅᑉ ᐊᓯᔨᕐᓂᖓ ᖁᐊᖑᐃᓇᕐᑐᒥ ᐱᑕᖄᒃᑎᓗᒍ ᑕᐸᓂ ᐊᒪᓗ ᐱᓗᐊᕐᑐᕐᒥ ᖃᓄ ᓱᑲᑎᒋᔪᕐᒥᒃ ᖁᐊᖑᐃᓇᕐᑐᑦ ᐊᓯᔨᕐᓂᐊᕐᒪᖕᖓᑕ. ᐃᒪᓇ ᐸᕐᓇᒃᑐᒍᑦ (1) ᖃᐅᔨᓴᕐᓗᒋᑦ ᐊᐅᒃᓴᕋᐃᓂᕆᔭᖕᒋᑦ ᑕᒪᑯᐊ ᓴᕐᔫᕐᑐᑦ, ᒪᓂᕋᒥᓗ ᓯᑯᖃᓂᕆᔭᖕᖓ ᐊᒪᓗ ᖃᓄᑎᒋ ᐊᖕᒋᑎᒋᒪᖕᖓᑦ, ᐊᒪᓗ ᐊᐅᔪᑯᑦ ᐅᕐᑯᓂᖓ, (2) ᓇᓗᓇᐃᓗᒋᑦ ᐊᖕᒋᑎᒋᓂᕆᔭᖓ ᓯᑯᖃᓂᐅᔪᖅ ᐊᒪᓗ ᓯᑯᖃᓂᐅᔪᑦ ᓄᓇᖓᑕ ᓱᓂᕐᑕᐅᓂᕆᔭᖓ ᓄᓇᖓᓗ (ᓲᕐᓗ ᓯᓯᑰᑉ ᐱᒋᐊᕐᓂᖓ, ᐊᔨᒋᖕᖑᖕᒋᑐᕐᒥᒃ ᐊᐅᒃᐸᓕᐊᓃᑦ) ᐊᒪᓗ (3) ᓇᓗᓇᐃᕐᓗᒋᑦ ᐃᔩᓄᑦ ᑕᑯᓴᐅᕆᑐᑦ ᐊᓯᔨᕐᐊᓕᐊᓂᖕᒋᑦ ᑕᒪᑯᓇᓂ ᓄᓇᔫᓂ ᐊᐅᒃᐸᓕᐊᔪᓂ. ᑕᐸᓂ ᐱᓕᕆᓂᐅᔪᖅ ᑲᔪᓯᓂᐊᕐᑐᖅ ᑕᓕᒪᓂ ᓄᓇᓂ ᖃᓂᒋᔭᖓᓂ ᔪᕆᑲᐅᑉ ᐊᒪᓗ ᐅᐸᒃᓯᒪᓚᑖᕐᓗᒋᑦ ᖃᐅᔨᓴᕐᓗᒋᑦ ᐊᒪᓗ ᓇᓗᓇᐃᕐᓗᒋᑦ ᐃᔨᓄ ᑕᑯᓴᐅᕆᑐᑦ ᐊᓯᔨᕐᓂᖓ, ᐊᐅᐸᓕᐊᓂᐅᔪᓗ, ᖁᐊᖑᐃᓇᕐᑐᓗ ᖃᓄᑎᒋ ᓂᒃᓕᓇᒪᖕᖓᑕ ᖃᐅᔨᓴᖃᑕᕐᓗᒋᑦ, ᐊᒪᓗ ᒪᓂᕋᒥ ᓯᑯᐃᑦ ᖃᓄᐃᑐᒪᖕᖓᑕ ᐱᔪᑎᖃᑐᑦ ᒪᕈᐃᑦ ᖃᓄᐃᑐᓂᕕᓂᖕᖓᓄᑦ ᐊᐅᒃᐸᓕᐊᔪᑦ. ᓇᓗᓇᐃᕐᓯᒪᑎᐊᕐᑐᓂᒃ ᖃᐅᔨᓴᐱᑎᑎᓂ ᓇᓗᓇᐃᕈᓖᕐᑐᒍᑦ ᖃᓄᑎᒋ ᓱᑲᑎᒋᔪᕐᒥᒃ ᐊᐅᒃᐸᓕᐊᒪᖕᖓᑕ ᐊᒪᓗ ᐊᑕᐅᓯᐅᖕᒋᑐᕐᓂ ᖃᐅᔨᓴᐱᑎᖃᓗᑕ ᐃᔨᓄ ᑕᑯᓴᐅᖕᒋᑐᓂ ᑎᑎᕋᐸᓕᐊᓗᑕ ᒪᕈᐃᓂᑦ ᓯᓚᓂᐊᕕᐅᔪᓂᑦ, ᐊᑕᐅᓯᖅ ᓄᓇᔫᑉ ᐃᓗᐊᓂᓗᓂ ᐊᒪᓗ ᐊᑕᐅᓯᖅ ᓯᓚᑖᓂᓗᓂ. ᖃᐅᔨᓴᐱᑎᖅᑲᓂᓗᑕᓗ (ᐃᑯᒪᖁᑎᑯᑦ ᖃᐅᔨᓴᐱᑎᒃ, ᐃᒪᐅᓗ ᐳᔪᐸᓕᐊᓂᖕᖓᓄᑦ ᖃᐅᔨᓴᐱᑎᖕᖓᓄᑦ ᐊᒪᓗ ᐊᓄᕆ ᐅᐊᓯᔭᐅᓗᓂ ᐊᕿᓯᒪᓗᑎᒃ ᓯᑯᖃᓂᐅᔪᕐᒥ. ᖁᐊᖑᐃᓇᕐᑐᑦ ᐊᒪᓗ ᒪᓂᕋᒥ ᓯᑰᑉ ᖃᓄᐃᑐᓂᖓ ᓄᓇᖑᐊᑎᒍᑦ ᓇᓗᓇᐃᕐᑕᐅᓂᐊᕐᑐᑦ ᑕᒪᑯᐊ ᓱᓂᕐᑕᐅᓯᒪᖕᒋᑐᕐᑎᒍᑦ ᐊᐅᖃᑦᑐᑦ ᐊᒪᓗ ᐊᑐᕐᑕᐅᓗᑎᒃ ᓄᓇᖓᑕ ᖃᓄᐃᑐᓂᖓ ᕿᖑᒥᓕᕐᑕᐅᓗᑎᒃ. ᑲᔪᓯᓂᐊᕐᑐᒍᑦ ᖃᐅᔨᓴᕐᓂᕆᖃᑕᕐᑕᑎᓂᒃ ᑐᑭᓕᕆᒃᓯᓯᒪᔪᓂᒃ ᖃᓄᐃᑐᕐᒥᓂᕆᔭᖕᖓᓗ ᖃᐅᔨᓴᕐᓗᒍ. ᖃᐅᔨᓴᓂᕆᔭᕗᑦ ᑐᑭᓕᕆᒃᓯᓯᒪᔪᑦ ᐊᖕᒋᓂᖕᒋᑦ ᐊᒪᓗ ᐊᖕᒋᓂᖕᒋᓗ ᐊᔨᒋᖕᒋᓂᖕᒋᑦ ᐅᓗᕐᓂ ᐊᔨᒋᖕᒋᑐᓂ ᐊᒪᓗ ᐊᓯᔨᕐᓂᕆᖃᑕᕐᑕᖕᒋᑦ ᐊᔨᒋᖕᒋᑐᓂᕐᓂᖕᒋᓄᑦ ᐊᒪᓗ ᓯᑰᑉ ᖃᓄᐃᑐᓂᕆᔭᖕᖓ ᒪᓕᓗᒍ ᑕᓱᒪ ᓇᓗᓇᐃᕐᓂᐊᕐᑕᖕᒋᑦ ᖃᓄ ᓯᕗᓕᕐᒥ ᑲᒪᒋᔭᐅᓂᐊᕐᒪᖕᖓᑕ ᖃᓄᐃᓕᖕᖓᓕᓂᕆᔭᖕᒋᑦ. ᐊᒪᑕᐅ ᐊᑯᓂᐅᔪᖅ ᖃᐅᔨᓴᕐᓂᕆᔭᕗᑦ ᐱᔪᑎᖃᖅ ᓄᐊᑎᐸᓕᐊᓗᑕ ᓯᓚᐅ ᐅᕐᑯᓂᕆᖃᕐᑕᓂᖕᒋᓂᒃ ᓂᓚᓱᓂᕆᖃᑕᖕᒋᓂᓗᓃᑦ ᐊᔨᒋᖕᒋᑐᓂ ᐃᒃᐱᑎᓴᖕᒥ ᓄᓇᖓᑕ ᖃᓄᐃᑐᓂᖓ ᓄᑕᐅᖕᒋᓂᖕᒋᓗ ᓯᕕᖓᓂᕐᓂ ᓄᐊᕕᐅᕙᓕᐊᔪᕐᒥ ᖃᑯᕐᑕᖅ ᓯᕐᒥᒥ ᑲᖕᒋᕐᓱᖕᖓᑕ ᐊᓂᕕᐊᑕ ᖃᓂᒋᔫᓂ ᐃᒃᐱᑎᓴᓐ ᓯᔭᕆᑐᕐᒥ (ᖃᐅᔨᓴᕐᓂᐅᖃᑕᕐᑐᑦ ᑲᔪᓯᓗᑎᒃ 50ᑭᓚᒥᑕᒥ), ᐃᓚᐅᓗᓂ ᖃᐅᔨᓴᕐᕕᐅᔪᑦ ᓂᐊᖁᐊᓂ ᐊᒪᓗ ᐃᓱᓕᕕᖃᓗᓂ ᖃᖁᑕᖅ ᓯᕐᒥᒥ, ᑕᕐᓴᓕ ᑕᓯᕐᒥ, ᐃᒃᐱᑎᓴᓐ ᓇᕐᓴᕐᒥ ᐊᒪᓗ ᐊᓚᐃᑦ ᓄᕗᐊᓂ.

ᐱᒪᕆᐅᓂᖓ:
ᐱᒪᕆᐅᔪᕐᒥ ᐊᕐᑯᓯᐅᕐᓯᒪᔪᒍᑦ ᑐᑭᓯᐅᒪᓂᒧᑦ ᖁᐊᖑᐃᓇᕐᑐᑦ ᐱᓪᓗᒋᑦ ᐊᒪᓗ ᖁᓕᕆᕐᓂᖕᒋᑕ ᖃᐅᔨᓴᕐᑕᐅᓂᖕᒋᑦ ᔪᕆᑲ ᓴᐅᓐ ᓇᑎᕐᓇᒥ ᐊᒪᓗ ᐃᒃᐱᑎᓴᓐ ᓯᒃᔭᕆᑐᕐᐸᓯᕐᒥ. ᑕᑯᐊ ᖃᐅᔨᓴᓂᐅᔪᑦ ᐃᑲᔪᑦ ᓄᑕᓂᑦ ᖃᐅᔨᓂᐅᔪᓂᒃ ᓇᑭᑦ ᐱᒋᐊᕐᓂᒪᖕᖓᑕ ᐊᒪᓗ ᓄᑕᐅᖕᒋᓂᖕᒋᑦ ᖁᐊᖑᐃᓇᕐᑐᑦ, ᖃᓄᑎᒋ ᓱᑲᑎᒋᔪᕐᒥᒃ ᐊᓯᔨᕐᐸᓕᐊᒪᖕᖓᑕ ᐊᒪᓗ ᐊᑕᕐᓇᑐᑐᐃᓇᕆᐊᖃᓂᖕᒋᑦ ᖁᐊᖑᓚᕆᓂᐅᔪᑦ ᓄᓇᓂᑐᑦ. ᑕᑯᐊ ᖃᐅᔨᔭᕗᑦ ᓇᓗᓇᐃᕐᓯᔪᑦ ᐊᒃᑐᐊᓂᖃᕐᓂᖕᒋᓂᒃ ᓄᓇᒥ ᓯᑯᐃᑦ ᐊᒪᓗ ᐊᒍᕐᓯᒪᓂᖕᒋᑕ ᓄᓇᐃᑦ ᑕᕆᐅᐸᓯᒥᑐᑦ ᐊᒃᑐᐊᓂᖕᒋᑦ.