

Compendium of Research in the Northwest Territories

2006



This publication is a collaboration between the Aurora Research Institute, the Canadian Department of Fisheries and Oceans, the Department of Environment and Natural Resources, the Government of the Northwest Territories and the Prince of Wales Northern Heritage Centre. Thank you to all who submitted a summary of their research and helped make this publication possible.

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Fisheries and Oceans
Canada

Pêches et Océans
Canada



FOREWORD

I am pleased to present you with the 2006 Compendium of Research in the Northwest Territories. This collaboration between the Aurora Research Institute, the Department of Environment and Natural Resources (ENR), the Department of Fisheries and Oceans (DFO) and the Prince of Wales Northern Heritage Centre is our annual publication of all licensed research summaries in the NWT. Each agency is responsible for the implementation and/or facilitation of consultation prior to the research as well as helping direct researchers on reporting results back to the affected communities. This Compendium represents a starting point to find contact information and brief abstracts on the state of the research world in the NWT.

The northern environment is rapidly changing. Global climate change is affecting the North at a disproportionately fast pace. These past few years have seen the publication of major international reports from both the International Panel on Climate Change and the Arctic Climate Impact Assessment. These have highlighted the speed, scope and importance of the climate change issue. All scientists must now consider this phenomenon in the development, implementation and analysis of their research. This Compendium shows the increase in focus across all types of research to include climate change. In the physical sciences, we see examinations into changing sea ice extent and permafrost melting, while in the social sciences we see examinations into human adaptation programs and changing traditional diets. Climate change has simply become a central aspect of all northern research.

The NWT provides a unique locale for all types of studies, especially related to climate change. There are various rare biomes and features that can be easily accessed through isolated centres, Arctic research facilities, and most importantly communities who provide untold support and collaboration to visiting researchers. We are proud of the inquiry that is being done here in the NWT, which is ultimately adding to the global body of knowledge and solutions for climate change. As we move into the future, may this caliber of such vital research continue.

Andrew Applejohn
Director, Aurora Research Institute

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ABOUT THIS BOOK

The Compendium of Research in the Northwest Territories is a summary of research licences/permits that were issued in the Northwest Territories during 2006. The information contained in this book is a collaboration between the Aurora Research Institute (ARI), the Prince of Wales Northern Heritage Centre (PWNHC), the Department of Environment and Natural Resources (ENR) and the Department of Fisheries and Oceans (DFO). The Compendium series began in 1986.

Licensing in the NWT

Under territorial legislation, all research in the NWT requires a licence/permit from one of three agencies, depending on the type of research being conducted:

- Prince of Wales Northern Heritage Centre - Archaeology
- Department of Environment and Natural Resources, Government of the Northwest Territories - Wildlife
- Aurora Research Institute - All other research in the NWT

Included in this Compendium are fisheries research projects conducted by the Department of Fisheries and Oceans staff. Other researchers conducting fisheries research are required to have a Science Licence and are included in this section of the Compendium. In addition to one of these licences/permits, there may be other permits required depending on the nature of the research work.

Through the licensing process, researchers are informed of appropriate organizations, communities and other licensing/permitting agencies that should be contacted prior to conducting studies. Licensing ensures research activities are communicated to interested parties and provides opportunities for the exchange of information.

Although the Compendium is a summary of all licences/permits issued in the NWT by all three licensing/permitting bodies, it is not a list of actual research conducted. The reader is encouraged to contact the researcher for further verification and additional information.

THE AURORA RESEARCH INSTITUTE

The Aurora Research Institute (ARI) was established in 1995 as a division of Aurora College when the Science Institute of the Northwest Territories (NWT) divided into eastern (Nunavut) and western (NWT) divisions.

The Aurora Research Institute's mandate is to improve the quality of life for NWT residents by applying scientific, technological and indigenous knowledge to solve northern problems and advance social and economic goals.

ARI is responsible for:

- licensing and coordinating research in accordance with the NWT *Scientists Act*: this covers all disciplines including the physical, social, biological sciences and traditional knowledge;
- promoting communication between researchers and the people of the communities in which they work;
- promoting public awareness of the importance of science, technology and indigenous knowledge;
- fostering a scientific community within the NWT which recognizes and uses the traditional knowledge of northern aboriginal people;
- making scientific and indigenous knowledge available to the people of the NWT;
- supporting or conducting research and technological developments which contribute to the social, cultural and economic prosperity of the people of the NWT.

To learn more about ARI, contact us at:

Aurora Research Institute
PO Box 1450
Inuvik, NT X0E 0T0
Tel: 867-777-3298
Fax: 867-777-4264
E-mail: licence@nwtresearch.com
Website: www.nwtresearch.com

THE DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

The Department of Environment and Natural Resources (ENR), Government of the Northwest Territories (GNWT)'s mandate is to promote sustainable development through the management and protection of the quality, diversity and abundance of natural resources and the integrity of the environment.

With respect to permitting for research and monitoring, ENR is responsible for:

- Issuing Wildlife Research Permits under the Wildlife Act (Section 24) for all studies on wildlife or wildlife habitat in the Northwest Territories (NWT). Wildlife includes all vertebrates, except fish and marine mammals.

To learn more about ENR, contact us at:

Wildlife Division

Environment and Natural Resources
Government of the Northwest Territories
PO Box 1320

Yellowknife, NT X1A 2L9

Fax: 867-873-0293

E-mail: wildliferesearch_permit@gov.nt.ca

Website: www.nwtwildlife.com/ResearchPermits/

THE PRINCE OF WALES NORTHERN HERITAGE CENTRE

The Prince of Wales Northern Heritage Centre (PWNHC), a Division of the Department of Education, Culture and Employment, Government of the Northwest Territories, is responsible for managing and protecting the archaeological resources of the NWT. Representing a continuous human occupation stretching back over 7000 years, archaeological sites are fragile and non-renewable and are protected from disturbance by legislation, regulation, and policy in the NWT. There are currently about 6000 archaeological sites recorded in the NWT, though this number represents only a small fraction of the actual number of existing sites, as large areas remained unexplored for archaeological resources. A large part of our work at the PWNHC involves reviewing land use and development permit applications. We currently review, on average, 300 permits per year, providing advice to 9 land management authorities.

With respect to permitting for research and monitoring, PWNHC is responsible for:

- Issuing NWT Archaeology Research Permits

To learn more about The Prince of Wales Northern Heritage Centre, contact us at:

NWT Cultural Places Program
Prince of Wales Northern Heritage Centre
4750 48th Street
PO Box 1320
Yellowknife, NT X1A 2L9
Phone: 867-873-7551
Fax: 867-873-0205
Email: archaeolog@gov.nt.ca
Website: www.pwnhc.ca

THE DEPARTMENT OF FISHERIES AND OCEANS

Fisheries and Oceans Canada (DFO) is responsible for developing and implementing policies and programs in support of Canada's scientific, ecological, social and economic interests in oceans and fresh waters. Some Fisheries management responsibilities have been delegated or transferred to other Federal agencies (e.g. Parks Canada), Provinces/Territories and co-management groups under Land Claim agreements.

DFO Fisheries Management is responsible for issuing Commercial, Domestic, Licence to Fish for Scientific Purposes (LFSP), Exploratory, Public Display and Educational licences in the NWT. Subject to Land Claim agreements, a Commercial licence is required to sell or barter fish.

All individuals fishing for scientific purposes, as described below, are required to obtain a Licence to Fish for Scientific Purposes (LFSP);

- Activities involving fishing, catching or attempting to catch fish;
- Activities where the potential exists for the incidental capture of fish;
- Sampling or possessing fish caught in a subsistence fishery.

For further information about licensing please contact DFO;

Licensing Officer

Central & Arctic Region
Fisheries and Oceans Canada
Government of Canada
Box 1871
Inuvik, NT X0E 0T0

Tel: (867) 777-7500 Fax: (867) 777-7501

email: xca-inuvikpermit@dfo-mpo.gc.ca

Website: <http://www.dfo-mpo.gc.ca/index-eng.htm>

HOW TO USE THIS BOOK

This book has four main sections. Each of these sections reflects a specific licensing agency and type of licence/permit issued. Within each section research descriptions have been grouped by subject, and listed alphanumerically by the principal researcher's last name. Refer to the Table of Contents for the specific page on which each section and/or subject begins.

1. Reference Number

The reference numbers shown in each of the Aurora Research Institute's subject areas refer to the file number issued to a particular researcher. It allows cross referencing with research material that may be available on file or in the ARI library. The reference numbers of the other two agencies refers directly to the permit numbers given to each researcher. When requesting information from any of these agencies on specific research outlined in the Compendium, please refer to the reference number in your correspondence.

2. Regional Abbreviations

Throughout the book reference is given to the specific land claim region(s) in which the research took place. The regions are shown in Figure 1. Some of the land claim regions are still under negotiation and boundaries shown are only approximations. The abbreviations shown for each region are as follows:

DC	Deh Cho	SS	South Slave
NS	North Slave	SA	Sahtu Settlement Area
IN	Inuvialuit Settlement Region	GW	Gwich'in Settlement Area

3. Glossary

A glossary of terms has been added to the Compendium. The intent of the glossary is to allow the reader to better appreciate the research descriptions.

4. Index

At the back of this book, you will find two indices. These have been developed to help the reader cross reference material more easily. The numbers used in the Researcher Index refer to the number listed with each research description. The numbers listed in the Subject Index refer to the page numbers.

Available in Print or Free Download

The Compendium is available as a printed publication. The Compendium can be downloaded from the Aurora Research Institute's website (www.nwtresearch.com) or a copy can be requested by contacting the Aurora Research Institute. We encourage photocopying of the printed publication to promote its distribution.

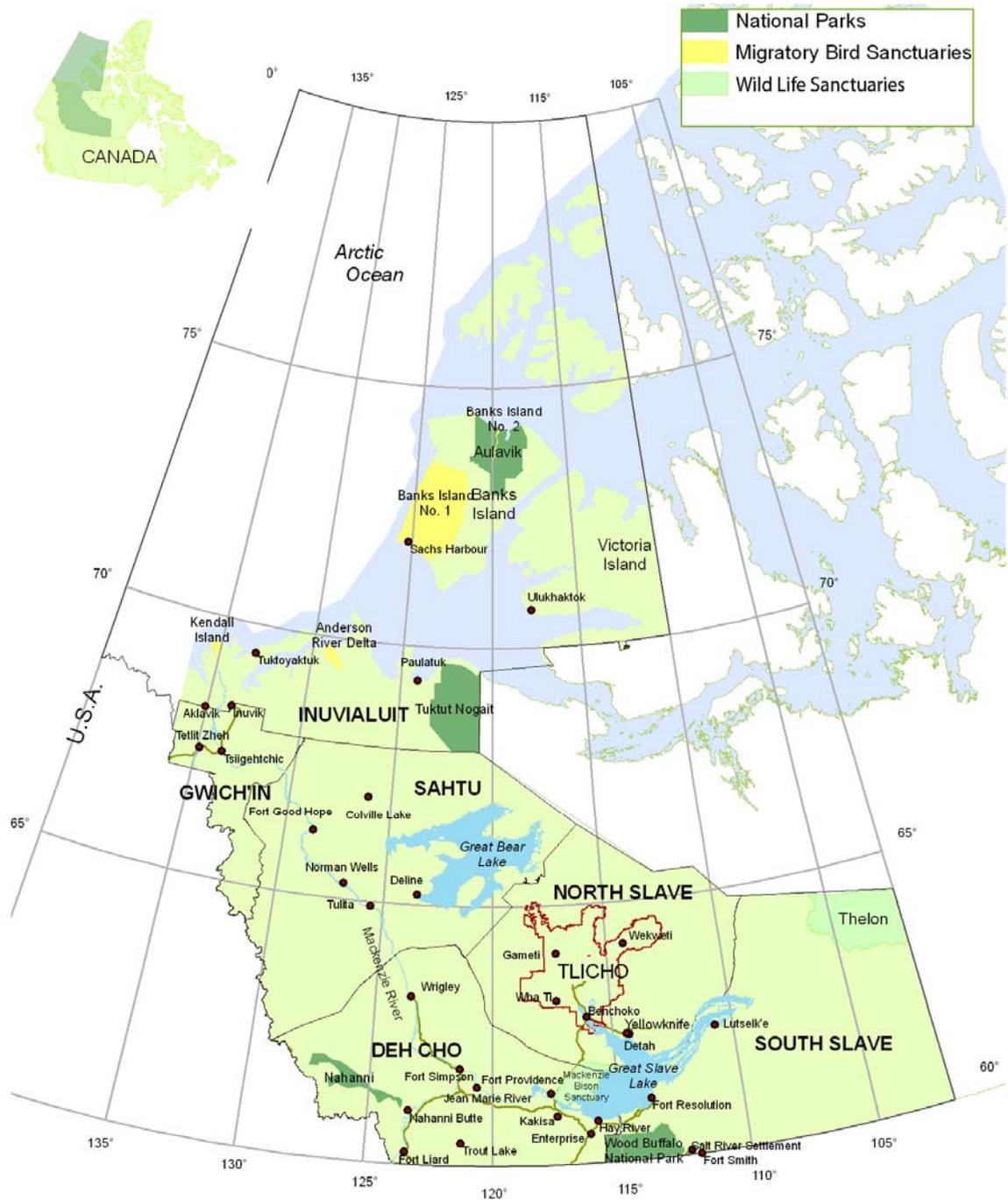


Figure 1: Land Claim Regions in the Northwest Territories (Aurora Research Institute)

2006 Licensed Research Projects

Scientific Research Licences

BIOLOGY

001

Biology

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File No: 12 402 747

Licence No: 14009

Region: NS, SS

Location: Gahcho Kue (Kennady Lake)

Gahcho Kue Project Studies

The 2006 hydrology field program at the Gahcho Kué site was conducted to collect additional data required to fill gaps in the existing data set. Site visits were made to various lake outlets and potential overflow/diversion locations within the Kennady Lake basin and larger regional study area between July 24 and 27. At all of the sites visited, a description was documented through field notes and photos of channel hydraulic characteristics, bed and bank material, observations of unusual or non-typical features and erodibility potential. Eleven sites in total were documented. At eight of the eleven locations, typical cross-sections were taken at the lake channel outlets through the use of level and tape surveys.

While the licence also covered research concerning vegetation, soil and terrain, and fisheries, no field work was done concerning these topics during the 2006 field season.

002

Biology

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File No: 12 402 532

Licence No: 14062

Region: IN

Location: In and around the Tuk 2 M-18 well site, and within a 20km-wide corridor from M-18 to the proposed Parsons Lake facility

Devon Tuk 2 Gas Development 2006 Field Assessment Program

The objective of the program was to collect biophysical and archaeological information in support of development activities at the Tuk 2 M-18 well site and within the potential pipeline corridor.

Biophysical and heritage resource surveys were taken in late summer and fall, and contributed to the assessment of a potential development projects (the Tuk 2 M-18 well site and connecting pipeline to Parsons Lake and the Mackenzie Gas Pipeline) located in the Tuktoyaktuk Peninsula, about 12 km southeast of Tuktoyaktuk and 125 km northeast of Inuvik.

The field assessment involved four separate surveys: grizzly bear denning; vegetation; terrain; soils and permafrost; and heritage resource surveys. The surveys were comprised of aerial surveys and field visits. Information will be used to assess routing options for the potential pipeline.

Aerial surveys were conducted to identify sites and features of interest, followed by ground visits using equipment such as cameras, GPS, binoculars, collection materials, and maps.

003

Biology

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Licence No: 14003

Region: NS

Location: Hill Creek at Hwy 3 crossing

Fish and fish habitat survey of Hill Creek at Highway 3 crossing

The objective of this survey was to provide conclusive evidence of fish presence/absence and provide additional stream flow assessments. Fish were captured using various techniques. Biological information such as length, weight, species and health was collected, and fish were returned to the environment.

A report was submitted the Department of Transportation, Government of the Northwest Territories.

004

Biology

Evans, Marlene

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File No: 12 402 503

Licence No: 14032

Region: IN

Location: Six tributaries and seven lakes or ponds in the Inuvialuit Settlement Region

Biological studies of waters along the proposed Mackenzie Gas Pipeline route - Inuvialuit Settlement Region

In August 2006, ten lakes and six streams were examined in the Inuvialuit region. The work went very well with the exception that a large rainfall limited some of the stream sampling; the researchers were unable to do the fish work in the streams due to high water levels and fast flowing currents, although they did sample the small animals that live in the mud and among the rocks. Many of the samples were in laboratories being analyzed at the time of reporting and so results are limited. The lakes and streams were very healthy with high oxygen levels, and with salt and metal concentrations that would be expected for clean waters unaffected by human activity. There was a healthy amount of microscopic plant and animal growth. The microscope studies are still being conducted and initial results also are good.

005

Biology

Evans, Marlene

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File No: 12 402 503

Licence No: 14045

Region: GW

Location: Four tributaries and seven lakes or ponds in the Gwich'in Settlement Area

Biological studies of waters along the proposed Mackenzie Gas Pipeline route - Gwich'in Settlement Region

In August 2006, seven lakes and seven streams were examined in the Gwich'in region. The work went very well with the exception that a large rainfall limited some of the stream sampling; the researchers were unable to do any fish work in the streams due to high water levels and fast flowing currents although they did sample the small animals that live in the mud and among the rocks. Many of the samples were in the laboratories being analyzed at the time of reporting, so results are limited. The lakes and streams were very healthy with high oxygen levels, and with salt and metal concentrations at levels which would be expected for clean waters unaffected by human activity. There was a healthy amount of microscope plant and animal growth. The microscope studies are still being conducted but initial results also are good. The Gwich'in Renewable Resources Board was conducting studies of the fish in Travaillant Lake and the researchers agreed to analyze the lake trout for mercury and other metals. The results from this study should be available soon.

006

Biology

Goad, Robin

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File No: 12 402 697

Licence No: 14037

Region: NS

Location: Fortune Mineral's NICO property and along the route of a proposed all-weather access road

Environmental Surveys of the Fortune Minerals NICO Project

The scope of the 2006 environmental studies at the NICO site included fish and fish habitat, water and sediment quality, benthic invertebrate abundance, wildlife and vegetation surveys. Aquatic surveys were conducted on each of the water bodies located within a 10 km radius of the mine site (study area) and a reference site. Similarly, all wildlife surveys were conducted within a 5 km buffer of the proposed road route and the 10 km radius of the project site.

Fisheries surveys focused on the collection of population metrics and spring and fall spawning information for northern pike, lake whitefish and walleye in each waterbody in the study area. Various techniques including: electro-fishing; angling; gill nets; and trap nets were used to collect specimens.

Early to late season (June - August) surveys of water quality were conducted on each waterbody in the study area to supplement the existing baseline dataset.

A vegetation survey in July identified and characterized vegetative communities with visual observations. This information will be used to further describe the local vegetation, and to assess impacts to wildlife.

Wildlife surveys were conducted to document existing environmental conditions, to support an environmental assessment, and to serve as a basis for any future wildlife impact monitoring should the project proceed. The following surveys were conducted: (a) aerial surveys in order to document wildlife numbers, distribution, and habitat use, particularly of caribou; (b) ground based surveys of caribou and moose pellets were conducted in early June to describe habitat use and to gauge the relative activity levels during the past winter and spring; (c) all known raptor nests and potential nest sites were visited to document the presence of raptor species on June 5, and again to document the number of chicks produced on July 28 (species observed nesting included bald eagles and a peregrine falcon); (d) point counts were conducted in early June to determine the abundance, species richness and habitat associations of upland breeding birds; and (e) two aerial surveys for water birds (including waterfowl, loons and grebes) were conducted on water bodies within the study area, one on June 4 and one on July 27.

007

Biology

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File No: 12 402 781

Licence No: 14034

Region: IN

Location: At selected sites throughout the Parsons Lake development area

Environmental Studies for the Proposed Parsons Lake Development Area during Summer and Fall 2006

During summer 2006, ConocoPhillips supported aquatics and vegetation environmental studies in the Parsons Lake Development Area.

During the aquatics field program, bathymetry surveys (depth profiles) were completed on 18 lakes along the proposed Pete's Creek winter access roads and in the area of Parsons Lake nearest the North Pad development. Water quality was also monitored at the Parsons Lake site. Also, four watercourses along the proposed all-weather road to the proposed CPC Airstrip and two small lakes in the vicinity of the proposed North Pad development were assessed for fish and fish habitat.

During the vegetation field program, lichen data was collected from 27 plots, where every species was identified and cover percentages were visually estimated. A total of 16 sample plots were randomly placed within 1 km of the development area. A total of 11 sample plots were randomly located at a distance of greater than 10 km from the Parsons Lake area. Samples of the two most common species, yellow and grey reindeer lichen (*Cladina mitis* and *Cladina rangiferina*), were also collected at each plot for later chemical analysis.

During the rare plant survey, 38 areas were surveyed. A total of 14 areas were surveyed within 1 km of the development area. A total of 24 areas were surveyed at a distance between 1 and 10 km from the development area and at locations greater than 10 km from the development area along the Pete's Creek Over Lakes Winter Access road. Overall, 29 populations of 11 rare plant species in 17 locations were observed. Six locations were identified within 1 km of the development area, ten were identified along the proposed Pete's Creek Over Lakes Winter Access road, and one location was identified at a location greater than 10 km from the development area. Two of these are new records for the Northwest Territories (flatleaf pondweed, *Potamogeton robbinsii*, and water starwort, *Callitriche* sp.).

008

Biology

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File No: 12 402 780

Licence No: 14026

Region: SA

Location: Bosworth Creek

Bosworth Creek Project

The Bosworth Creek Monitoring Project is a high resolution habitat study of a drainage basin dominated by a major creek system that enters the Mackenzie River at Norman Wells (Latitude 65° 17 N, 126° 48 W). This long term project is facilitated by the Sahtu Renewable Resources Board and is being undertaken by youth from Mackenzie Mountain School. The project seeks to identify biological components of Bosworth Creek and associated forest.

The first task of this undertaking is to create comprehensive baseline inventories that are generally lacking throughout the proposed Mackenzie Gas Pipeline route. These predominantly include aquatic and terrestrial invertebrates, although recent investigation by this team suggests that fish species are also under-represented in published inventories by MGP proponents. Water and soil quality are also being monitored throughout the life of this study. Baseline sediment data and seasonal water data were collected that will be used along with additional sampling in future field work, to monitor industrial activities and natural change over time.

009

Biology

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File No: 12 402 775

Licence No: 14014

Region: NS

Location: Five lakes in the Horseshoe Zone of the Damoti Lake property

Damoti Gold

Gartner Lee Ltd. (GLL) has been retained by Doublestar Resources Ltd. to carry out a baseline study of the environment in and around the Damoti Gold Project site. The site is located 200 km north of Yellowknife, NT. The objectives of the 2006 Field Programs were to carry out a study of the aquatic environment around the Damoti project area that would be of sufficient detail to support the design engineers in planning the layout of the mine and supporting infrastructure, and to begin collecting information to support future development of an Environmental Impact Statement (EIS) for the project. The identification of any particularly sensitive areas and linkages between water (quality and quantity) and aquatic resources was also an objective. To meet these objectives, detailed assessments of the following parameters were made in the local study area: hydrological conditions; bathymetry; water and sediment quality; primary and secondary productivity; and fish and fish habitat.

The hydrological conditions of the Damoti Gold project area were assessed in May, July and September 2006. Hobo Leveloggers were established at each site to record the water level at a timed interval. Stream surveys were also conducted at each site to meter the stream and measure the water level. Stream flow was subsequently calculated based on water level and discharge measurements.

Stream flow patterns observed at the site are similar to those observed in the region. Collecting large amounts of stream flow measurements to support creation of a rating curve was not economical due to the remote location of the site. A Hobo Weather Station was also installed south of the camp in July 2006, to measure air temperature, solar radiation, barometric pressure, precipitation, wind speed, and wind direction. Data from the meteorological station will be used in all future data analyses once a more complete record has been obtained.

The bathymetry program consisted of measuring the depths of four lakes in the LSA. Lake volume was estimated from depth measurements and from the horizontal position in the lake where depth was measured. These measurements took place in early September of 2006.

The water quality program of 2006 consisted of four field trips in May (early and late), July and September. Four lakes and six stream sample sites were visited during each field visit. For the purposes of

reviewing the results of the water sampling program, the Canadian Council of the Ministers of Environment (CCME) guidelines for the protection of aquatic life were used.

Lake water samples were collected at each site in July and September at 1 m below surface. Under-ice sampling was successfully undertaken in lakes L04 and L05. Lakes samples were analyzed for chlorophyll *a* and for physical, ion, nutrient and organic parameters. Total and dissolved metals were analyzed at two detection limits (low and ultra-low). Hobo "TidBit" continuous temperature loggers were established in Lakes L03, L04 and L06. Secchi depths were also measured at all lakes in July.

Stream water samples were analyzed for the same suite of parameters as the lake samples other than chlorophyll *a*. Water quality for most of the streams within the study area was very similar to the water quality of the lakes. Streams S01, S02 and S03 are generally similar and different from streams S05 and S06.

Sediments were analyzed for pH along with a suite of metals. Lake bottom sediment samples were collected from the deepest portion of the lake using an Ekman dredge.

To assess primary productivity, phytoplankton samples were collected in September 2006, from Lakes L03, L04, L05 and L06. Due to the organic nature of the substrate in the streams within the study area, it was only possible to collect a periphyton sample from stream sample site S06 in September 2006.

To assess the secondary productivity of lakes in the vicinity of the study area, species richness was calculated for zooplankton and both species richness and abundance were calculated for benthic macro-invertebrates. Zooplankton samples were collected from lakes L01, L03, L04, L05, L07, L08 and L09 in August, 2006. Benthic invertebrates were also collected from stream sample sites S02, S03, S06 and from lakes L03 and L06.

Fish sampling focused on determining species composition, relative abundance, seasonal use of lakes and streams, and life history characteristics. Various collection methodologies were employed, including gill netting, minnow trapping and electrofishing. The specific methodology used was dependent upon the profile of the waterbody, the type of habitat sampled and size of fish targeted. All fish were identified to species. Fork length and weight were measured and structures such as scales, otoliths, dorsal tissue, stomach and liver were removed from most fish. All fish of large enough size were aged. A portion of the fish sampled were dissected and liver, dorsal tissue and stomachs were removed.

Lake habitat assessments included data collection on substrate type, lake depth, bathymetric features (such as littoral shelves) and vegetation characteristics.

Streams located within potential areas of impact were studied over their entire length for habitat quality. Stream stage, habitat, cover type, channel substrate type, stream bank substrate, and percent of bank instability were all visually estimated. Stream bank slope was visually estimated and spot-checked with a Suunto clinometer, while bank height was measured with a meter stick.

010**Biology****Hamm, Sharleen**

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File No: 12 402 775**Licence No:** 14015**Region:** NS**Location:** DO-27 and DO-18 kimberlite pipes (previously known as the Tli Kwi Cho pipes) and exploration camp**WO Diamond Project**

Gartner Lee Ltd. (GLL) has been retained by Peregrine Diamonds Ltd. (Peregrine) to carry out a baseline study of the environment in and around the proposed Peregrine Diamonds WO project (WO project) mine site. The site is located between the north and west arms of Thonokied Lake, roughly 300 km northeast of Yellowknife, in the Northwest Territories of Canada. This region is renowned for its abundance of kimberlites. The Peregrine WO Diamond project is focused on the DO-27 kimberlite complex. Data collection was conducted from May to September, 2006. The 2006 field program was designed to expand on existing data and to collect sufficient new baseline data. To meet these objectives, the following parameters were assessed in the local study area: hydrology; physical limnology; surface water quality of local streams; rivers and lakes; sediment quality; primary and secondary productivity in aquatic habitats; and fish and fish habitats.

The hydrology field program focused on establishing a hydrometric network concentrated in the Peregrine Diamonds Project area and targeting areas that would potentially contain mine infrastructure. During field visits in May/June, July, August, and September, staff collected stream stage and discharge measurements. A climate station was also installed at the mine site as part of the meteorological program.

The purpose of the bathymetric program was to estimate lake volumes of seven selected sample lakes. These lakes were chosen as they may be affected by or affect future mine infrastructure. The bathymetric

data was collected during the August field visit.

The water quality program consisted of three field trips in May, July and September, 2006. Seven lake and nine stream sample sites were visited and a total of approximately 45 samples were collected. Key indicators used for the water quality analysis were pH, hardness, alkalinity, productivity (measures include total phosphorus, chlorophyll *a*, and Total Kjeldahl Nitrogen (TKN)), and trophic status (classified as ranges of phosphorus concentrations).

Sediment samples were collected from lakes throughout the study area. Overall, the metal levels for the lake bottom sediments appear to be low. Few analytes from the study area lakes exceeded the CCME Probable Effects Level (PEL) for sediment. For those analytes that were found to exceed CCME guidelines, it is believed that these levels are most likely natural.

Primary producers (periphyton in streams and phytoplankton in lakes and secondary producers (benthic invertebrates in streams and lakes and zooplankton in lakes) were examined to evaluate the existing condition of fisheries resources within the study area.

Various collection methodologies were employed for fish sampling, including: gill netting; angling; minnow trapping and electrofishing. However, electrofishing surveys were relatively ineffective throughout the study area, primarily because of the low conductivity of the water.

011

Biology

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File No: 12 402 775

Licence No: 14051

Region: NS

Location: Giauque Lake and Lake A, Discovery Mine

Discovery Mine Aquatic Studies

Indian and Northern Affairs Canada (INAC) completed final remediation of the abandoned Discovery mine site in 2005, following remediation of exposed tailings in 1999/2000. The 2006 aquatic health study, pertaining to these permits, was designed to address data gaps arising from the 2005 study and to obtain further tissue mercury concentrations in support of a Human Health Risk Assessment, also conducted by Gartner Lee Limited in 2006. This study is a direct follow up to the 2005 study in which no young lake trout were captured, which left a gap in knowledge about mercury uptake in the fish population, and complicated the interpretation of the results. For the 2006 study, northern pike were also specifically targeted to provide additional data on a second top predator species that is also of interest for human consumption.

The 2006 aquatic study was carried out by Gartner Lee Limited and included the following components: sampling of two target species (lake trout and Northern pike) of fish in Giauque Lake and control Lake A; extended sampling at different site locations in Giauque Lake in the attempt to catch more young lake trout; composite sampling of benthic invertebrates in Giauque Lake for mercury analysis; basic chemical and physical characterization of surface water in the two study lakes; migratory habitat characterization along the river between Lake A and Giauque Lake; and combined assessment of the 2005 and 2006 study data and comparison to previous studies. An obstruction was noted on the McCrea River, which appeared to be limiting fish migration upstream from Giauque Lake to Lake A.

Sampling occurred over a period of 9 days between August 5 and 13, 2006. 178 fish were captured collectively in Giauque Lake and Lake A. All fish were measured for length and weight, unless fish displayed signs of stress. Then fish were released unsampled. A portion of lake trout and northern pike caught were lethally sampled to obtain age structures and tissue. Remaining fish that succumbed during sampling were measured, examined internally and externally and disposed of back into the lake. Although more young lake trout were captured in 2006 than 2005 in Giauque Lake, no fish younger than nine years were captured. The reason that no young lake trout have been captured in any of the recent aquatic studies, including 2006 where special effort was made, are not understood at this time.

The primary results of the 2006 study indicated that mercury in lake trout and northern pike in Giauque Lake were elevated above pan-northern averages in 2005/06. The trend assessment of mercury over time continues to suggest a decreasing trend in mercury in lake trout from Giauque Lake, as was found in 2005. Mercury in fish in reference Lake A remain slightly elevated above pan-northern averages.

012

Biology

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Location: Pine Point

Tamerlane Baseline Studies

The objective of this project was to obtain sufficient baseline data to develop a lead and zinc mine adjacent to the old Pine Point property. Data regarding water quality, rare plants, and wildlife were collected over 2005 and 2006.

In 2006, water quality sampling occurred at Twin Creek (the closest waterbody to the proposed pilot-plant local study area), and at two other nearby points located at the head and middle of a fen (or low, flat swampy area). In addition, Tamerlane also requested that samples be collected from an existing water well, which had been installed in the 1980s to conduct groundwater pump testing. In general, the physical and chemical water quality parameters exhibited low values and are consistent with those of 2005 sampling. While levels for ammonia and values for aluminum, chromium and iron exceeded Canadian Council of Ministers of the Environment (CCME) guides for freshwater aquatic life, these levels and values appear indicative of background conditions, and there is no evidence that water in the sampling area has been contaminated by past mining activities. Both the Slave River and Little Buffalo River are regarded as naturally-enriched sources of ammonia, chromium and iron. Furthermore, data from previous Great Slave Lake sampling indicate that this lake has naturally-elevated background aluminum levels. Aluminum is typically associated with Pine Point area geology.

The intent of the 2005 vegetation/ecological land classification (ELC) field programme was to map ecosites based on common vegetation characteristics. Rare plants are often found in habitats not sampled in an ELC programme, so a separate survey for rare plants was undertaken in 2006 to supplement the ELC work. The survey was completed in two parts in order to include plants that flower in response to the photoperiod (that is, the duration of plants' daily exposure to light) as well as plants with a neutral response to photoperiod. The survey focused on those areas that would be directly impacted by the Tamerlane project footprint. Along with the survey, six ecosites within the established study area also were identified and mapped at 1:5 000 scale (an "ecosite" is an integrated soil/vegetation unit derived from statistical analysis of detailed vegetation-plot data and can ensure practical integration of sustainable development into planning). A total of 13.1 km of transects were surveyed within the ecosites and 3.9 km of transects were surveyed for the development footprint, representing a high sampling intensity. A total of 135 species of plants (including mosses and lichens) were recorded. No rare plants were observed in either survey; however, it is important to note that this type of survey can confirm presence of species, but not their absence.

Building upon data collected through wildlife baseline surveys in 2005, additional surveys were undertaken in 2006 for owls, amphibians and breeding birds within the 16 551 ha Wildlife Study Area established in 2006 for the Tamerlane project. Pre-selected owl stations were surveyed twice during the spring. A total of 14 owls were recorded as follows: five Great Horned owls, one Great Grey owl, one Long-Eared owl and seven Boreal owls. Based on observed distances between intra-species territorial calls, occupied territories also were determined. To accommodate for limited information on amphibian distribution and breeding behaviour within the NWT, a pilot study was conducted, with a single auditory survey at selected habitats in May. Amphibian observations and calling indexes also were documented in April and May in conjunction with the owl surveys, and in June in conjunction with the breeding bird survey. During the auditory survey in May, 12 stations were surveyed, representing a variety of breeding habitats, including roadside ditches, temporary pools, wetlands, ponds, streams, highway-accessible lakes, trails and cut-lines. Boreal Chorus frogs were documented at all of the auditory stations and two Wood frogs at two stations. The Northern Leopard frog and Canadian toad were not documented. Since spring arrived earlier than normal in 2006, peak Wood frog breeding was predicted to have occurred prior to the survey date in April. Calling by Boreal Chorus male frogs (breeding behaviour) was documented in many different habitat types. The breeding bird survey focused primarily on passerines (also known as "perching birds"), which make up the largest and most diverse group of birds in the Wildlife Study Area. Upland nesting birds (grouse and ptarmigan) and shorebirds (gulls, plovers and sandpipers) also were recorded. Nineteen survey stations were pre-selected in each community type, proportional to available habitat in the Wildlife Study Area and were surveyed in June. A total of 195 birds were recorded at the point-count stations, including 31 different passerine species, one upland nesting bird and four shorebird species. The most common species

encountered were: White-Winged Crossbill; Ruby-Crowned Kinglet; Hermit Thrush; White-Throated Sparrow; Yellow-Rumped Warbler; Palm Warbler and Chipping Sparrow. The number of birds recorded in each habitat type was calculated, as well as species richness. The highest average number of species – that is, species richness – was found in the graminoid fen habitat type; “fen” is a low, flat swampy area, and “graminoid” refers to grass-like plants, such as sedges. Treed fen habitats had the lowest average species richness.

013

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Location: MacTung project area

MacTung Project Environmental Baseline Studies

As part of a suite of environmental baseline studies in 2006, a study of vegetation and documentation of terrestrial ecosystems was undertaken to update and supplement historic baseline information (circa 1983) for the MacTung Project area, on the Northwest Territories (NT)/Yukon border. Quickbird satellite imagery was obtained for ecosystem land classification (ELC) mapping. The vegetation local study area (LSA) lies within the Selwyn Mountain Ecoregion of the Taiga Cordillera Ecozone, and vegetation in that area is highly variable. Vegetation field sampling was conducted and included initial reconnaissance (on 09 July 2006 in the NT) for rare plants. However, as areas planned for development were not known at the time of the study, it is recommended that a rare-plant survey occur, once the project footprint is known. In addition, in-the-field quality assurance/quality control of the mapping prepared in 2006 should be conducted, as well as collection of baseline information on trace-element concentrations in vegetation to support future effects modelling and impact assessment.

Surface water quality sampling was conducted in four events in June, July, August and September 2006, in conjunction with other environmental baseline studies, within the MacTung Project area, on the Northwest Territories (NT)/Yukon border. Water stations were established at streams in both Yukon and NT, with NT samples collected on Dale Creek (southeast of the project site), Cirque Creek (northeast of the project site) and the Tsichu River (east of the project site). All water samples were submitted to ALS Environmental Laboratory in Edmonton for analysis of total and dissolved ultra-low metals, low-level nutrients, total organic carbon and low-level routine water chemistry.

As part of a suite of environmental baseline studies in 2006, a fisheries and aquatic resources study was undertaken to update and supplement historic baseline information for the MacTung Project area, on the Northwest Territories (NT)/Yukon border. The objective was to document fish and benthic species and habitat characteristics within the study area. Fisheries and aquatic sampling was conducted at five stations in the NT in August 2006; stations were located as follows: on the upper and lower Dale Creek (stations FS1 and FS5), Cirque Creek (station FS2), and the upper and lower Tsichu River (stations FS3 and FS4), all east of the MacTung Project camp. Electrofishing was the method used for fish sampling; however, no fish were observed or captured at any of the NT sampling stations during the 2006 survey. Aerial surveys further downstream did not indicate any signs of impassable barriers to fish movement.

The hydrological and meteorological surveys in 2006 represent a continuation of data collection begun in 2005 for the MacTung Project area, on the Northwest Territories (NT)/Yukon border; the period of survey was between July and September 2006. To gain an understanding of hydrological conditions, two stations were installed to determine time history of creek discharges and water temperatures; one station was installed on the NT side of the project area, east of camp, on Dale Creek (Site 2). Discharge from Dale Creek basin flows eastward to the Tsichu River and eventually to the Keele River in the NT. There is a pre-existing (federal) meteorological station at MacMillan Pass on the NT border, but distance and elevation differences between this location and the MacTung site led to installation of a second meteorological station in 2005, 50 m south of MacTung camp, on the Yukon side; continuous data collection has occurred at this station through 2006. From 10 July to 20 September 2006, creek stage data were recorded every 15 minutes by instrumentation, resulting in 17 discharge measurements which were used to develop a stage-discharge relationship for Site 2. The meteorological station is equipped to measure wind speed and direction, air temperature, relative humidity and incident solar radiation.

Aerial and ground-based wildlife surveys were conducted in four events in June, July, August and September 2006, following methodology from previous studies and centered on the MacTung Project area, on the Northwest Territories/Yukon border. Target species of the 2006 study included: woodland caribou; Dall's

sheep; moose; breeding birds; waterfowl and raptors. Air transect surveys were flown as follows: 14 June; 7-8 July; 5 August and 19 September (for ungulates) and 7 August (for waterfowl). Raptor surveys were flown concurrently with the ungulate surveys. Ground surveys for breeding birds were conducted in June, using standard point-count methodology.

014

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Region: NS, SS

Location: Snap Lake, Northeast Lake, King Lake Outlet and Stream 27

De Beers Snap Lake Project- 2006 Monitoring Program

The objective of this monitoring program was to collect annual data pertaining to terrestrial and aquatic resources to compare Project-related effects with the environmental assessment predictions and comply with the Project's regulatory requirements as outlined in the Project's Water Licence, Environmental Agreement, Land Use Permit and Fisheries Authorization.

Sampling was conducted by Golder Associates Ltd. around the site between January and October, 2006. The aquatics program included water quality, sediment quality, benthic invertebrates, plankton, and fish health monitoring. The wildlife program included caribou, grizzly bear, wolverine, wolf and falcon surveys. Vegetation, air quality, and hydrology (surface water monitoring) studies also occurred on site. Members of aboriginal communities participated in facets of these studies and provided input on fish habitat, fish palatability, aquatic sampling, and wildlife surveys.

Results of the programs will be submitted as part of the 2006 annual reporting requirements under the Project's Water Licence and Environmental Agreement. These reports will become part of the public record.

015

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Region: SA

Location: Smith Arm and Russell Bay of Great Bear Lake

Assessment of lake trout stocks in Great Bear Lake

Field work on Great Bear Lake was conducted between July 28 and August 7 2006. All fish were caught in multi-mesh gill nets and small mesh beach seine nets. The work was conducted by four DFO employees and six residents of Deline NWT.

Lake trout were the most abundant fish species in the Keith Arm portion of study, with a total of one hundred and ninety six caught in gillnets set in the Russell Bay area of Keith Arm. Twelve cisco, four round whitefish, and eight lake white fish were also caught. Two juvenile lake trout and two nine spine stickleback were captured in beach seines. No fish were released. The largest lake trout in this study was 37.5 inches long and 21.8 pounds, the smallest was 7.2 inches and 0.1 pounds, and the average was 21.6 inches and 5.1 pounds. The average cisco was 8.3 inches, and 0.3 pounds. The average round whitefish was 16.1 inches and 1.6 pounds. The largest lake whitefish was 25.8 inches and 10.4 pounds, and the average was 17.3 inches and 6.1 pounds.

In the Smith Arm, a total of two hundred and eighty fish were caught during the study. Two hundred and one lake trout (20 released), thirty one lake whitefish (18 released), nineteen cisco spp. (0 released), sixteen round whitefish (8 released), four grayling (0 released) were caught in gill nets. Five nine spine stickleback (0 released), and three sculpin (0 released) were caught in beach seines. The average lake trout in this study was 25.3 inches long, and 7.6 pounds, with the largest being 51.2 inches and 32 pounds, and the smallest being 7.1 inches and 0.2 pounds. The average lake whitefish was 20.9 inches long, and 4.9 pounds, and the average round whitefish was 13.1 inches, and 0.8 pounds. There were relatively few cisco caught, and the average size was 7.1 inches and 0.1 pounds.

Completion of the sampling process will occur in the winter 06/07. During this time the structures that were removed in the field will be analyzed in the lab to determine age and fecundity (number of eggs per mature female) where applicable. Additional statistical analysis will be performed after the lab work is

complete. The remaining structures taken from fish in the field will be stored for potential analyses in the future.

016 **Biology**

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Location: Big Fish River Fish Hole

Community Monitoring of the Fish Hole (Big Fish River) near Aklavik, NWT: 2006

No work pursuant to this program was conducted in 2006.

017 **Biology**

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Licence No: 13968
Location: In the vicinity of Sachs Harbour and Ulukhaktok

Qiviuq Collection

Muskoxen grow a thick layer of down wool, called qiviuq, under their guard hair, to keep warm in the frigid arctic winter. The qiviuq is shed every spring. It is eight times warmer than sheep wool (by weight), very fine and light weight. It is a valuable commodity in the exotic textile industry. The aim of this project is to use scratching posts in order to facilitate passive qiviuq collection. Success of this project depends on the animals willingness to use man-made scratching posts introduced into their habitat.

Eight 50 by 50 cm muskcombs were built using metal screws fitted with yellow plastic anchors. The anchors serve to cover the edge of the screws making it safe for the animals, and to snag and hold hair. In June 2006, researchers traveled by ATV to Kellet River and positioned the muskcombs on various points along the river and one of its tributaries.

In the summer of 2006, only one herd of 25 animals was in area of the muskcombs, and only for part of the summer. Accordingly, no signs of interaction between the animals and the muskcombs were observed.

018 **Biology**

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Region: GW

Licence No: 14031
Location: Campbell Hills, Inuvik

Mushroom Cultivation

Oyster mushrooms from a commercial spawn were grown on a local substrate inside the Aurora Research institute. The substrate consisted of 90% birch and alder from local trees, 9% store-bought seed (barley), and 1% dolomite or gypsum. Two cycles of mushroom were grown. Harvested mushroom were cooked in various recipes and consumed in a public event, where consumer interest was assessed by a questionnaire. The questionnaire found a high level of consumer interest.

The challenge for growing mushrooms was found to be maintaining suitable humidity levels. It was concluded that an automatic humidifying system, available commercially, would be required for a mushroom operation to be viable. Waste heat from the power station may be recycled for this purpose.

Therefore, it can be concluded that wood-eating mushroom can be grown indoors in Inuvik on a local and abundant substrate. Mushroom cultivation can be a viable cottage industry that provides an affordable, nutritious source of fresh food. Mushrooms can supplement some of the food deficiencies in the local diet (e.g. fibre) and be used to promote public health.

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Region: IN, GW

Location: Twenty-three sites ranging from Fort McPherson to the Tuktoyaktuk Peninsula

Autecology of Green Alder in the Mackenzie Delta

There is growing evidence that a warmer arctic climate is increasing the frequency of thermokarst terrain disturbances. Since arctic vegetation has important effects on climate, understanding the impact of altered disturbance regimes on the structure of northern vegetation is critical to understanding the impacts of global climate warming. To examine the relative importance of climate and disturbance on plant community composition, green alder population ecology, and the tundra microenvironment the researchers sampled recent and old thaw slumps and undisturbed tundra across a temperature gradient from Inuvik to the low arctic tundra on northern Richards Island.

Preliminary results show increases in alder productivity, catkin production, seed viability, and density of green alder at disturbed sites, as compared to undisturbed tundra. The researchers also observed elevated snow pack, increased nutrient availability, warmer ground temperatures, and a thicker active layer at slump sites. Analysis of plant community composition suggests that abiotic variables (such as snow pack, active layer depth and nutrient supply rates) are important drivers of plant community structure, which differs markedly on thaw slumps compared with undisturbed terrain. If the frequency of thaw slumping increases with continued warming, the effects of these disturbances may magnify the direct effects of temperature on northern ecosystems.

020 **Biology**

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Region: NS

Location: Diavik diamond mine, Lac de Gras

Community-based monitoring camp

The community-based monitoring camp was created by Diavik to involve Aboriginal Peoples of communities affected by the mine site. People are concerned with affect of the mine on fish, water and caribou. During the monitoring camp, people from local communities gathered information about Diavik and environment-related issues and provided input and recommendations to EMAB.

Participants learned to use scientific equipment and collect samples of water, benthos and sediment. This data will be analyzed to determine if there are any changes to Lac de Gras. This effort is separate from Diavik's own aquatic effects monitoring sites.

Participants learned about fugitive dust monitoring and lichen studies taking place at the Diavik mine and were able to observe dust collection methods to learn about air quality monitoring from a GNWT Environment & Natural Resources expert. Participants learned about accepted methods and practices out in the field.

Participants in this year's Fish Palatability and Texture Study caught fish, prepared them for eating and evaluated the quality. Community members also recorded standard biological information on each fish collected. The fish used in the study included Lake Trout and Round Whitefish (approximately 30).

021

Biology

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Region: IN

Location: Within the proposed study boundaries in the Inuvialuit Settlement Region

2006 Biophysical and Reconnaissance Studies in the Inuvialuit Settlement Region

The objectives of this project were to collect data to assess the feasibility of constructing a potential oil and gas pipeline for the Mackenzie Gas Project. Data gathered from these studies will be used, in combination with existing technical/scientific information and local knowledge, to develop a knowledge base for: planning, assessing and producing environmental plans; progressing engineering design, and supporting regulatory processes.

The biophysical and reconnaissance studies in the Inuvialuit Settlement Region (ISR) included access route and site reconnaissance; aquatic studies; terrestrial; engineering, geological and geophysical studies. The studies were conducted by crews of up to six individuals, including a local assistant, using helicopters and in some cases watercraft (boats and barges) and all terrain vehicles. The Program took 126 calendar days to complete between May 30 and October 4, 2006.

Route and site reconnaissance was comprised of verification of locations for the pipeline route, compressor stations and infrastructure, (camps, equipment storage sites) as well as access roads, borrow sites and identification of land features.

Aquatic studies were conducted at various project sites including barge landings, borrow sources, access roads and pipeline watercourse crossings. Reconnaissance studies were conducted followed by detailed aquatic surveys. Information collected during the surveys included fish capture data (presence, age, length, and weight), when possible, with backpack electrofishing units, boat electrofishing units, minnow traps, beach seines, angling or gill nets. Fish habitat assessments were also conducted and mapped. Lake bathymetry data were collected at selected sites and river bathymetry data near proposed barge landings. Observations were made of slope and vegetation in the predicted flow path between infrastructure/facility sites and receiving waterbodies. Water and sediment quality samples were also collected.

Vegetation surveys involved three types of data collection. Visual checks were conducted via helicopter to confirm vegetation types assigned during aerial photo interpretation. Ground plots were surveyed to quantify main tree, shrub and groundcover plant species and snag and coarse woody debris cover. Rare plant reconnaissance surveys were conducted on project sites where small patch communities and uncommon terrain features with higher potential to support rare plants were found.

Engineering studies were comprised of thermistor data recovery, assessment of stream temperatures, river channel and thalweg surveys, assessment of slope stability design, examination of soil resistivity, aerial photography and fault line surveys. Geotechnical and constructability assessments were conducted at potential barge landing sites.

022

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Region: DC

Location: Within the proposed study boundaries in the Deh Cho Region

2006 Biophysical and Reconnaissance Studies in the Deh Cho Region

The objectives of this project were to collect data to assess the feasibility of constructing a potential oil and gas pipeline for the Mackenzie Gas Project. Data gathered from these studies will be used, in combination with existing technical/scientific information and local knowledge, to develop a knowledge base for: planning, assessing and producing environmental plans; progressing engineering design, and supporting regulatory processes.

The 2006 biophysical and reconnaissance studies in the Deh Cho Region (DCR) included access route and site reconnaissance; aquatic studies; terrestrial; engineering, geological and geophysical studies. The studies were conducted by crews of up to six individuals, including a local assistant, using helicopters and, in some cases, watercraft (boats and barges) and all terrain vehicles. The Program took 172 calendar days to complete between April 24 and October 12, 2006.

Route and site reconnaissance was comprised of verification of locations for the pipeline route, compressor stations and infrastructure, (camps, equipment storage sites) as well as access roads, borrow sites and identification of land features.

Groundwater surveys were conducted to identify any groundwater-related features that might impact, or be impacted by, activities related to the borrow sites and infrastructure sites.

Aquatic studies were conducted at various project sites including barge landings, borrow sources, access roads and pipeline watercourse crossings. Reconnaissance studies were conducted followed by detailed aquatic surveys. Information collected during the surveys included. -

Aquatic studies were conducted at various project sites including barge landings, borrow sources, access roads and pipeline watercourse crossings. Reconnaissance studies were conducted followed by detailed aquatic surveys. Information collected during the surveys included fish capture data (presence, age, length, and weight), when possible, with backpack electrofishing units, boat electrofishing units, minnow traps, beach seines, angling or gill nets. Fish habitat assessments were also conducted and mapped. Lake bathymetry data were collected at selected sites and river bathymetry data near proposed barge landings. Observations were made of slope and vegetation in the predicted flow path between infrastructure/facility sites and receiving waterbodies. Water and sediment quality samples were also collected.

Vegetation surveys involved three types of data collection. Visual checks were conducted via helicopter to confirm vegetation types assigned during aerial photo interpretation. Ground plots were surveyed to quantify main tree, shrub and groundcover plant species and snag and coarse woody debris cover. Rare plant reconnaissance surveys were conducted on project sites where small patch communities and uncommon terrain features with higher potential to support rare plants were found.

Engineering studies were comprised of thermistor data recovery, river channel and thalweg surveys, assessment of stream temperatures, assessment of slope stability design, examination of soil resistivity aerial photography and fault line surveys. Geotechnical and constructability assessments were conducted at potential barge landing sites.

023

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Region: SA

Location: Within the proposed study boundaries in the Sahtu Settlement Area

2006 Biophysical and Reconnaissance Studies in the Sahtu Settlement Area

The objectives of this project were to collect data to assess the feasibility of constructing a potential oil and gas pipeline for the Mackenzie Gas Project. Data gathered from these studies will be used, in combination with existing technical/scientific information and local knowledge, to develop a knowledge base for: planning, assessing and producing environmental plans; progressing engineering design, and supporting regulatory processes.

The 2006 biophysical and reconnaissance studies in the Sahtu Settlement Area (SSA) included access route and site reconnaissance; aquatic studies; terrestrial studies; engineering, geological and geophysical studies. The studies were conducted by crews of up to six individuals, including a local assistant, using helicopters and, in some cases, watercraft (boats and barges) and all terrain vehicles. The Program took 178 calendar days to complete between April 26 and October 20, 2006.

Access route and site reconnaissance was comprised of verification of locations for the pipeline route, compressor stations and infrastructure, (camps, equipment storage sites) as well as access roads, borrow sites and identification of land features.

Groundwater surveys were conducted to identify any groundwater-related features that might impact, or be impacted by, activities related to the borrow sites and infrastructure sites.

Aquatic studies were conducted at various project sites including barge landings, borrow sources, access roads and pipeline watercourse crossings. Reconnaissance studies were conducted followed by detailed aquatic surveys. Information collected during the surveys included fish capture data (presence, age, length, and weight), when possible, with backpack electrofishing units, boat electrofishing units, minnow traps,

beach seines, angling or gill nets. Fish habitat assessments were also conducted and mapped. Lake bathymetry data were collected at selected sites and river bathymetry data near proposed barge landings. Observations were made of slope and vegetation in the predicted flow path between infrastructure/facility sites and receiving waterbodies. Water and sediment quality samples were also collected.

Vegetation surveys involved three types of data collection. Visual checks were conducted via helicopter to confirm vegetation types assigned during aerial photo interpretation. Ground plots were surveyed to quantify main tree, shrub and groundcover plant species and snag and coarse woody debris cover. Rare plant reconnaissance surveys were conducted on project sites where small patch communities and uncommon terrain features with higher potential to support rare plants were found.

Engineering studies were comprised of thermistor data recovery, assessment of stream temperatures, river channel and thalweg surveys, assessment of slope stability design, examination of soil resistivity, aerial photography and fault line surveys. Geotechnical and constructability assessments were conducted at potential barge landing sites.

024

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Region: GW

Location: Within the proposed study boundaries in the Gwich'in Settlement Area

2006 Biophysical and Reconnaissance Studies in the Gwich'in Settlement Area

The objectives of this project were to collect data to assess the feasibility of constructing a potential oil and gas pipeline for the Mackenzie Gas Project. Data gathered from these studies will be used, in combination with existing technical/scientific information and local knowledge, to develop a knowledge base for: planning, assessing and producing environmental plans; progressing engineering design, and supporting regulatory processes.

The 2006 biophysical and reconnaissance studies in the Gwich'in Settlement Area (GSA) included access route and site reconnaissance; aquatic studies; terrestrial; engineering, geological and geophysical studies. The studies were conducted by crews of up to six individuals, including a local assistant, using helicopters and in some cases watercraft (boats and barges) and all terrain vehicles. The Program took 160 calendar days to complete between April 27 and October 3, 2006.

Access route and site reconnaissance was comprised of verification of locations for the pipeline route, compressor stations and infrastructure, (camps, equipment storage sites) as well as access roads, borrow sites and identification of land features.

Aquatic studies were conducted at various project sites including barge landings, borrow sources, access roads and pipeline watercourse crossings. Reconnaissance studies were conducted followed by detailed aquatic surveys. Information collected during the surveys included fish capture data (presence, age, length, and weight), when possible, with backpack electrofishing units, boat electrofishing units, minnow traps, beach seines, angling or gill nets. Fish habitat assessments were also conducted and mapped. Lake bathymetry data were collected at selected sites and river bathymetry data near proposed barge landings. Observations were made of slope and vegetation in the predicted flow path between infrastructure/facility sites and receiving waterbodies. Water and sediment quality samples were also collected.

Vegetation surveys were conducted in the GSA from July 27 to August 3. Vegetation surveys involved three types of data collection. Visual checks were conducted via helicopter to confirm vegetation types assigned during aerial photo interpretation. Ground plots were surveyed to quantify main tree, shrub and groundcover plant species and snag and coarse woody debris cover. Rare plant reconnaissance surveys were conducted on project sites where small patch communities and uncommon terrain features with higher potential to support rare plants were found.

Engineering studies were comprised of thermistor data recovery, river channel and thalweg surveys, assessment of stream temperatures, assessment of slope stability design, examination of soil resistivity (i.e. specific resistance), aerial photography and fault line surveys. Geotechnical and constructability assessments were conducted at potential barge landing sites.

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File No: 12 402 788**Licence No:** 13958**Region:** IN, GW, SA**Location:** Mackenzie River and related watercourse areas**Stock Delineation of Fish Species in the Mackenzie River**

In this study a population genetics approach was used to study the structure of fish species in the Mackenzie River system. Researchers focused on three species: lake whitefish (crooked back, *Coregonus clupeaformis*), inconnu (coney, *Stenodus leucichthys*), and burbot (loche, *Lota lota*). In 2006, the researchers finalized the optimization of the genetic markers (10 microsatellite loci) for lake whitefish and ran samples from several sites in the lower Mackenzie system: Peel River, Arctic Red River Tsiigehtchic, Inuvik, and Travaillant Lake. The researchers plan to increase the sample size and to include more sites (e.g., Aklavik, Tuktoyaktuk, Fort Good Hope). This study resulted in the development of the first ever microsatellite markers for inconnu. Finally, broad sampling of inconnu and burbot is being conducted in the Mackenzie Delta and upriver. Preliminary results for lake whitefish show that the population in Travaillant Lake is very differentiated from all other locations.

026**Biology****Millar, Nathan**

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File No: 12 402 788**Licence No:** 13983**Region:** GW**Location:** Netting locations will be determined in consultation with the Gwichya Gwich'in Renewable Resource Council**Arctic Red River Fish Study**

The Arctic Red River has long been an important fishery for the Gwich'in. Despite this importance, relatively little information exists on the river's fisheries resources. Of notable absence are sound baseline data on biological characteristics of fish (e.g., length, weight, age at maturity, migration patterns, date of spawning) and on presence-absence of species: data that are necessary to monitor changes in fisheries over time. The Renewable Resources Board and Department of Fisheries and Ocean's Peel River Fish Study successfully established this information for the Peel. The intent of this study was to mirror this in the Arctic Red River. Experimental gill nets were used to collect fish from July to September. Captures included longnose suckers (*Catostomus catostomus*), northern pike (*Esox lucius*), inconnu (*Stenodus leucichthys*), walleye (*Stizodeum vitreum*), broad whitefish (*Coregonus nasus*), cisco (*Coregonus spp.*), burbot (*Lota lota*), and lake whitefish (*Coregonus clupeaformis*). Fish were "dead sampled" and biological characteristics were recorded. These data will be combined with previously collected data (from 2003 and 2004) on fish resources of the Arctic Red River and will thus contribute to sound baseline data. This study complements a traditional knowledge study also conducted this year (licence # 13929).

027**Biology****Millar, Nathan**

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File No: 12 402 788**Licence No:** 13984**Region:** GW**Location:** To be determined in consultation with the Tetlit Gwich'in Renewable Resource Council.

Investigation of Vittrekwa River Dolly Varden

Dolly Varden (a species of char, *Salvelinus malma*) are culturally and economically important for the communities of Fort McPherson and Aklavik, NWT. Many of the Dolly Varden populations in the Northern NWT and Yukon have been studied in great detail, but little information is available on the population that spawns in the Vittrekwa River. In this study, researchers collected a variety of information on the Vittrekwa population. Visual surveys were used to identify critical spawning and rearing habitat. Ten char were equipped with radio transmitters and were followed during their post-spawning movements to identify over-wintering habitat. The researchers collected biological data (e.g., length, weight, sex, maturity) on over 100 char and floy tagged a portion of these to learn more about their movements and growth. Genetic samples (adipose fins) were collected for use in a larger study on the population structure of Dolly Varden. Of particular interest was the finding that the Vittrekwa harbours a large number of resident male fish – fish that do not go out to the ocean, but remain in freshwater their entire lives.

028

Biology

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File No: 12 402 788

Licence No: 14078

Region: GW

Location: Travaillant Lake and Travaillant River

Travaillant Lake Fish Population Assessment 2006

The Travaillant Lake system, located entirely within the Gwich'in Settlement Area (GSA) is an area of great cultural, traditional, and ecological importance. In light of proposed nearby industrial development, Travaillant Lake has become a focus of fisheries related studies. In this current study, information was collected on the biological characteristics (e.g., age, length, weight), vital rates, and life history traits of important fish species, with a particular focus on broad and lake whitefish. Baseline information was also collected on population abundance and species composition of all fish species captured. With future monitoring, this baseline information will permit the detection of changes in the fish abundance and population structure. This study was initiated in 2004 and is proposed to be carried out over a 5 year period. In 2006, researchers sampled fish from Travaillant Lake for 10 days in late July. They caught lake whitefish, broad whitefish, cisco species, lake trout, and northern pike (409 fish total). Fish were sampled from the Travaillant River north of Travaillant Lake (inflow) and south of Travaillant Lake (outflow) in late October. Only broad and lake whitefish were caught, most of which were in spawning condition (246 fish total).

029

Biology

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File No: 12 402 644

Licence No: 14052

Region: DC, SA

Location: Selected streams and lakes along the proposed Mackenzie Gas Pipeline route (Sahtu Settlement Area and the Deh Cho Region)

Distribution and Habitat Use of Sensitive Fish Species along the Mackenzie River Valley

Stream surveys were conducted in selected reaches of three streams in the Deh Cho Region during July, 2006. Streams were electrofished and habitat availability and use were recorded. A total of 223 fish representing eight different species were captured. Slimy sculpin was the most abundant species in this area representing 70.4 % of the total catch followed by lake chub (16.6 %), Arctic grayling (6.3 %), burbot (2.2 %), white sucker (2.2 %), and northern pike (1.3 %). Emerald shiner and round whitefish accounted for only 0.8 % of the catch. Lake chub were found in all of the streams surveyed. Mean depths ranged from 7.8 cm to 46.3 cm, mean velocities ranged from 0.19 m·s⁻¹ to 0.73 m·s⁻¹, cobble and pebble was the most common substrate found, and cobble and boulder was the predominant cover observed. Mean temperatures were 13.3 °C for Smith Creek and 16.5 °C for White Sand Creek.

In the Sahtu Settlement Area, stream surveys were conducted in selected reaches of 15 streams during 2006. Habitat availability and use were recorded in seven of these streams. A total of 908 fish representing

nine different species were captured. Slimy sculpin (*Cottus cognatus*) was the most abundant species in this area representing 67.5 % of the total catch followed by Arctic grayling (*Thymallus arcticus*) (27.5 %), lake chub (*Couesius plumbeus*) (2.1 %), bull trout (*Salvelinus confluentus*) (1.0 %), and Dolly Varden (*Salvelinus malma*) (1.3 %). Brook stickleback (*Culaea inconstans*), northern pike (*Esox lucius*), mountain whitefish (*Prosopium williamsoni*), and white sucker (*Catostomus commersoni*) accounted for only 0.6 % of the catch. Arctic grayling was the most widespread species found in this area as it was present in all but one location where fish were caught. Mean depths ranged from 7.1 cm to 42.5 cm; mean velocities ranged from 0.04 m·s⁻¹ to 0.34 m·s⁻¹; mean temperatures ranged between 6.7 °C and 17.7 °C; and cobble was the dominant substrate and cover observed.

030

Biology

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Region: NS, SS

Location: Lac de Gras

Diavik Diamond Mines Inc. Shoal Habitat Monitoring Program: a Lake Trout Habitat Utilization Survey

As per Subsection 8.1.3 of the *Fisheries Authorization*, Diavik conducted the Shoal Habitat Utilization survey for 2006 during the period from September 7th to 10th, 2006. The survey's purpose is to monitor the fish habitat use in the vicinity of the mine (including shoals) on an annual basis, to determine if use of these habitats has been altered, as indicated in the *Project Plan*.

For the 2006 survey, eight existing sites (three along the A154 dike and five shoals directly east of the A154 dike) were monitored for evidence of lake trout activity. Hydroacoustic, angling, and a remotely operated vehicle were the three methods used to determine evidence of lake trout. Fish caught by angling were measured (fork length), weighed, checked for spawning condition, and then tagged with a plastic Floytag.

A total of 18 fish LKTR were caught by angling, only six were able to be landed with five being tagged and one already a tagged fish that was released from the A418 fish out. It should be noted that transect "I" was the only transect that did not have a fish that was hooked by angling. All transects had fish detected by the hydroacoustic survey with a total of 89 fish detected.

031

Biology

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Region: DC, SS, NS

Location: Along roads in the North Slave, South Slave and Deh Cho regions

Surveys of Rare and Exotic Plants in the NWT

During August 2006 all territorial highways in NWT were driven to survey for exotic plants (i.e. species not native to NWT) which were visible and identifiable from a moving vehicle. Fifteen roadside walking surveys were also conducted to detect less conspicuous plants. In addition to roadsides, other habitats known to harbour exotic plants were surveyed (e.g. urban areas, agricultural areas, railways, disturbed sites). More than 5,200 km were driven and 2,959 biological (mostly exotic plant) observations were documented from 548 geo-referenced (using GPS) locations. Forty-nine of the known 94 species (52%) of exotic plants in NWT were documented during the 2006 surveys. The ten most common exotic plants along NWT roadsides based on the 2006 survey are: White Sweet-clover [319 sites]; Field Sow-thistle [172]; Narrow-leaved Hawk's-beard [134]; Yellow Sweet-clover [113]; Alsike Clover [94]; Alfalfa [71]; Red Clover [61]; Pineapple-weed [57]; Smooth Brome [56] and Prostrate Knotweed [52]. Thirteen plant species not previously recorded in NWT, most or all of which are non-native were documented during the surveys. Note that the component of the project to obtain information on rare plants in the Inuvik region was abandoned for logistical reasons, therefore the research was limited to surveys for exotic plants.

032**Biology****Osawa, Akira**

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File No: 12 402 412**Licence No:** 14041**Region:** SS**Location:** Adjacent to and along Highway #5, Fort Smith**Structure and Carbon Dynamics of Boreal Forests in Discontinuous and Continuous Permafrost Zones**

Forests produce organic matter through chemical reaction called photosynthesis, by combining water in the soil and carbon dioxide (CO₂) in the air. This is why trees, like other green plants, can reduce the amount of CO₂ in the atmosphere, thus having an effect of delaying the warming air temperature of the planet. This research, therefore, looks at the amount of carbon dioxide the forests can remove from the atmosphere annually.

For this project's purposes, it is necessary to examine the amounts of organic matter and carbon (major element in carbon dioxide) moving through the forest ecosystem. Forests consist of two major parts: living biomass; and soil. Thus, the researchers first measured amounts of organic matter and carbon in living plants and those in the soil. Then estimates were made of the amounts moving between these two parts, and between them and the atmosphere. These amounts were measured or estimated by various means in jack pine forests, for example, by the use of aboveground litter traps, fine-root ingrowth cores, and an infrared gas analysis to measure the flux of CO₂ from the soil. The researchers have now accumulated several years of measurements, and will be ready to write a major report in the near future.

033**Biology****Rempel, Laura**

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File No: 12 404 655**Licence No:** 13970**Region:** SA**Location:** Canyon Creek**Sediment Transport Processes in Canyon Creek, Sahtu Settlement Region**

Field work at Canyon Creek in 2006 was carried out from May 4th to May 20th and from July 28th to August 5th. The four-person field crew included the principal investigator, two DFO technicians and a wildlife monitor). This was the second year of the project to characterize sediment transport and channel dynamics in Canyon Creek.

Sites were accessed by all-terrain vehicles and a temporary camp was set approximately 100 m downstream of the winter road ROW for the duration of field work. Several field activities were completed: (a) a long profile survey was conducted along 1.4 km of the river channel from the Enbridge ROW downstream towards the Mackenzie River; (b) 23 cross-section surveys were conducted across the channel, spaced 50 m apart; (c) fixed bench marks were installed to allow repeated surveys in future years; (d) habitat units were mapped along 1.4 km of the river channel and included water depth measurements; (e) 20 scour chains were installed at random locations within the surveyed area to measure depth of bed scour due to flooding (in addition to the 20 chains installed in 2005); and (f) 500 tracer stones were inserted in the bed to measure gravel transport distance during the 2007 spring flood. However, no fishing or biological sampling occurred.

All field work was completed successfully and the camp site was returned to its original condition. Preliminary analyses indicate that fish habitat in Canyon Creek is relatively stable between years, that the streambed is subject to only minor natural erosion during flooding, and that sediment transport rates are modest.

034**Biology****Schryer, Richard**

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File No: 12 402 696
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Licence No: 14070
Location: Screech Lake

UrEnergy 2006 Screech Lake Baseline Program

The purpose of this program was to collect baseline aquatic data on Screech Lake and associated inflow and outflow streams on behalf of UrEnerger (UR). All fieldwork was completed in August 2006.

Screech Lake and associated inflow and outflow streams were habitat mapped by walking along the shoreline and recording general habitat features. Aerial mapping was completed in areas with limited accessibility (boggy terrain; shallow water depth preventing boat access). Bathymetric data were recorded for Screech Lake.

Water quality (chemistry and limnology), sediment chemistry, and benthic invertebrate community samples were collected from ten sampling locations within Screech Lake and associated inflow and outflow streams. In addition, two samples of aquatic vegetation were collected from the area between the springs and the outflow stream. Water and sediment samples will be analyzed for nutrients, metals, and radionuclides; sediment particle size will also be analysed. The aquatic vegetation will be analyzed for metals and radionuclides.

Fish capture methods included minnow traps and angling. Ten baited Gee minnow traps were set overnight within Screech Lake (Total of 227 trap hours); no fish were captured. Five lake trout and five arctic grayling were successfully captured by angling. All captured fish had a full external and internal health assessment completed and were submitted for chemical analysis of existing metals and radionuclides concentrations in flesh and bone.

A final report of this study will be submitted to UR in 2007.

035

Biology

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File No: 12 402 787

Licence No: 14059

Region: IN, GW, SA **Error! Bookmark not defined.** **Location:** Crown land and/or municipal land sites within the Inuvialuit Settlement Region, Gwich'in Settlement Area and the Sahtu Settlement Area

Northern Native Plant Development in the Northwest Territories

A list of target plant species for the Northwest Territories was compiled during the spring 2006. Plant species were identified through species growth characteristics, literature reviews, consultation with reclamation specialists and field observations on pre-existing disturbances. In the fall, 200 seed collections were gathered from 40 different plant species. The majority of the species that were targeted in these early collections were grasses, legumes and forbs. Seed collections were made in the following regions across the Northwest Territories: Inuvialuit Settlement Region, Gwich'in Settlement Area and Sahtu Settlement Area. The seed collections were brought back to the Aurora Research Institute in Inuvik, where the collections were dried at temperatures between 20 and 30°C. Voucher plant specimens were obtained for each seed collection that was made; these specimens will be mounted and kept in the Aurora Research Institute Herbarium in Inuvik. All of the seed collections from the Northwest Territories seed collections were sent to the Alberta Research Council (ARC) in November 2006. The seeds are still in process of being cleaned, evaluated and grown by the Alberta Research Council technicians in the ARC plant development division.

036

Biology

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File No: 12 402 787
Region: NS

Licence No: 14075
Location: Areas adjacent to the highway between Yellowknife and Behchoko

Northern Native Plant Development Collections in the NWT

A list of target plant species for the Northwest Territories was compiled during the spring 2006. Plant species were identified through species growth characteristics, literature reviews, consultation with reclamation specialists and field observations on pre-existing disturbances. In the fall, 45 seed collections were gathered from 16 different plant species. The majority of the species that were targeted in these early collections were grasses, legumes and forbs. Seed collections were made at sites accessed by vehicle near the communities of Behchoko and Rae within the Tlicho Territory. The seed collections were brought back to the Aurora Research Institute in Inuvik, where the collections were dried at temperatures between 20 and 30°C. Voucher plant specimens were obtained for each seed collection that was made; these specimens will be mounted and kept in the Aurora Research Institute Herbarium in Inuvik. All of the seed collections from the Northwest Territories seed collections were sent to the Alberta Research Council (ARC) in November 2006. The seeds are still in process of being cleaned, evaluated and grown by the Alberta Research Council technicians in the ARC plant development division.

037

Biology

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File No: 12 402 783
Region: IN

Licence No: 14049
Location: Twenty-six near-shore and offshore locations in the Beaufort Sea

Past climate change and carbon cycle in the Arctic region

This research focuses on records of past climate change preserved in marine sediment, in the forms of biological and organic molecular fossils. These fossils are used to predict the influence of future climate change in the Arctic region.

During the last glacial maximum (LGM), the sea level was lowered by ~125m. After the LGM, the area of Bering, Chukchi, and Beaufort Seas expanded dramatically, in association with the rapid raising of the sea level due to the collapse of the continental glacier, and the nutrient rich Pacific water stream into Chukchi Sea had become stronger than that of during the LGM. The abrupt rise of sea level during the termination period after the LGM affected the Beringian climate, the fresh water budget of the Arctic Ocean, and ocean circulation, however, a comprehensive view of climatic changes has yet to be understood. Controversies exist as to whether the Bering Land Bridge was covered by moist or dry tundra climate as large mammals and man migrated between continents. This lack of understanding is partly due to the fact that relative sea level in Beringia is likely to have differed from eustatic sea level as a result of tectonic and possible glacio-eustatic effects. In addition, very little high-resolution paleo proxy data exists for sea surface conditions in the Bering, Chukchi and Beaufort Seas. Thus the objectives of this cruise was to understand the mechanism of these dynamic environmental changes associated with climate change.

The researcher examined the ecology and biology of planktonic protozoans, including radiolarians and foraminifers, in the western Arctic. Plankton towing in Beaufort Sea was conducted at five or six depth intervals above 1,000 m on the continental margins off the Mackenzie River. Samples were obtained using vertical hauls of a closing-net with 100 µm meshes.

Research data is available through the R/V Mirai, JAMSTEC website:
<http://www.jamstec.go.jp/cruisedata/e/>.

038

Biology

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File No: 12 402 782
Region: GW

Licence No: 14039
Location: Mouth of Pierre Creek on the Mackenzie River (28 km upstream from Tsiighehtchic)

Modeling of migratory patterns to spawning and over-wintering areas of harvested fish species in rivers along the Mackenzie Valley pipeline route

This study was initiated in 2004 and has since implanted radio-telemetry receivers (tags) in 118 migratory Coregonid fish in the lower Mackenzie River, including 66 Broad Whitefish, 30 Inconnu, 20 Lake Whitefish, and two Arctic Cisco. Numerous tracking flights were performed each year to follow fish movements. In addition, up to six stationary data-logging receiver stations were set up each year in strategic locations along the Mackenzie River between Tuktoyaktuk and Norman Wells. Each year the project involved working with local Aboriginal adults and youth. To date, a total of 60 individual fish have been relocated, many of which have been relocated on several occasions. As a result, we have identified six over-wintering areas: in the nearshore lakes and mouth of Kugmallit Bay; in lakes in the Mackenzie Delta near Inuvik; and upstream of Tsiigehtchic in the main Mackenzie River. We also identified five potential spawning areas; in the Mackenzie River at Point Separation; near Tsiigehtchic; upstream of Tsiigehtchic in the Mackenzie River; up the Hare Indian River; and in the Mackenzie River at the Ramparts Rapids. Data analysis and continued field research is ongoing for this project. Annual reports and posters have been provided to local communities involved with the research project.

039

Biology

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File No: 12 402 782

Licence No: 14067

Region: SA

Location: Yeltea Lake

Population abundance and vital rates of fish harvested from lakes along the Mackenzie Valley pipeline route: Yeltea Lake 2006

A fish stock assessment field study was performed at Yeltea Lake, Sahtu Settlement Area, Northwest Territories from September 1 to 14, 2006. The objective of this study was to document information on harvested fish species prior to the potential construction of the proposed Mackenzie Gas Pipeline. The proposed pipeline route crosses Tieda River which connects Yeltea Lake to the Mackenzie River and may be used by fish. The field crew for the study consisted of a biologist from DFO, a fisheries technician, two adults from Fort Good Hope, and one youth from Fort Good Hope. Multi-mesh sized gill nets were set in several locations in the lake and fish that were caught were sampled for length, weight, sex, maturity stage, ageing structures, muscle tissue, and genetic tissue. A total of 290 fish were caught and sampled including: 30 Burbot; 56 Lake Cisco; 39 Lake Trout; 138 Lake Whitefish; 9 Northern Pike; and 18 Round Whitefish. Preliminary analysis indicated that Broad Whitefish ranged from 119 mm to 579 mm in size and 1 to 20 years of age, burbot ranged from 229 mm to 773 mm in size and 3 to 18 years of age, lake cisco ranged from 103 mm to 154 mm in size and 1 to 8 years of age, lake trout ranged from 437 mm to 714 mm in size and 8 to 39 years of age, lake whitefish ranged from 109 mm to 502 mm in size and 1 to 40 years of age, and Northern pike ranged from 151 mm to 900 mm in size. No age data is available for pike at this time.

040

Biology

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Region: GW, INError! Bookmark not defined.

Location: Fort McPherson, Tsiigehtchic,

Inuvik, Aklavik and Tuktoyaktuk

Arctic Borderlands Ecological Knowledge Co-op Community Monitoring Program

The objective of the Co-op program was to document observations based on local knowledge of the land, plants, animals, and community life. These observations contribute to a broader regional ecosystem monitoring program, intended to assist in the understanding of what is changing and why. It was the community residents themselves who initiated and who continue to support the inclusion of local knowledge in the regional monitoring. This was the tenth year that the program has been running in Old Crow, Aklavik

and Fort McPherson. It was the sixth year in Arctic Village and the third in Tuktoyaktuk. Tsigehtchic has also participated for two years but was unable to take part in the program in 2005-2006.

In January and February 2006, each community monitor interviewed about 20 experts in their community using a questionnaire which asked for observations about weather, berries, caribou, fish, other animals and life in the communities themselves. Results from this research are available online at <http://www.taiga.net/coop/community/index.html> and include written summaries of the information obtained from the interviews and quotes from the local experts, drawn directly from the completed interviews.

041

Biology

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Region: SS

Location: Selected portions of Trudel Creek and Talston River

Bathymetric and Fisheries Surveys carried out for the Trudel Creek Aquatics Assessment

The Northwest Territories Energy Corporation's (NTEC) proposed Taltson Expansion Project will alter the flow regime of Trudel Creek, which currently receives excess water not used for power generation in the Taltson River system. The Expansion Project will maximize the use of this excess flow, thereby significantly reducing water flow through the South Valley Spillway and into Trudel Creek.

Fish habitat and community surveys were conducted at six stream sites and three lake sites along Trudel Creek between the spillway and the confluence of the Taltson River. Fish habitat was also characterized at three previously sampled sites on the Taltson River downstream of the Twin Gorges Dam in order to establish reference conditions for fish habitat and community.

Fish habitat quality was generally fair to good at all sites in Trudel Creek, lakes within the Trudel Creek system, and Taltson River. Taltson River sites were deeper than the Trudel lake sites, which were deeper than Trudel Creek. At all sites, the dominant cover type was in-stream vegetation.

A total of 114 fish were captured during the September 2006 sampling trip. The most abundant species was Lake whitefish, followed by Northern pike, White sucker, Walleye, and Longnose sucker. Burbot were seen but not captured, and lake cisco may be present in the lakes. The species composition of Trudel Creek and lakes differs from the Taltson River in that there are more whitefish, fewer suckers, and no lake trout in the Trudel Creek system. Catch-per-unit-effort (CPUE) was significantly lower in Trudel Creek than in the Taltson River or lakes of the Trudel Creek system.

042

Biology

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Region: IN

Location: Twenty-two historic well sites

Shell Canada Limited Summer 2006 Historic Well Site Investigations

During the summer of 2004, Shell Canada Energy (Shell) completed an inventory and initial environmental assessment of 22 historic well sites in the Inuvialuit Settlement Region. Shell is developing a risk-based remedial approach for addressing the environmental impacts associated with the drilling sumps. To facilitate this process, additional information from the historic well sites was collected during August 2006 by IEG Consulting and WorleyParsons Komex.

The objectives of the program were to: fill in specific data gaps identified following the preliminary reconnaissance work for the drilling sumps; collect and classify terrestrial, aquatic and/or marine invertebrate samples from typical sites representing the drilling sumps; complete detailed vegetation surveys at typical sites representing the four geographic divisions; assess the current vegetation and potential vegetation stress at all sites; collect plant tissue samples to assess potential for bio-concentration of contaminants.

Results of this study are documented in a report prepared by WorleyParsons Komex, entitled *Field Wide Risk Assessment: Background Document, Mackenzie Delta Drilling Sumps* (published in May 2007).

043**Biology****Weagle, Ken**

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File No: 12 402 720**Licence No:** 13991**Region:** NS, SS**Location:** At Matthews Creek (64° 6'10.6" 111° 15' 32.8")**Hydrometric Survey, Matthews Creek, NWT**

During summer and autumn 2006, EBA Engineering Consultants Ltd. (EBA) conducted a second year of hydrometric surveying of Matthews Creek, which flows between Matthews Lake and Courageous Lake, NT; the first year of hydrological work was 2005. The survey was on behalf of Seabridge Gold Inc. (Seabridge), which maintains a mineral property in this area, approximately 220 km northeast of Yellowknife. The report produced summarizes the data collected manually and by datalogger over the two years of the survey.

Three survey events occurred in 2006: the first event consisted of reinstalling the instrumentation and collecting an initial set of stage-discharge information; further stage-discharge data were collected during the second event; and during the third event, final stage-discharge data for the year were collected and the instrumentation removed for the season. With the inclusion of the 2006 discharge data, the stage-discharge relationship was improved. This changed the relationship somewhat, thereby changing the 2005 hydrograph. Therefore, the maximum and minimum discharge estimates for 2005 have also changed slightly. The hydrographs for the years 2005 and 2006 are similar with respect to discharge and trends.

In 2005, the maximum recorded discharge (by datalogger) of 1.15 m³/s for Matthews Creek occurred on 24 June. Generally, creek flows reduced in volume over the summer and autumn. A minimum flow of 0.14 m³/s was recorded on 22 September, just prior to the creek's freezing over. In 2006, the maximum-recorded discharge (by datalogger) of 1.02 m³/s for Matthews Creek occurred on 18 June. Again, creek flows typically reduced in volume over the summer and autumn, with a minimum flow of 0.23 m³/s recorded on 06 October, just prior to freeze-up. Creek water temperatures were recorded over the same two-year period. The Matthews Creek hydrographs for the years 2005 and 2006 are similar with respect to discharge and trends.

Since year-to-year variations can be significant, it is recommended that the hydrology programme be continued for at least another year, to improve the stage-discharge relationship and to increase the period of record for Matthews Creek discharges and water temperatures. Research also should be done with respect to relating water-equivalent precipitation to Matthews Creek discharge response, installing a site meteorological station to collect this data.

044**Biology****Wen, Marc**

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File No: 12 402 766**Licence No:** 13981**Region:** NS**Location:** Over seventy lakes and seven streams in the EKATI Diamond Mine area**2006 Aquatic Monitoring Program**

In 2006, researchers collected the second year of comprehensive data from Upper Exeter Lake, the receiving water body for the Pigeon Watershed in the EKATI claim block for BHP Billiton Diamonds Inc. The objective of the study was to obtain reference (baseline) data to represent unaffected conditions prior to development if this occurs. These data will be used to determine potential effects the mine may have on the surrounding water bodies and aquatic life if development begins. The second year of stream baseline data was collected at Pigeon Stream upstream of Pigeon Road culvert and at Fay-Upper Exeter Stream in 2006. The aquatic baseline program within the Pigeon Watershed monitored water quality, hydrology, sediment quality, physical limnology, phytoplankton, zooplankton, lake benthos, stream benthos, and lake fish community. Variations observed in the data were similar to historic values, or natural variation for these measured parameters. In the future, the following sites will be routinely monitored AEMP sites if development begins: Upper Pigeon Stream; Lower Pigeon Stream; Fay Lake; Fay-Upper Exeter Stream; and Upper Exeter Lake.

An Aquatic Effects Monitoring Program (AEMP) at the EKATI Diamond Mine was also conducted within the Koala and King-Cujo watersheds to identify potential effects that the mine may be having on the surrounding water bodies and/or aquatic life. Lakes and streams were monitored within both watersheds for water quality, hydrology, physical limnology, phytoplankton, zooplankton, lake benthos and stream benthos. Water quality variables collected in the Koala Watershed including pH, sulphate, chloride, total dissolved solids (TDS), potassium, total ammonia, nitrate, nitrite, total arsenic, total nickel, and total molybdenum increased downstream of the Long Lake Containment Facility (LLCF). Geographically, changes in some parameters were found as far as Lac de Gras. All values measured in 2006 at all lakes and streams were within compliance with BHP Billiton's water licence and were below Canadian guidelines for the protection for aquatic life. Biologically, a decrease in cladocerans (a type of small animal that floats in the water) was seen in Moose Lake. In 2006, detectable water quality changes in the King-Cujo Watershed (downstream of Misery Camp), included increased pH, sulphate, chloride, TDS, potassium, total ammonia, total arsenic, total molybdenum, and total nickel increased downstream of the King Pond Settling Facility (KPSF). Geographically, changes in some parameters were found as far as Christine-Lac du Sauvage Stream. All reported values were in compliance with the Class A Water Licence and were within conservative guidelines for the protection of aquatic life. Increased lake benthos in Cujo Lake, and decreased stream benthos diversities in Cujo outflow were found.

Also in 2006, a second year of comprehensive data was collected from five primary lakes (Lake A, Lake I, Fox 3 Lake, Fox 2 Lake, and South Fox 2 Lake) and several small lakes and ponds in the Fox Area of the EKATI claim block in order to collect baseline data to characterize the unaffected conditions of the area. It is anticipated that waste rock piles from the nearby Fox Pit will be extended horizontally, although there is no detailed plan as of yet. These data will be used to determine potential effects that the mine may have on the surrounding waterbodies and aquatic life in the Fox area when development begins. The second year of stream baseline data was also collected at four streams in the area during this field season. The aquatic baseline program within the Fox Area monitored water quality, physical limnology, phytoplankton, zooplankton, lake benthos, and stream benthos. Most lakes and ponds studied as part of the Fox Area baseline project were generally oligotrophic and had water quality that is characteristic of undisturbed lakes and ponds in the EKATI claim block, however, not all lakes and ponds selected as part of this baseline study are un-impacted. Some water bodies that were included are within the receiving environment of the LLCF. Concentrations for water quality parameters including sulphate, TDS, chloride, potassium, nitrate and molybdenum are influenced by the discharge from this facility.

In 2006, the first year of comprehensive data was collected from multiple sites in Lac du Sauvage and from Ursula Lake in the EKATI claim block for BHP Billiton Diamonds Inc. The objective of the study was to obtain reference (baseline) data to represent unaffected conditions prior to development if this occurs. These data will be used to determine potential effects the mine may have on the surrounding water bodies and aquatic life if development begins. The aquatic baseline program within the Jay Pipe Area monitored water quality, sediment quality, physical limnology, phytoplankton, zooplankton, lake benthos, stream benthos, and lake fish community and habitat.

Variations observed in the data were similar to historic values, or natural variation for these measured parameters.

045

Biology

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Inuvik Community Garden Society

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File No: 12 402 770

Licence No: 13988

Region: IN, GW

Location: Within municipal bounds of Inuvik

Northern Native Seed Development Greenhouse and Field Trials

The Inuvik Community Garden Society worked with seed from 21 collections of nine different native plant species from the Inuvik area. The nine plant species included three different species of legumes, one forb and five different species of grass. These seed collections were evaluated in germination trials and grown in the greenhouse. During the summer, three field sites were established in existing disturbances around the community of Inuvik and were selected in consultation with the town of Inuvik. Plants were transplanted to each of these sites and will be monitored for growth and production. In the fall, additional plots were seeded at each of field sites. These three sites will be monitored in the upcoming years for vegetation growth and establishment.

046

Biology

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File No: 12 402 779

Licence No: 14028

Region: IN, GW

Location: Inuvik, Tuktoyaktuk, Sachs Harbour, Olokhaktuk (Holman), Paulatuk, Aklavik, Tsiigehtch'ic, Fort McPherson, and Kugluktuk

2006 Canada Western Arctic Germplasm Collection

No work pursuant to this project was conducted during 2006.

047

Biology

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Licence No: 14035

Region: NS

Location: Diavik Diamond Mine, Lac de Gras

A418 Fish Salvage

Diavik Diamond Mine required the construction of a system of water retention dikes in Lac de Gras to facilitate open-pit mining under dry conditions. The water retention dikes will result in a loss of fish habitat within the footprint of each dike. Diavik Diamond Mines Inc. (DDMI) has received authorization to construct the dikes in Lac de Gras. As a condition of the project's authorization, Diavik salvaged fish from all water bodies that will be lost or altered. Study timing, methods of fish collection, care and handling of fish, and morphological measurements were documented.

Field crew equipped with a boat, depth sounder, GPS unit, and fish sampling equipment completed the project. A fish transfer station will be established at a suitable location on the Lac de Gras side of the A154/A418 dike, where all fish release to Lac de Gras will occur. Daily water quality measurements included: temperature; pH; dissolved oxygen; and specific conductivity. In addition, a water quality depth profile for each parameter was conducted weekly in the deepest location within the dike area.

CONTAMINANTS

048

Contaminants

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File No: 12 402 745

Licence No: 13947

Region: IN

Location: the Kendall Island Bird Sanctuary

Environmental Soil Chemistry at Abandoned Drilling Mud-Sumps in the Kendall Island Bird Sanctuary, Mackenzie Delta Region

Frozen soil cores were obtained at two abandoned drilling mud sumps in the Kendall Island Bird Sanctuary in March 2006: Niglintgak B-19; and Kumak J-06. These cores progressed to depths of up to approximately 2 m, and provided soil samples from background, near sump, and sump cap locations. The cores were deep enough that they went through the active layer and into the underlying permafrost. Selected soil samples were analyzed for: pH; electrical conductivity; moisture content; ice distribution; major ions; organic and inorganic carbon; grain size distribution; and Atterberg limits. Thermistor cables were installed in selected boreholes to monitor the soil temperature profile in background and sump caps both immediately after sampling, and in the future. The data indicate that at the two sumps investigated contaminant migration from the sumps is not occurring to any significant degree. Small concentrations of salt ions were detected at two localized locations, possibly the result of old surface spills. The work was sponsored by Canadian Wildlife Services and support by the Aurora Research Institute. Copies of the report have been provided to both agencies.

049

Contaminants

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Licence No: 14006

Region: IN

Location: East Whitefish, Kendall Island, Shingle Point, Hendrickson Island

Linking Neurochemistry to Contaminant Exposure in Belugas of the Mackenzie Delta

Beluga sampling took place in the Inuvialuit Settlement Region (ISR) in July, 2006. One team member stayed on Hendrickson Island and worked closely with the whale monitor during sampling. Permission was obtained from each hunter prior to sampling. Brains were removed using a power-generated saw, which required a small generator. Samples were collected from 16 whales at East Whitefish Station, while 36 whale brains were obtained from whales harvested at Hendrickson Island. Environmental disturbance was minimal during sampling. There were no oil or gas spills, and all garbage and human waste was collected and transported to Tuktoyaktuk. No bears were encountered and very little interaction occurred with birds or small mammals on the island. The research team member stayed on the shore when hunting was taking place, and discussed her project with hunters and demonstrated sampling techniques to those interested. The project was also presented to adults and youth at the Coastal Zone Canada Youth Forum in Tuktoyaktuk.

Samples from this research are being stored in freezers at the University of Northern British Columbia in Prince George, British Columbia. The analysis of mercury and neurochemistry will continue until complete (2010). The results will be sent to the different Hunters and Trappers Committees in the ISR, the Aurora Research Institute, the Environmental Impact Screening Committee, NWT Contaminants Committee, Fisheries Joint Management Committee and the Department of Fisheries and Oceans.

050**Contaminants****Danon-Schaffer, Monica**

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File No: 12 402 776**Licence No:** 14017**Region:** IN, GW, NS**Location:** Within the municipal bounds of Inuvik, Tuktoyaktuk and Yellowknife**Determination of PBDEs in Canadian North Landfill Leachate and Soils**

The objective of this research was to provide understanding of factors affecting the spread of polybrominated diphenyl ethers (PBDEs) in Canada's Arctic environment, determine the level of PBDEs in leachate from the Northern Arctic landfills and the rate of leaching, to provide information to formulate regulatory standards, to assess the effectiveness of alternative landfill liners, and to assess Best Management Practices for mitigating PBDE contamination in the Canadian Arctic. The research was intended to provide knowledge and modeling tools to anticipate, manage, prevent and/or mitigate adverse impacts of industrial pollution.

Given the threats of polybrominated diphenyl ethers (PBDEs) and their widespread appearance in marine mammals and far northern communities, identifying the sources of these compounds and of various PBDE congeners in air, water and soil are of utmost importance. Potential ecological and human health risks, and increasing concentrations of PBDEs in the environment require early implementation of containment. The study looks at the leachability of PBDEs from e-wastes and examines landfill sites to determine the fate of PBDEs. Researchers looked at PBDE's generation, use, consumption, transport and accumulation patterns in order to increase the understanding of global transport of these compounds among different environmental media.

The sampling program involved the collection of leachate and water runoff in predetermined solid waste site locations in Inuvik, Tuktoyaktuk and Yellowknife. The locations were chosen due to their likelihood of contributing PBDE contaminant deposition. Most of the solid waste disposal sites, from which samples were collected, contain leachate discharged into the water body nearest to each site.

051**Contaminants****Dube, Monique**

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File No: 12 402 784**Licence No:** 14054**Region:** DC**Location:** Three sites along the Flat River; three sites on Prairie Creek; thirty-one sites in the South Nahanni River Basin**Characterization of the reference condition of northern biota and assessment of potential changes due to mining activity in the South Nahanni River Basin (NWT)**

The objectives of this project were to document current aquatic conditions in rivers of the South Nahanni watershed, to assess current monitoring methods in northern environments and to make recommendations to improve future effects monitoring in northern ecosystems. Two rivers in the South Nahanni Watershed, Flat River and Prairie Creek, are subject to industrial activity. From August 21 to September 2, 2006, sampling was conducted to collect information on fish, invertebrates, algae, water and sediment at a reference site and compared to samples from high and low exposure sites at both Tungsten Mine and Prairie Creek Exploration Property. Samples were also collected at 24 regional reference sites in the South Nahanni Watershed for comparison to exposure sites on Flat River and Prairie Creek. Results of this monitoring allowed for characterization of invertebrate, algae and fish communities. Invertebrates and algae demonstrated importance for detecting changes in community structure. Although slimy sculpin were the most abundant fish species in the sites sampled, the low abundance of fish species in these ecosystems and the effects of monitoring programs on fish populations should be seriously considered in future monitoring. Results from this study indicate that invertebrates and algae were more sensitive in detecting changes than fish and should be used in future monitoring programs.

052**Contaminants****Evans, Marlene**

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File No: 12 402 503**Licence No:** 14046**Region:** SA, SS**Location:** Great Slave Lake (East Arm, near Lutsel K'e; West Basin, near Fort Resolution; West Basin, near Hay River); and Kelly Lake (near Norman Wells)**Spatial and long-term trends in persistent organic contaminants and metals in lake trout and burbot from the Northwest Territories**

This study is investigating inorganic and organic contaminant trends in lake trout captured from the Lutsel K'e area (East Arm) and Hay River area (West Basin) and burbot from the Fort Resolution area (near the Slave River outflow). It also examined lake trout from Colville and Cli lakes. Contaminant levels remain low in Great Slave fish. There is some evidence that organic contaminants such as DDT, HCH, and chlordane have decreased slightly over 1993 to the present while mercury levels may have increased slightly. Most of the differences in contaminant levels from year to year seem to be associated with variation in the fat content, age and feeding behaviour of the fish. We do not know why this is occurring. Mercury levels in lake trout from Colville Lake were higher in 2005 than 1999 and this appears to be mainly due to the fact that the fish were older and slower growing in 2005. Preliminary data suggest that mercury levels have not changed in lake trout in Cli Lake. Our data are being used as part of Canada's assessment of the effectiveness of national and international programs in reducing contaminant transport to Canada's north. Data also are being used to investigate the potential impacts of climatic variability on contaminant transport and uptake pathways.

053**Contaminants****Evans, Marlene**

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File No: 12 402 503**Licence No:** 14055**Region:** IN**Location:** Sachs Harbour**Temporal trends and spatial variations in persistent organic pollutants and metals in sea-run char from the Canadian Arctic**

No work pursuant to this program was conducted during 2006.

054**Contaminants****Fawcett, Skya**

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File No: 12 404 644**Licence No:** 14010**Region:** NS**Location:** Giant Mine (10km north of the City of Yellowknife)**Speciation and Mobility of Antimony in Sediment, Pore Water and Surface Water in the Region of the Giant Mine, Yellowknife, NWT**

In July 2006 researchers sampled surface waters, pore-water, and sediment in the aquatic environment on the Giant mine site. The surface waters were sampled for the third time in 2 years in order to observe changes in chemistry along the flow path from the effluent treatment plant to its eventual discharge into Yellowknife Bay. Also, it is important to detect annual and seasonal variability in surface waters on the mine site. Sediment and pore-water samples were collected for a second time in Baker Creek (the channel and the vegetated area), this time with improved sampling equipment. Water samples were analyzed for iron, sulphate, and sulphide using Taiga Laboratory facilities. Pore-water samples were also analyzed for the presence of unique antimony-sulpha complexes, however none were detected. In addition, water samples

are undergoing analysis for cations, anions, and speciation of arsenic and antimony (results have not yet been received). Sediment samples have been submitted for bulk chemistry analysis (36 elements), results have not yet been received.

055 **Contaminants**

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Licence No: 13977

Region: IN, GW

Location: Within the municipal bounds of Inuvik

Inuvik Dumpsite Fire

Non-routine monitoring of the Inuvik Solid Waste Disposal Facility (SWDF) was undertaken following a fire on site. Incineration of trash is known to release environmental contaminants, including organochlorides and fire-retarding chemicals. Monitoring occurred for organochlorines, organofluorines, and brominated fire retardants (BFRs), and was done in four waterways that drain the area of the SWDF. Results indicated that more volatile organofluorines, and lighter weight BFRs were found in higher concentrations down wind, consistent with the SWDF being a point source. Levels of organochlorines were similar to levels in another arctic lake (Lake Peter), and lower than the levels in the great lakes. Levels of BFR's varied between comparable to about ten times higher than levels in Lake Winnipeg (in 2004). Organofluorines were detected at concentrations much higher than organochlorines and BFRs, by a factor of 100 to 1,000. Their concentrations are comparable to concentrations in arctic lakes near Resolute Bay. Of the waterways tested, Boot Lake is the only one used for recreation. However, it is flooded by the river channel every spring, so water is exchanged, and the level of fishing and swimming is low. However, if the level of recreation on Boot Lake increases, organofluorines should be monitored further.

056 **Contaminants**

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Licence No: 13985

Region: NS

Location: Four transects in the vicinity of Yellowknife

Dendrochemical Investigation of Arsenic Exposure from Giant Mine on Spruce and Jack Pine Forests, Yellowknife, NWT.

Growth patterns of jack pine (*Pinus banksiana*) near Giant Mine in Yellowknife, NWT were studied in order to assess the impacts of mine activities on tree-growth and forest health during the 24th century. Differences in arsenic (As) and sulphur (S) concentrations in tree-rings and surface soil and differences in groundcover species richness (GCSR) were compared for sites downwind (contaminated) and upwind (reference) of the mine. Concentrations of As and S in soil and tree-rings were significantly higher at contaminated versus reference sites, while soil pH was not significantly different. As and soil-S concentrations decreased significantly with increasing distance of study sites from the mine. Lower GCSR at contaminated sites compared to reference sites corresponded to higher levels of soil-As concentrations. Tree-ring concentrations did not reflect changes in As emissions from Giant Mine. However, changes in calcium (Ca) concentrations in tree-rings coincided with calcine management activities. The onset of activity at Giant Mine coincided with divergences in growth patterns between mean contaminated and reference chronologies unprecedented in the pre-operational period covered by this study (1900-1948). Due to constraints in data availability, differences in the climate-growth response of jack pine at contaminated and reference sites remain uncertain.

057 **Contaminants**

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File No: 12 402 774
Region: NS

Licence No: 14008
Location: On Great Slave Lake in the vicinity of effluent discharge points from Giant Mine, as well as reference locations (Yellowknife River)

Cycle 2 Environmental Effects Monitoring for Giant Mine

The objectives of this study were to characterize environmental conditions in the project area and to supplement existing environmental information with the final goal of determining whether mine effluent is affecting aquatic organisms. Sampling was conducted by Golder Associates Ltd. in two areas in and around Yellowknife Bay of Great Slave Lake, Northwest Territories, in July and September 2006. The exposure site was the mouth of Baker Creek (downstream of the outfall for Giant Mine) which is exposed to treated mine effluent. The reference areas (i.e. not exposed to mine effluent) were the upper and lower sections of the Yellowknife River.

The field surveys involved the sampling of fish and aquatic invertebrates, and characterization of fish habitat at each site. The fish studies consisted of a population survey of small bodied fish. Fish were sampled using a variety of gear (minnow traps, backpack electrofisher, seine net), and were processed for length, weight, age, liver weight and samples for histopathology, gonad weight and samples for histopathology. Hester-Dendy artificial substrate plates were used at Baker Creek and the Yellowknife River to sample aquatic invertebrates from the water column. The invertebrate species abundance and richness, and the total biomass will be evaluated for each study. Field water quality was measured and sediment and water samples were collected and which were analyzed for total metals and organic compounds.

Researchers also completed a multi-staged fish salvage project at Baker Creek within the Giant Mine property. An important component of the Giant Mine Site Remediation is the restoration of the historic channel morphology of Baker Creek. In early summer, a pond was partitioned from Baker Creek by the construction of a temporary channel needed to divert water around the construction area. Dewatering and fishing out the pond was required to enable construction to continue, and took place during July 2006.

During early November, investigatory drilling activity was conducted on the frozen core dam separating B2 Pit and Baker Creek. The portion of the dam that had been repaired was failing (visible slumping). INAC maintained existing water levels for a few days while a fisheries crew undertook a fish salvage from the wetland.

Until recently, Baker Creek flowed under Highway 4 into Mill Pond before continuing downstream into Great Slave Lake. The Mill Pond is isolated from Baker Creek. The sectioning off of the Mill Pond had caused fish to become trapped. Thick ice and lack of inflow would likely cause winter-kill of all fish fauna trapped in the pond. A single day of fish salvage was undertaken in October prior to freeze up. Once the ice had thickened enough to allow work to continue, the fish salvage continued during November 2006.

The objective of all Baker Creek fish salvage efforts were to capture all the fishes present in each area (longnose sucker, white sucker, ninespine stickleback, burbot, northern pike, lake herring, and lake whitefish) for release into the main channel of Baker Creek (July salvage) or into Great Slave Lake (October-November salvage).

Data collected for the field survey will be reported in the Cycle 2 EEM final interpretative report submitted to INAC and Environment Canada, in early 2008 as required under the Metal Mining Effluent Regulations (MMER).

058

Contaminants

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File No: 12 402 767
Region: IN, GW

Licence No: 13982
Location: Within Town of Inuvik limits (off of Navy Road)

A Global Reconnaissance Survey of Perfluorinated Compounds in Soils

The objective of this research was to investigate the distribution of perfluorooctanoic acid (PFOA) near Inuvik. PFOA is a synthetic compound that has been detected around the world, but particularly in the Arctic. This compound is associated with consumer items that have been treated to resist staining or wetting, including clothing, upholstery, fast-food containers and cookware.

The only research activity to take place in Inuvik, NT, Canada was to have a soil sample collected. This sample was collected by a staff member at Aurora College in May, 2006.

The sample is being stored in a laboratory with other samples from around the world. The PFOA-analysis methodology is still being developed, but samples will be analyzed in 2007 after the analysis protocol is established.

059 **Contaminants**

Wiatzka, Gerd

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Region: SA

Location: Port Radium Mine site

Contaminated Site Environmental Monitoring and Assessment - Port Radium, Contact Lake and El Bonanza Historic Mining Operation

The project involved environmental investigations at the Port Radium, Contact Lake and El Bonanza historic mining properties. Indian and Northern Affairs Canada (INAC) is responsible for managing these abandoned sites. Depending on the type of mining that occurred and knowledge of conditions at each of the sites, information on the following environmental components was collected: water and groundwater; sediment; benthic invertebrates; fish (species presence/abundance; quality; habitat); vegetation; soil/tailings/wasterock; radiological characterization; mine openings; infrastructure; and general site conditions. The work involved manual sampling and measurement with minimal disturbance of site conditions.

Some of the issues identified during the site investigations included: natural radiation from historic mining, localized hydrocarbon contamination, small quantities of hazardous materials (e.g., asbestos), miscellaneous debris and physical hazards such as mine openings. Based on a thorough evaluation of the results, the sites are not believed to be having a significant impact on human health or the environment. Using the information collected by the project, INAC is in the process of developing and implementing strategies to manage each of the sites. This includes the remediation of the Port Radium site (which is ongoing) and the preparation of "Remedial Action Plans" for the Contact Lake and El Bonanza Mines.

060 **Contaminants**

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Region: NS

Location: Indore Mine and Beaverlodge Mine

Contaminated Site Environmental Monitoring and Assessment - Indore and Beaverlodge Historic Mining Operations

The project involved environmental investigations at the Indore (on Hottah Lake) and Hottah (on Beaverlodge Lake) historic mining properties. Indian and Northern Affairs Canada (INAC) is responsible for managing these abandoned sites. Depending on the type of mining that occurred and knowledge of conditions at each of the sites, information on the following environmental components was collected: water, sediment, fish (species presence/abundance, quality, habitat), shoreline assessment and radiological characterization. The work involved manual sampling and measurement with minimal disturbance of site conditions.

Some of the issues identified during the site investigations included: natural radiation from historic mining, no concerns with respect to water quality, sediments with elevated concentrations of metals near the Indore Mine and no evidence of fish being impacted by the mines. Based on a thorough evaluation of the results, the sites are not believed to be having a significant impact on human health or the environment. Using the information collected by the project, INAC will develop and implement strategies to manage each of the sites.

ENGINEERING

061

Engineering

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Licence No: 13989

Region: NS

Location: Hamlet of Rae and Hamlet of Edzo sewage lagoons

Enhanced Sewage Treatment Using Aeration Technology

The twin aboriginal communities of Bechoko (Rae and Edzo) agreed to participate in this project. The Rae lagoon system is larger and operates on a discontinuous discharge, and is located 1.5 kilometers south of the community and consists of a primary lagoon and a secondary polishing lagoon. The lagoons are approximately 48 hectares in size each and constructed from a modified natural lake. The flow is from the primary raw sewage cell to a secondary polishing pond. The secondary polishing pond is decanted once yearly to a "wetlands" downstream which flows into Frank Channel and into Great Slave Lake. Once the secondary polishing pond has been decanted sufficiently enough to accommodate the volume of effluent from the primary lagoon, the valves are opened between the two lagoons to allow effluent to flow and refill the secondary lagoon.

Edzo has a piped sewage system which discharges continuously into a two cell, constructed sewage lagoon. The primary cell receives the raw effluent via an under ground sewage line. The secondary cell has an open valve connecting the two cells, which maintains the same levels of fluid in each of the two cells. The secondary cell has an open valve which continuously discharges into a wetland downstream. The wetland area drains into an engineered drainage field approximately 30 m downstream of the lagoons. From the field, the liquid flows approximately 400 meters downstream before discharging into Great Slave Lake.

The treatment enhancement was started in July of 2006 with the installation of two different systems, the Little River Pond Mill and the Airolator, following construction of electrical panels at each site.

The Little River Pond Mills (2) was installed in the Rae Lagoon primary cell. These units mix a portion of the lagoon and passively introduce oxygen into the surface waters of the lagoon. Both units have been operating continuously since the power was turned on 18 July 2006. Maintenance was performed on both units prior to freeze up to clear debris entangled in the fan blades of both units. Both units ran continuously through-out the winter months. The units were shut down for approximately two weeks during the spring breakup and repositioned in their original locations and turned back on.

The Airolators were installed into two small constructed lagoons at Edzo, and aggressively mixed and aerated the contents of each lagoon by spraying the waters into the air. Each cell is approximately seventy-five by seventy-five feet. The units ran continuously, spraying water until October 19, when the Airolators were lowered approximately 4 to 5 feet below the surface of the water in order to help prevent the units from freezing up. The units were no longer spraying the effluent but aerating through mixing instead. Once both units had frozen over, it was decided to turn the power off and allow the units to freeze in.

A sampling program was established to evaluate the water quality of the lagoons plus one station downstream of each lagoon, which matched the sampling station that the water licence had established for monitoring compliance to the licence. Baseline sampling commenced 17 May 2006 in order to gain some background information prior to the installation of the aeration systems being installed. Parameters and frequency for each sampling station are provided in the supporting documentation. Sampling continued once to twice per month until freeze-up in fall 2006.

062

Engineering

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Licence No: 13927

Region: SA

Location: Commissioner's Land, Norman Wells

Norman Wells Straw Bales and Reflective Surface Test

The Norman Wells Straw Bales and Reflective Surface Test is a program that has been operating within the municipal boundaries of Norman Wells. The objective of the program is to test the thermal properties of straw bales and reflective surfaces for use on permafrost slopes along a potential pipeline route in the Mackenzie Valley. Temperature data from sub-surface thermistor cables are being collected periodically. This is a multi-year program as data collection is proposed to last through to the summer of 2009.

It took five field days to prepare the site and install the test materials between March 14 and March 18, 2006. A small bulldozer was used to clear the snow from the proposed site to expose the ground surface. The bulldozer and a brush cutter were used to clear the selected site of vegetation, amounting to an area of 40 meters by 80 meters. An auger drill rig was brought in to drill three 150 mm diameter holes to a depth of 10 meters. PVC standpipes were installed in each borehole and the thermistor cables were then installed inside the standpipes.

Two test sections of 20 meters by 20 meters were established. One test section was covered with traditional small (27 kg) straw bales of flax. The bales were placed tightly together by hand and held in place by sand bags and steel pegs driven into the topsoil. On the other test section, a white geotextile reflective material was put in place and secured by steel pegs. Each test section was positioned over one of the thermistor cable installations. The other thermistor location is being used to monitor ground temperatures remote from the test sections, to provide control information.

063

Engineering

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Region: IN

Location: In the McKinley Bay navigation channel

Bathymetric and Sediment Sampling in McKinley Bay, NWT

Before Shell Exploration and Production Company (Shell) mobilized the Mobile Offshore Drilling Unit Kulluk from McKinley Bay, NWT, to a point offshore, a field hydrographic survey of McKinley Bay Channel was undertaken in the last week of July 2006. Canadian Petroleum Engineering Inc. (CPE) contracted a number of Inuvialuit enterprises to conduct the work and managed the project. Aquatics Environmental Services Inc. (Aquatics) of Calgary was contracted to conduct the bathymetric survey and Golder Associates (Golder) to conduct geotechnical soil assessment. Horizon North was contracted to provide a tug boat (Delta Eagle) and a support barge (William Bradley), as support vessels for accommodation and lodging.

The tug boat, support barge, and the surveying crew were mobilized at Inuvik on July 25 and arrived on site at McKinley Bay two days later. The field surveying work was completed on July 30 and the surveying crew was demobilized at McKinley Bay.

The 1999 Canadian Hydrological Service survey indicated that the central portion of the channel, from N 7764500 to N 7770500, contained three small isolated areas that had a water depth of 8.5 m. The new bathymetry survey was conducted in the last week of July, 2006, in order to define the current depth of the navigational channel. The 2006 program consisted of bathymetry survey, a shallow seabed soil evaluation by deploying a free falling penetrometer and side scan sonar survey. The bathymetry survey was conducted from a shallow survey vessel Sweep that towed six echosounders placed at 3 m apart and a side scan sonar.

By comparing the 1999 and 2006 survey data (water depths) it appears that there was no channel infilling with transported sediment due to current and wave activity.

Both the 1999 and 2006 bathymetry surveys indicate that the central portion of the channel, from N 7764500 to N 7770500, contains areas that have a water depth of less than 10 m and in some isolated areas as low as 8.5 m.

064

Engineering

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Region: SA

Licence No: 14082
Location: Within the pipeline study corridor of the Tulita District of the Sahtu Settlement Area

2006 Winter Field Geotechnical Investigation Program in the Sahtu Settlement Area - Tulita District

No work pursuant to this program was conducted during 2006.

065 **Engineering**

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Location: Richards Island, Beaufort coast, Mallik Bay, Dennis Lagoon, and Harry Channel

EnCana Corporation Richards Island 2006 Summer and Fall Field Assessment Program

The objective of the study was to determine: the best access for a drilling and development location on Richards Island; which lakes may be suitable for water withdrawal; and geotechnical baseline conditions along a proposed pipeline corridor; proposed gas conditioning facility location; and possible quarry site.

The geotechnical program used hand-held augers to assess the surficial materials to a depth of 1m along a proposed pipeline right-of-way, proposed facility location, and potential quarry (near Crooked Lake).

066 **Engineering**

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Region: GW

Licence No: 14038
Location: Sites within the pipeline study corridor of the Gwich'in Settlement Area

2006 Summer Field Geotechnical Investigation Program – Gwich'in Settlement Area

No work pursuant to this program was conducted during 2006.

067 **Engineering**

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Location: Pointed Mountain gas field, plant site, and airstrip, 30km NW of Fort Liard

Pointed Mountain

The objective of this assessment was to examine the quality of groundwater and surface water in the Pointed Mountain Gas Field in conjunction with the decommissioning of the gas field. Groundwater sampling occurred at 5 well sites, 1 plant site, and the airstrip.

FOSSILS

No licences were issued under this category.

GEOLOGY

068

Geology

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Region: IN

Location: Mallik (69° 28' 134° 40') and Niglintgak (135° 22' 69° 19')

Natural Resource Canada 2D High-Resolution Seismic Surveys at Mallik and Niglintgak

No work pursuant to this program was conducted during 2006.

069

Geology

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Region: DC

Location: Blackwater Mackenzie River basin

Surficial geology mapping of the Southern Mackenzie Valley along the Proposed Gas Pipeline

Surficial geology mapping in southern Mackenzie Valley along the proposed gas pipeline has yielded a large amount of qualitative and quantitative data. Geoscience information has been captured for 1072 natural exposures and hand-dug pits between 2005 and 2006, in an area of approximately 50 000 km². These data provide descriptive information about surficial sediments, their distribution, as well as insight into their geologic history. Till matrix was sampled for geochemical analysis and clast lithology content documented to determine sediment provenance. Glaciolacustrine sediments were sampled for geotechnical properties and eolian sediments for radiometric age determination.

Geoscience data will be published as follows. Three types of digital maps: 1) surficial geology maps on digital topography at 1:100 000 scale; 2) surficial geology polygons on Radarsat; and 3) landslide maps linked with a database. The fourth product will be a CD-ROM containing all of the above mentioned maps, in addition to the geochemical data and drift (potential) thickness maps. Surficial geology polygons will be linked to sites and their description captured as figures showing stratigraphy accompanied by photographs, sample locations, pie charts of lithology, and geochronological data where possible. In turn, sample numbers will be linked with the geochemical data, age reports, macrofossil reports, and other relevant information.

A special emphasis is being placed on the landslide data, and in some areas mapping extends up to 50 km east and west of the pipeline. Till, glaciolacustrine sediments and shale bedrock are most common along the eastern boundaries of the Mackenzie Mountains and plains developed further east: the area covered by this program. Here, postglacial stream incision reaches over 100 meters. Landslide development is most common in particular where new rivers and minor streams are developed. Landslides formation is widespread and active today, and can change the landscape over the span of a year.

070

Geology

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Region: SA

Licence No: 14065
Location: Great Bear River (approximately 8km upstream of its confluence with the Mackenzie River)

2006 Great Bear River Seismic Test Program in the Sahtu Settlement Area - Tulita District

The 2006 Great Bear River Seismic Test Program in the Sahtu Settlement Area – Tulita District (SSA-TD) was a program executed on the Great Bear River, approximately eight kilometers upstream of its confluence with the Mackenzie River. The objective of the Program was to collect information regarding the surficial geology of the Great Bear River at the location of the proposed pipeline watercourse crossing. The information will be used to determine the depth to bedrock as part of the information for a river crossing design. The sub-surface information will be used in the design of a proposed horizontal directional drill (HDD) crossing at this location. The program took nine field days to complete between October 12 and October 20, 2006.

The operation was comprised of a parallel series of reversed seismic refraction sections, which were at right angles to the centerline of the proposed pipeline crossing. Each section was centered on the centerline and extended 192 meters upstream and 192 meters downstream of the centerline. The streamer cable containing 24 geophones was aligned in the current, parallel to the banks of the river. The length of the survey section was 192 meters either side of the centerline.

The survey was conducted across the full width of the river. The approximate channel width at the crossing point for the Great Bear River is 389 meters. The transverse spacing of each of the sections did not exceed 100 meters. The section spacing and the geophone spacing were adjusted to clearly demonstrate the presence of bedrock and the near-surface lithology under the crossing down to 30 meters below the mudline.

The geophones on the streamer cables were equally spaced. A minimum of 24 channels of data was required. Data was presented in SEG-2 format for both the interpreted and the raw system data.

Two boats were required to perform the work. One boat towed the streamer cable and its crew collected the data. The other boat carried the airgun and its crew was responsible for positioning the airgun in the correct relationship to the streamer cable orientation. Each boat was crewed by three people; a specialist geophysical technician; a boat driver; and a wildlife/environmental monitor.

Four section transects were required for the Great Bear River's channel width of 389 meters. Two separate observation setups (streamer locations) were required along each transect. Each data recording session required approximately four discharges of the airgun. The geophone streamer remained in one location while the airgun was discharged about 50 meters downstream of the streamer, at the downstream end of the streamer cable, at the upstream end of the streamer cable and 50 meters upstream of the streamer cable. This procedure was repeated for each setting location of the streamer cable. Accordingly, 40-60 shots were discharged per section transect resulting in 160-240 shots for the entire program.

071

Geology

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Location: In the area located between Gameti and Chartrand Lake, encompassing Mattberry, Ingray, De Vries, Norris, Zinto, Black Lichen and Castor lakes

Southern Bear Province Geological Mapping Project

The Southern Bear Geological (bedrock) Mapping Project has been taking place ~240 km north of the city of Yellowknife, NT and in three to four years will map most of the ground within NTS map sheets 085B/4 and 5 and 086C/1-8. The 2006 field season, which was the third for the project, started on June 11th and ended on August 21st. Field mapping was completed with a core crew of six people operating out of three main base camps, which were located on Castor Lake in June, on Black Lichen Lake in July, and on Hardisty Lake in August.

Rocks within the project area can be subdivided according to age: Archean rocks, which are older than 2.5 billion years, are found mainly in the east; and younger Proterozoic rocks that are between 2.5 and 0.6 billion years old are found in the west. Several samples weighing about 20-25kg were collected to obtain precise ages on these rocks. Some of the Proterozoic rocks in eastern parts of the area, for example at Norris, Castor and Ingray lakes, contained rusty zones (called gossans) that may bear sulfide minerals. Other Proterozoic rocks, near DeVries Lake and near what has been unofficially called Fab Lake, contained

alteration zones that elsewhere in the NWT are associated with copper, silver, and gold. Samples (about 1-2 kg) of the gossans and alteration zones were collected to see if they contained appreciable amounts of precious metals. To date some of the samples have been found to contain elevated concentrations of copper (Cu), Tungsten (W), Cobalt (Co), Gold (Ag), and Manganese (Mn). These concentrations are reported in NWT Open Report 2006-002 available through the NWT Geoscience Office website at <<http://www.nwtgeoscience.ca>>.

In 2006, the Southern Bear project supported three B.Sc. thesis studies (at the University of Alberta and the University of Toronto), a Masters thesis (at the University of Alberta) and a post-doctoral study (at Memorial University of Newfoundland). Technical results from the bedrock-mapping project are presented annually at the Geoscience Forum held in November in Yellowknife and are posted on the NWT Geoscience Office website. Abstracts from the 2006 Yellowknife Geoscience Forum can be viewed on the NWT Geoscience Office website and those pertaining to the Southern Bear project are by Azar, B. et al., Bennett, V. et al., Bennett and Rivers, Byron, S.J. et al., Corriveau, L. and Mumin, H., Jackson, V.A. et al., Steeves, N. et al., and Sutherland, B. et al. The mapping results are also published in the form of a map and accompanying report, which are also available through the NWT Geoscience Office.

072

Geology

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Region: GW, SA

Location: Dempster Highway site, east of Snake River, east of Cranswick River, Orthogonal River, and Imperial Canyon and river

Regional Geoscience Studies and Petroleum Potential of the Peel Plateau and Plain, Northwest Territories and Yukon

This project was part of a four-year (2005-2009) collaborative study among the Northwest Territories Geoscience Office, Yukon Geological Survey, and Geological Survey of Canada. The project objective was to improve knowledge of regional geology, including stratigraphic relationships, depositional and tectonic histories, basin evolution, and petroleum potential. The study area has widespread hydrocarbon potential yet is under-explored and its geological history is poorly understood. New geological knowledge in the north is necessary to stimulate petroleum exploration, industry investment, and economic development for the benefit of Northerners.

During 2006, new studies were initiated in an area where much of the geological mapping dates back to the 1960's. In June and July, geological field studies took place in stratigraphic sections (layered rocks) exposed along ridges at the northern front of the Mackenzie Mountains, in uplifted areas within the Interior Plain such as Imperial Hills, and along river valleys and canyons. The work was helicopter-supported, and spanned the areas of Norman Wells, Fort Good Hope, Sans Sault Rapids, Upper Ramparts River, and Snake River. Bedrock ranges in age from the Proterozoic Era (about 800 Million years old), through Paleozoic Era (about 540 to 350 Million years old), to Mesozoic Era (early Cretaceous Period, 120-90 Million years old). Several different formations make up the stratigraphy, and many of these are of interest for their petroleum potential, either as hydrocarbon source rocks, or as reservoir rocks.

In total, more than 20 stratigraphic sections were measured and described in detail. In addition, more than 30 sites were visited to study key parts of the stratigraphy and examine structural features (folds and faults). New measurements were taken from surface in order to correlate to the subsurface of Peel Plateau and Plain. Sample collection included: 1) lithological samples for sedimentary petrology; 2) black, organic shale for source rock potential; 3) potentially porous carbonate (limestone and dolostone) and siliciclastic (sandstone) rocks for reservoir potential; 4) various lithologies for microfossil analysis. The goal of these analyses is to better understand which formations across the sedimentary basin have favourable source and reservoir characteristics as part of a hydrocarbon resource assessment. Fossils are needed to provide accurate dates for the different formations to improve regional correlations within the sedimentary basin.

The stratigraphy represents a series of stacked sedimentary basins through time. Paleoenvironments changed through both time and space, which requires studying a large region. Paleozoic rocks represent deposition along the ancient Pacific continental margin edge, which includes the development of extensive Devonian reef systems such as the one that contains the prolific Norman Wells oil fields. In the late Devonian, and again in the Cretaceous, mountain building events to the west created a foreland basin (a basin marginal to a mountain belt) setting across the Peel Plateau and Plain region. The tectonic and depositional setting of this Cretaceous basin is similar to that of economically important, oil and gas-bearing

rocks of Alberta.

Results from laboratory analyses are expected in early 2007. Data and interpretations from this year's field work will be presented at upcoming conferences and published in a series of government reports. The project web page is at <<http://www.nwtgeoscience.ca/petroleum/PeelPlateau.html>>.

073 **Geology**

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Region: IN

Location: Parsons Lake development area

ConocoPhillips Canada (North) Limited 2006 LiDAR Survey

Terra Remote Sensing Inc. conducted the ConocoPhillips Canada (North) Limited 2006 Light Detection and Ranging (LiDAR) survey for the proposed Parsons Lake development, with ground support provided by ALL-CAN Engineering and Surveys Ltd. and North of 60 Geomatics. The program's objective was to obtain high resolution, highly accurate, three-dimensional topographic imagery of proposed access routes and infrastructure sites for ConocoPhillips' proposed Parsons Lake natural gas development.

Data acquisition occurred in September 2006. Four technical experts used one fixed-wing aircraft and one helicopter for place verification targets, installing the base station, and setting up GPS at the base station. The Tuktoyaktuk Hunter and Trappers Committee provided a wildlife monitor that accompanied the personnel setting out and retrieving targets and base stations.

Following the data acquisition, Terra Remote Sensing Inc. processed the LiDAR and digital image data to supply the final deliverables data.

074 **Geology**

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Region: SA

Location: Sekwi Mountain, Mount Eduni and Wrigley Lake

Sekwi Mountain Mapping Project

During July and August, 2006, a team of geologists conducted research on the rocks of the Mackenzie Mountains on NTS sheet 105P. The team investigated local rocks and made notes, sometimes collecting a small fist-size sample to bring back to the field camp. The notes were used during the winter of 2006-2007 to prepare a map that shows the distribution of the various rocks of the area. The researchers also used the data in an attempt to explain how the mountains formed in the area, at what geological time, and under what tectonic regime. They also try to explain how the rocks were deposited before they were formed as mountains. University students on the research team used this project for graduate studies (master's and doctorate work), while government workers on the researcher team have presented their work at conference in Yellowknife, Whitehorse, Vancouver, Edmonton and Calgary. A pamphlet called "The Geology along the Canol Heritage Trail" was also produced as an outreach product, and will soon be available in Yellowknife, Norman Wells, Tulita and Fort Good Hope. Finally, the maps and reports relating this project will be available to the public through the NWT Geoscience website: <http://www.nwtgeoscience.ca>.

075 **Geology**

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Location: Mackenzie Mountains, Mount Clark, Black Water Lake and Cap Mountain

Central Mackenzie Geological Field Program

The objective of the project was to observe and document geological features in completing a reconnaissance of the surface geology of the Cambrian and Proterozoic sections in four areas of the Central Mackenzie region: Mackenzie Mountains, Mount Clark, Black Water Lake and Cap Mountain. Geological information obtained from this field program will be used to refine Devon Canada's exploration model in the Central Mackenzie region.

The 2006 field program was based out of Norman Wells, NWT and included daily field excursions by helicopter into the Mackenzie and McConnell Mountains. A total of 18 primary field locations were visited and sections measured, with additional stops to assist in defining local Cambrian and Devonian stratigraphy. The field program covered a range of 350 km between Fan Creek in the NW to Cap Mountain in the south east. The Cambrian section was extensively sampled. Sample studies are currently underway, and include the following: thin section petrography (reservoir distribution & diagenesis); Geochemical Roc-Eval (source potential & maturity); porosity-permeability (reservoir quality & distribution); Micropaleo/Macropaleo (stratigraphic zonation & regional correlations); and heavy minerals (source provenance).

Preliminary results include documentation of several Cambrian reservoirs, more accurate and updated Cambrian stratigraphy for the Central Mackenzie valley, new Cambrian play types, thick regionally extensive Cambrian source rocks and multiple structural styles impacting Cambrian and Devonian reservoir targets.

076

Geology

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Location: At locations in the Great Bear Lake area ranging between 65.5 to 66.3 deg. N and 122.2 to 124.5 deg. W

Sahtu Gravity Survey, 2006

A longline gravity survey was acquired in 2006 to evaluate Exploration Licences (EL) 436 and EL 437 (held jointly by Devon Canada and Talisman) in the Great Bear Lake Area. The gravity data provides a view of the area subsurface by sensing differences in density. Seismic data is very limited and very difficult to acquire in this remote area. The higher resolution gravity survey is a cost effective way to complement limited seismic data and shows trends in the geology. The Proterozoic is approximately 1200 meters below surface in the Great Bear Lake Area. The gravity data is used to map faults, relative highs and lows and geologic trends of the Proterozoic basement.

The gravity data exhibits a northeast to southwest trending fabric in the eastern two thirds of the survey area. A more northerly trend is observed at the west part of the survey. Bands of alternating high and low gravity readings east of the Losh Lake G22 well are interpreted as faults in the Proterozoic. The juxtaposition of these strong density contrasts show that very different rocks are next to each other and have likely been brought together by lateral movement along wrench fault planes. It is interpreted that the reservoir at the G22 well location once contained hydrocarbons. This reservoir has been breached by the wrench faulting. The gravity data interpretation agrees very well with the seismic data.

HEALTH

077

Health

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Region: IN, GW

Location: Inuvik

Monitoring Temporal Trends of Human Environmental Contaminants in the NWT and Nunavut

The overall goal of this program was to establish a time trend of specific environmental contaminants in human blood and hair. A baseline study was completed in the Inuvik region in 1999–2000. A follow-up assessment to this baseline study was then undertaken in 2006 to observe human exposure to specific contaminants across a representative cross-section of moderately and highly exposed regions (Inuvik and Baffin regions). Information on dietary habits was also collected in 2006 to describe the connections between contaminant exposure, the frequency of consumption of traditional foods, and selected lifestyle factors. It is hoped that the results of this study will strengthen national and international efforts to limit the global pollution that affects northern people. Information collected about lifestyle during pregnancy will help to explain relationships between lifestyle and exposure to environmental contaminants, and to promote healthy pregnancies and babies in the Inuvik region.

In 2006, 86 pregnant women were recruited as research participants at their home health centres. When each participant arrived in Inuvik to give birth or to undergo a prenatal appointment, she was interviewed for information pertaining to lifestyle and diet during her pregnancy. Informed consent was obtained from each participant agreeing to provide a hair and blood sample. Blood samples were obtained during a normally-scheduled blood draw, and were sent to the Centre de Toxicologie du Quebec for organochlorine, heavy metal, and trace element analyses. Hair samples were sent to Health Canada for mercury analysis.

Consultation was a key component to this project and included meetings with and ongoing presentations to territorial health departments, regional health authorities and staff, territorial environmental contaminants committees, and regional and national aboriginal organizations including the local Inuvialuit Regional Corporation and the Gwitch'n Tribal Council. Consultation focused on women of childbearing age who had given birth in Inuvik. Results were communicated to the communities of Inuvik and Tukoyaktuk in March of 2006, and final community visits to Aklavik, Paulatuk and Holman, are expected to occur in 2007.

This study will be valuable in Canada's effort to meet its international obligation to the Persistent Organic Pollutants (POP) and Heavy Metals Protocols of the United Nations Economic Commission for Europe (UN/ECE) and Long Range Transboundary Air Pollution (LRTAP) Convention. The program will contribute data to the Global Monitoring Plan created under the Stockholm Convention that includes human blood as a biomarker.

Results from the previous studies conclude that the no participants from the Inuvik Region were exposed to contaminant levels that exceeded any known guidelines for contaminants or required any 'levels of action' to be subsequently undertaken. The Inuvik region remains not to be considered a highly exposed area and thus the promotion of country food continues to be a priority to get the message out that the benefits of harvesting and the consumption of regional traditional foods still outweigh any risk from any animal species in this region.

078

Health

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Region: NS

Location: Within the municipal bounds of Yellowknife

The Educational Needs of Women and Families after a Miscarriage and the Educational Needs of Nurses Caring for these Women and Families: A Needs Assessment

The purpose of this research was to consider the needs of families after an early pregnancy loss, at or less than 20 weeks, as well as the needs of nurses who care for these families. Interviews with fourteen women and two men indicate that nursing care after a loss should center around the themes of assisting with discovery of the loss, acknowledging the loss, learning about the loss, telling others, nurturing, living after the loss, and planning for the future and subsequent pregnancy. Many of the 23 nurses surveyed felt that their knowledge in the area of pregnancy loss care was inadequate and they felt that not enough patient education material about the physical and emotional effects of loss existed within their area of work. Based on the findings of this study, there is a need for patient education material in the area of early pregnancy loss, health care provider education, as well as ongoing follow-up for families experiencing early pregnancy loss.

079 **Health**

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Location: Rae-Edzo, Northwest Territories

Genetic Study of Bardet-Biedl Syndrome and Related Disorders

Bardet-Biedl Syndrome (BBS) is a genetic condition that affects northern communities such as Rae-Edzo. This condition leads to night blindness with narrowing of the side field of vision also referred to as retinitis pigmentosa. BBS is inherited in autosomal recessive way. When a person has BBS they receive two non-working copies (two mutations) of the gene, one from their parents. Those that receive only one non-working copy (one mutation) from either one of their parents are considered carriers of the disease and are not at risk of developing the disease or losing vision. When two carriers have a baby there is a one out of four chance that they will pass the disease to the baby.

The genetic change responsible for this condition in Rae-Edzo was identified in the researcher's previous study. The objectives of the 2006 study were to determine the frequency of this genetic change in the general population of Rae-Edzo and to identify those who are carriers so they understand the risk of passing this disease onto their children and future generations. One hundred and sixty-one people in the community participated by giving blood. DNA was extracted from the blood and genetic testing performed. Of the 161 people tested 23 people or 14.3% were found to be carriers of this genetic change.

The researchers note that there is at least one other type of night blindness that exists in Rae, which is not related to BBS. They intend to identify the genetic change for those participants thought to have this condition in future work.

080 **Health**

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Region: GW

Location: Fort McPherson

Gwich'in Traditional Food for Health

In spring 2006, researchers conducted assessments of food intake and overall health using diet and health questionnaires as well as body measures of blood pressure, height, weight, waist circumference and body composition in women 20 to 40 years of age and children 10 to 12 years of age. Participation rates were 62% for women and 77% for children. Preliminary analyses of data indicate that physical activity could be improved in both women and children and traditional foods and healthy purchased foods should be encouraged to improve quality of food consumed.

Intervention activities, which were initiated after this assessment and are ongoing, have included the development of a recipe book based on local foods and a physical activity program for women. The

researchers also initiated a healthy eating program in the school which included a “Drop the Pop NWT Challenge”, traditional food cookout, and field trip to gather edible plants.

In August, two community members attended the Centre for Indigenous Peoples' Nutrition and Environment (CINE)/McGill case study partners meeting in Montreal. This was an opportunity for participants to learn about interventions conducted by the other eleven case studies, and to gather new ideas from colleagues in other communities.

In September, Dr Kuhnlein visited Fort McPherson with the video documentation team (KP Studios) to develop a Gwich'in DVD that will describe Gwich'in traditional food circumstances.

081

Health

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Region: IN

Location: Within the municipal bounds of Inuvik and Tuktoyaktuk

Healthy Foods North: A Healthy Stores Intervention Program (formerly North of 60)

The goal of this multi-year program is to improve healthy food consumption through improving availability of healthy foods and by offering nutrition education to prevent risk factors for chronic disease. In order to initiate this program, researchers began training of local data collectors from Inuvik and Tuktoyaktuk. The data collectors then completed 101 dietary interviews of men and women over 18. Data was also collected on 24-hour food recalls in the two communities. Finally, key stakeholders (elders, community leaders, health staff, store staff) from Inuvik and Tuktoyaktuk were interviewed regarding nutrition and food-related issues.

The initial data will be disseminated to the communities in 2007 through presentations and workshops. The results will be used to develop a comprehensive healthy eating community intervention program in six phases over three years, depending on the availability of funding.

082

Health

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Region: NS

Location: Yellowknife

Understanding Near-term Care Of Very Early Rheumatoid Arthritis (UNCOVER)

The UNCOVER study included 339 patients from 18 arthritis specialists spread across Canada to investigate how patients with a severe, disabling form of arthritis, known as rheumatoid arthritis (RA) are being cared for.

The clinical charts of a total of 20 patients from the researcher's rheumatology practice, including his Edmonton and Yellowknife clinics, were included in the study. All patients from the researcher's practice had previously provided informed consent for their clinical charts to be used for such research purposes. Prior to beginning the study, the Stanton Territorial Health Authority Research Ethics Board approved its conduct. The study is now complete.

Overall it was determined that 39.1% of Canadian RA patients are treated with the appropriate medication within six months of first developing symptoms of the disease. It appears that 78% of this delay to treatment occurs before the patient is referred to an arthritis specialist. The factors that contribute to this delay, the specific medications used, and clinical assessments used by doctors to determine and monitor the disease, were examined.

These study results have been presented at Canadian conferences for arthritis specialists. This research received a best research award from the Canadian Rheumatology Association. Future presentations at international conferences are planned.

PHYSICAL SCIENCES

083

Physical Sciences

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Region: IN

Location: Beaufort Shelf, in a survey area bounded by 131°W to 141° W and 69°30'N to 71°N

Beaufort Shelf Seabed Mapping Project

The objective of the seabed mapping program was to conduct a regional survey of the Beaufort Shelf. Ice scouring processes, benthic habitats, abandoned artificial islands, pingo-like features, gas seeps, seafloor foundation condition and sub-sea permafrost were investigated.

The Beaufort Seabed Mapping Project is designed to assess the environmental impact of offshore hydrocarbon exploration and transportation on the renewable resources of the Beaufort Sea. Knowledge of ice scour depths and distribution of ecologically-sensitive areas and permafrost will constrain sub-sea pipeline burial depths and offshore development. In addition, seabed mud volcanoes and gas seeps were investigated to determine if they are venting biogenic or petrogenic gases which may form the basis of a unique ecosystem. Artificial islands were also investigated as hazards to navigation and impediments to ice flow.

Seabed sediment samples were collected, the bottom photographed, and offshore acoustic/sonar surveys of the seabed conducted. A short range multibeam echo sounder was used to produce maps of the seabed. A sidescan sonar mapped the distribution of ice scours, and a single beam echo sounder, their depths. Sub-bottom profilers mapped the distribution of sediments to 100m below seabed, investigating mud volcanoes, gas vents, artificial islands, permafrost, and habitat sites. A drop camera and a bottom towed video camera photographed the nature of the seabed and benthic habitat. Sediment grab samples and sediment cores of the upper 2 m of seabed will be collected to provide controls and calibrate data. About 80-100 samples were also taken.

084

Physical Sciences

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Region: IN, GW

Location: Paulatuk, Garry Island, Illisarvik, Inuvik

Permafrost Investigations in Western Arctic, Canada

In 2006, research efforts were focused on obtaining ground temperatures from permafrost that show the impact of recent climate warming on the ground. The research team obtained the first ground temperatures from Herschel Island which indicate warming of the permafrost there by about 1.30°C since 1970. These measurements were from depths to 42 m.

A ground temperature cable was installed to a depth of 50 m in the tundra at the Illisarvik experimental research reserve. This cable was installed on 10 August, and within ten days of installation the ground had frozen back. Temperature readings were obtained 20 August, but it is unclear whether those data were fully recovered from the drilling disturbance. However, they support earlier data from 2004, which indicate that the ground has warmed by about 1.50°C since 1970.

A cable was also installed to a depth of 28 m near Paulatuk (drilling went down to 40 m, but the access casing was blocked at a 28 m depth). One set of data was collected from this cable in late 2006, but the results suggest that perhaps the cable was not working properly, and that it may have to be replaced in 2007.

Results from the Herschel Island research will be available in report and poster form in 2007.

085

Physical Sciences

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Region: SS

Location: In the deep sector of Christie Bay (approximately 20 km NNW of Lutsel K'e), covering an area of about 10 km x 80 km

Glacial History of the Great Slave Lake - Part 2: Surveys in Christie and McLeod Bays

This project aimed to reconstruct the glacial history of Great Slave Lake, focusing on deep troughs located in the northeast arm of the lake. A large ice dome formed over the Great Slave region during the Last Glacial Maximum and meltwater possibly formed a large subglacial lake in the deep sector of Christie Bay during this period, when ice was about 4 km thick. Subglacial lakes are important because they influence the evolution of ice sheets such as the one over North America during the last glaciation.

Reflection of specific signals were used to make estimates of sedimentary properties from which a history of geological activity can be inferred. A series of surveys were conducted with vertical resolution high enough to inform the distribution of different layers within the sedimentary sequences. The surveys are based on acoustic sounding with an underwater CHIRP seismic source and a compressed air surface source, and swath multi-beam bathymetry for detailed mapping of the lake floor topography. The survey location was the deep sector of Christie Bay.

086

Physical Sciences

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Region: IN, GW, SA

Location: Landslide sites in the following areas: Travaillant Lake-Thunder River; north of Inuvik; and between Norman Wells and Fort Good Hope

Regional Terrain Hazards Mapping

This project was initiated to address baseline knowledge gaps on regional terrain hazards, especially landslides, in the Mackenzie Valley. Assessment of landslide hazards in the Mackenzie Valley is essential as they could have severe impacts on existing infrastructure, communities, transportation corridors, and on land-use planning. Thus, for the second consecutive year, a field reconnaissance at landslide sites was planned to achieve two main objectives.

The first objective was to instrument landslide sites that exhibit on-going movement in order to qualify the rate of movement through remote sensing. For this, ten coherent targets were installed for InSAR (Interferometric Synthetic Aperture Radar) application to monitor landslides. These targets are aluminium-made trihedral corner reflectors, which were deployed with very minimal disturbance at or in the vicinity of three landslide sites situated in an adjacent valley east of Thunder River valley, about 120 southeast of Inuvik. Three of these targets were installed along the southern side of an old abandoned airstrip and anchored into the frozen ground as they will act as reference targets.

The second objective of this project was to collect soil samples which would allow the researchers to characterize materials involved in slope failures. For this, twenty-three 30 cm³ soil samples were collected at the three instrumented landslide sites. Laboratory analyses (grain size distribution, organic matters, geotechnical properties) will be completed in late fall 2006.

Due to time constraints and unfavourable weather conditions, field validation of previous data collected through air photo interpretation at several sites in the Fort Good Hope, Norman Wells, and north of Inuvik regions was cancelled.

Results from the landslide mapping and inventory indicate an average density of one landslide per 5 km² and show that the dominant landslide types are retrogressive thaw flows (28%) and active layer detachments (25%). Rock falls (10%), debris flows (10%), earth slides (9%), surficial land slides (6%), and retrogressive thaw slides (5%) are lesser represented. About 46% of all landslides took place in morainal deposits, 19% in lacustrine sediments, 14% in bedrock, and 13% in glaciofluvial sediments. The relative age

of landslides was estimated based on tone, texture, and vegetation regrowth attributes, where 39% were classified as old (>50 years old), 39% intermediate (10-50 years old), and 22% recent (<10 years old).

Results of these research activities were presented at the 34th annual Yellowknife Geoscience Forum were in November 2006.

087 **Physical Sciences**

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Region: IN

Location: Melville Island, Eglinton Island, Prince Patrick Island

Environmental Change in the Western Canadian Arctic Islands

Two camps were mobilized during the 2006 field season (4 July - 1 August) on south Eglinton Island and Wolley Bay, Prince Patrick Island. Helicopter surveys (7 - 11 July) of the south and east coast of Prince Patrick Island to Wilkie Point identified raised marine sediments and several important shell sites that were sampled for radiocarbon dating. A terrestrial cosmogenic nuclide (TCN) dating transect from Wolley Bay to Satellite Bay yielded ten rock samples that will help determine the age of retreat of the last glaciers there. The Prince Patrick Island party moved to Cape Hemphill on 19 July, where abundant raised marine sediments were surveyed and sampled for driftwood and shells. This will enable the construction of the first sea level curve for Prince Patrick Island (pending dates). A second (perpendicular) TCN transect was undertaken to supplement the first. The season was completed by a helicopter survey of the raised marine sediments, including several shell collections, at the North end of Prince Patrick Island on 28 July. The Eglinton Island party was evacuated early due to unforeseen circumstances, but sites related to the sea level history including several shell collections were made during a helicopter survey of Eglinton Island from 29 - 30 July. All empty fuel drums and garbage were removed following the field season.

088 **Physical Sciences**

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Region: NS

Location: In the vicinity of the Daring Lake Tundra Ecosystem Research Station

Assessing snowpack water equivalent distribution in the Exeter-Yamba-Daring Lake catchment, Coppermine River Basin, NWT for passive microwave algorithm development and stable isotope analysis

During the April 2006 field campaign, satellite passive microwave datasets were acquired with spatially and temporally correspondent snow cover data and multi-station differential GPS data. This unique, multi-scale data set represents a key further contribution to the development of a tundra SWE retrieval algorithm. Snow cover sampling sites were chosen based on previous years sampling locations. At these sites, snow depth data were obtained with 30 randomly located probe measurements. Bulk snow density was measured five times with an ESC-30 snow tube. Finally, snow pits were excavated to determine vertical density profiles, snow crystal types and size, and snowpack stratigraphy. High resolution, differential GPS terrain data were collected in order to develop an improved tundra terrain model.

Preliminary results comparing field measured snow cover data to multi-scale airborne and satellite passive microwave data were presented in August of 2006 at the International Geoscience and Remote Sensing Symposium in Denver, Colorado. Preliminary analysis has shown that tundra snow cover is controlled a great deal by terrain variability. Furthermore, we have been able to differentiate between heterogeneous snow cover and terrain characteristics using the multi-scale airborne data collected during the 2005 field campaign. This has allowed us to better understand the relationship between coarse resolution satellite scale data and our multi-year ground measured snow dataset (collected during the 2003, 2004 and 2005 campaigns). The inclusion of the 2006 snow cover dataset has allowed us to better

understand and begin to establish the relationship between snow measured on the ground and satellite scale passive microwave data. The addition of the 2006 snow cover data set has been a critical step in developing an operational satellite scale passive microwave snow water equivalent estimation algorithm. This research forms the basis of the PhD thesis of Mr. Andrew Rees. One more field season is required to complete this research project.

The second portion of this research focused on measurement of evapotranspiration rates within different tundra plant communities in the vicinity of Daring Lake. This fieldwork extended from 18 June to 30 August 2006. The initial phase of the field campaign involved site selection and instrumentation. Six sites were established ranging from a wetland sedge dominated site to a very dry dwarf birch site. Instrumentation included establishing a mini-meteorological (~1.7m vertical) tower at four of the sites; these recorded vertical differences in air temperature, relative humidity and wind speed/direction. Solar radiation was measured at four of the sites. A large full scale meteorological tower established by a research group examining carbon flux provided continuous data on similar parameters up to 10m in height. Monitoring of the different sites included daily assessment of direct evaporation using evaporation pans, recorded depth to permafrost, soil moisture and temperature on representative transects within each plant community. Soil samples were extracted for physical measurements including bulk density, porosity and texture. These analyses were completed either in the field at the Tundra Ecosystem Research Station or at the lab at Wilfrid Laurier University. This research will constitute the masters thesis of Mr. Shawn LeCompte.

An additional component of this research included sampling the Yamba River in order to determine changes in the proportional contribution of snowpack water from spring-melt until late fall in the Exeter-Yamba-Daring Lake basin.

089

Physical Sciences

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Location: On the western Arctic coastline, including the mainland coast, Mackenzie Delta and Banks Island

Hazards, Sea-Level Rise and Climate Change Impacts on Arctic Coasts

Surveys to measure coastal erosion were undertaken at several sites on Banks Island, including Aulavik National Park and Sachs Harbour. Surveys were also carried out at Tuktoyaktuk and at several locations in the Mackenzie Delta. Past changes in relative sea level were investigated using sediment cores from flooded basins at Sachs Harbour. Diatom studies in these cores will help to determine the date when seawater flooded over the sills into these former lakes. One breached lake was found to be highly stratified with very high salinity (almost three times higher than the Beaufort Sea) near the bottom. Seabed mapping was carried out in the approaches to Sachs Harbour and in De Salis Bay. Bottomfast ice and breakup conditions in the Mackenzie Delta were studied using satellite imagery and airborne surveys. Ground penetrating radar was used to study bottomfast ice and near-surface ground ice in the Delta. Studies of regional subsidence and delta compaction were undertaken using global positioning system (GPS) observations at continuous GPS sites (Inuvik, Tuktoyaktuk, Ulukhaktok) and monuments on northern Banks Island and in the Delta. Results were reported in visits to ISR communities in early 2007.

090

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Location: Beaufort Sea/Amundsen Gulf area

ArcticNet Theme 1: Integrated Regional Impact Study of the Coastal Western Canadian Arctic

For the third consecutive year, the Canadian research icebreaker *CCGS Amundsen* traveled north for ArcticNet's annual expedition to the coastal Canadian Arctic. Since 2004, ArcticNet has established long-term marine observatories in the western Arctic (Amundsen Gulf/Beaufort Sea), northern Baffin Bay, Hudson

Bay and Laptev Sea (Russia). Each observatory consists of a number of moorings all equipped with instruments that gather continuous records of the physical-chemical properties of the water column (e.g. temperature, salinity, current speed and direction). A main objective of the 2006 expedition was to service and redeploy the western Arctic and northern Baffin Bay moorings in an effort to maintain the network of long-term marine observatories.

Leaving its home port of Quebec City on August 22, the *CCGS Amundsen* spent 80 days at sea and traveled more than 10 000 nautical miles (18 500 km) across the vast coastal Canadian Arctic. Throughout the voyage, bathymetry, seabed geophysical characteristics, zooplankton abundance and fish distribution were monitored with the ship's continuous operating sounders. In addition to servicing and redeploying the western Arctic and northern Baffin Bay moorings, ArcticNet scientists sampled at over 150 oceanographic stations (see map). Samples taken at each station covered almost all natural science fields, including geology, chemistry (e.g., contaminants), biology, oceanography and meteorology.

As part of ArcticNet's outreach and communication activities, the *CCGS Amundsen* made a scheduled stop in Sachs Harbour, NT where local residents were invited onboard for a tour of the ship. In all, 7 senior officials, 23 students and 2 teachers from the community participated in the visit. In total, over 100 ArcticNet researchers, students and technicians from twelve Canadian universities, four federal departments (Fisheries and Oceans, Environment, Natural Resources, Parks) and two institutions from the United States were involved in the 2006 expedition.

091 **Physical Sciences**

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Region: DC

Location: Along the Hay River from approximately Enterprise to the Town of Hay River

Hay River Ice Jam Study

The research program in 2006 involved field observations along the Hay River, in and around the town of Hay River, NWT, during the period of river ice breakup (April 24 to 26). Water levels were measured along the river bank at key sites, and the instrument set up at the Town's fire hall in 2004 measured the intensity of sunshine occurring in Hay River (important to the nature of river ice breakup). Video and photographs were taken to document the breakup progression both from the ground and from a small plane (chartered locally). Chief Roy Fabian of the Hay River Dene Band accompanied us on one of these flights. River breakup in 2006 involved a number of ice runs and the formation of ice jams in both the East and West Channels and minor flooding resulted. Data provided from the Flood Watch Committee was particularly valuable for our study.

As part of this Science Licence, the researchers had requested permission to stay for the entire breakup period and to conduct further surveys on the river in the summer of 2006 to complete the bathymetric survey undertaken in the summer of 2005. Unfortunately, due to federal government cutbacks, research funding was quite limited and the researchers were forced to leave Hay River before breakup was finished. Thus, summer surveys were omitted from the study. The researchers intend to continue their research in 2007.

092 **Physical Sciences**

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Region: IN, GW

Location: Taglu, Reindeer Station, and Rengleng River

Variation of Near-Surface Ground Temperatures in Spruce Forests of the Mackenzie Delta

Permafrost has an important influence on hydrology and ecology of northern environments. An understanding of near-surface ground temperatures will provide a baseline from which to assess change

and identify sensitive areas. The objective of this thesis project was to determine the natural variation of near-surface ground temperatures within spruce forests of the Mackenzie Delta. Ecological investigations have identified four spruce forest communities in the delta based on plant community composition, including spruce-alder/bearberry, spruce-feathermoss, spruce-crowberry/lichen and spruce-tamarack/sphagnum forests. Surface conditions such as canopy cover and thickness of the organic layer vary between these communities. Variable surface conditions may cause differences in ground temperatures between forest communities.

In summer 2006, 24 boreholes were drilled in four areas of the Mackenzie Delta, south of treeline. Measurements of vegetation and soil characteristics were made at the same time. Ground temperatures were recorded at all sites in late August 2006, one month after thermistor installation; however, these measurements may be elevated due to the introduction of water during drilling. To confirm that ground temperatures have equilibrated, additional thermistor readings will be made in January and April 2007 at all sites. Snow depth and density measurements will be made in April for comparison of winter surface conditions between sites. Once these measurements are complete, an analysis of the relations between surface conditions and ground temperatures will be conducted. The results will be publicly available in a thesis report.

093

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Region: SA

Location: Camp 222 on the Tsichu River, 15 km east of MacMillan Pass on the Canol Heritage Trail

Long-term Ecological and Geomorphological Investigations in the Alpine Tundra of the Mackenzie Mountains, NWT

Approximately 15 days were spent in the field area in 2006. The main activities in the vicinity of Macmillan Pass and Camp 222 on the Tsichu River were to retrieve stored information from the five automated microclimate stations established in 1990, and to measure depth of thaw on six permafrost landforms. The researchers also conducted ground-penetrating radar surveys on six landforms. One permafrost landform has dramatically deeper thaw depth and this feature is rapidly melting. Others have stable thaw depth on top but are melting from their edges. Based on these studies it is evident that the permafrost is warming (≈ 0.8 to 1°C) and melting continues at a rate of -1% of the area of permafrost landforms each year.

094

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Region: IN

Location: Melville Island Ice Cap

Mass Balance of Arctic Glaciers

Work for this project occurred on the Melville South Ice Cap between April 20 and 26, 2006. The mass balance was measured at 16 locations on the ice cap: the height of the pole was measured first above the snow, and secondly, above the ice. These measurements were then compared with those taken during the previous year. The difference gives the balance at that location. If ice has melted rather than formed then the pole is longer, and vice versa. For the balance year 2005-2006 (i.e. end of summer 2005 to end of summer 2006) it was found that there had been a decrease in the level of ice. That is the ice cap lost some of its volume in keeping with the generally warming conditions of the summers. Generally, this ice cap shows a loss of ice from its surface but, surprisingly, the three previous years to this one had gained volume. Overall, this ice cap has been getting smaller in most years since 1964 when measurements began. The ice cap probably started to grow about 1,000 years ago as the climate cooled from its highest temperatures

9,000 years ago. It reached a thickness of between 50 and 60 m before, beginning to thin about 60 years ago due to a change from the cooling trend to the present warming one. The main reason for ice loss is the longer melting season caused by warmer summers. Rocks are now beginning to appear at the surface and perhaps within 20 years only those areas where there is thicker ice in the valleys will remain. There is also no doubt that the summer conditions from year to year are becoming more variable.

Data was downloaded from the single automated weather station on the ice cap. In addition, precision global positioning systems were used to get the precise elevations of the ice for comparisons in the future. The goal of this is to relate the amount of melting or ice accumulation each year to summer temperatures. This may allow researchers to better understand how other ice caps in the Arctic will respond to global warming trends.

095

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Region: IN

Location: the Kendall Island Bird Sanctuary

Environmental Conditions at Abandoned Drilling Mud-Sumps and Surrounding Terrain in the Outer Mackenzie Delta (Kendall Island Bird Sanctuary)

In March and August 2006, environmental information was collected from four abandoned drilling-mud sumps in and adjacent to the Kendall Island Bird Sanctuary, Mackenzie Delta Region. Snow cover, vegetation cover, ground-ice, and ground-thermal data was collected to investigate potential relationships amongst these variables and to determine the effect of vegetation on winter snow accumulation and ground-thermal conditions.

Preliminary results of the field investigations indicate that sump caps are positive relief features that promote the accumulation of snow at the perimeter. Field data also indicate that growth of tall standing vegetation (shrubs) on the sump cap will promote snow accumulation, and thick snow accumulation can retard ground-heat loss in winter. Perennial snow accumulation around the perimeters and on the tops of sump caps with tall shrubs can result in warming of the permafrost and an increase in thaw depth.

The collection and subsequent analysis of this data will provide insight into the long-term terrain and ecological responses to disturbance which may occur as a result of development in the Mackenzie Delta Region.

096

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Region: IN

Location: Sites within the Mackenzie River Delta ranging from Inuvik to the Beaufort Sea coast

Environmental Studies across the Treeline, Mackenzie Delta Region

Data regarding snow properties and vegetation characteristics were collected at 8 sites along a 130-km transect from Inuvik to the Beaufort Sea coast in March and August of 2006. The sites are instrumented to record near-surface ground temperatures at 5, 10, 50, and 100 cm below the ground surface. Results show that both snow depth and the height of vegetation decreases northward along the transect. The deeper snow depths in association with taller shrubs retard ground heat loss and may explain why permafrost is warmer at Inuvik than near to the coast.

The effects of permafrost degradation on lake water quality were also examined. Tundra lakes affected by thaw slumping have elevated ionic concentrations and lower dissolved organic carbon concentrations in contrast to undisturbed lakes. The rates of retrogressive thaw slumping have recently increased in response to climate warming.

Ground temperature results along the 130-km transect are of importance with respect to planning development of the proposed Mackenzie Gas Pipeline which will cross tree line north of Inuvik. Understanding the variability in lake water chemistry provides a baseline for development of aquatic effects monitoring programs which are often required to examine the environmental impacts of development.

097 **Physical Sciences**

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Region: NS **Location:** At Daring Lake (64.83 N 111.63 W)

Canadian Tundra Carbon Exchange Project (CTCEP)

The CTCEP group conducted their research at the Daring Lake site. Two new instrument towers were established in May: one in a sedge meadow and one on a small island in Daring Lake. These complimented the main instrument tower on an upland tundra site. All towers were operational from May 20 to August 25, 2006. Data acquisition from these towers will help determine landscape-level carbon dioxide exchange in Canada's low arctic. Analysis of the data is on going; thus results are preliminary at this point. However, the main finding suggests that the meadow is a larger carbon sink than the upland site and the lake was a carbon source to the atmosphere during the open water season. Chamber measurements of carbon flux from upland tundra were also made in a number of small plots, where vegetation clipping was used to simulate caribou grazing levels. These experiments will help to test the influence that large caribou herds have on tundra carbon exchange. Finally, we installed plastic sheeting on semi-permanent greenhouse plots to test the effects of warming and drying on tundra vegetation growth. The experimental plots were monitored in mid-season for vegetation composition and abundance. Long-term, on-going monitoring of these experiments will test the possible effects of climate change on tundra vegetation.

098 **Physical Sciences**

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Region: IN **Location:** Within two clusters of lakes lying to the west of Inuvik and the East Channel, and to the north of Inuvik along the East Channel

Biogeochemistry of Lakes in the Mackenzie Delta

This project is on-going with the long-term goal to develop an ecosystem model for lakes in the Mackenzie Delta to facilitate assessing the effects of multiple stresses on major arctic river deltas resulting from global change. Specific goals for the 2006 season included: (1) assessing sources and fates of dissolved organic carbon (DOC) in aquatic food webs of delta lakes; (2) assessing the importance of dissolved organic matter transformation into microscopic transparent exopolymer particles (TE-particles) among lakes of the delta; and (3) assessing seasonal changes in the carbon dioxide content of lake-waters to infer the balance of bacterial respiration versus photosynthetic production. From June through August, water samples were collected roughly weekly from a set of six lakes near Inuvik for experiments on bacterial respiration efficiency and for assessment of TE-particle concentrations and their degree of colonization by aquatic bacteria. Data analyses are still in progress, but preliminary results show a wide range in bacterial respiration efficiencies among the lake-waters, including strong effects in lakes influenced by thermokarst. TE-particle abundance was loosely related to the pattern of photosynthetic production among the lakes, but higher than expected abundance occurred in river-waters. Carbon dioxide concentrations were measured among a suite of 40 lakes three times over the summer, and showed a striking reversal in pattern from lowest concentrations in river-influenced lakes in early summer to lowest concentrations in lakes isolated from the river in latter summer. An internet web page summarizing the researcher's work on the Mackenzie Delta, including a list of his publications, is being maintained at <http://www.sfu.ca/limnology>.

099**Physical Sciences****Marsh, Philip**Environment Canada
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philip.marsh@ec.gc.ca**File No:** 12 404 378**Licence No:** 13945**Region:** IN**Location:** At Trail Valley Creek, Havikpak Creek, northern Richards Island, Zed Creek, and Hans Creek**Hydrological Studies, Mackenzie Delta Region: Snow Accumulation/Runoff in High Latitude Permafrost Basins**

Field studies were conducted in the Inuvik area during 2006, looking at the factors controlling the movement of energy and water between the land surface and the atmosphere during the spring snowmelt period. These factors control both the supply of energy and water to the atmosphere, as well as snowmelt and therefore spring runoff in the streams and rivers. The long term objective of these studies is to improve the ability to predict weather, climate, and water resources. With future uncertainties in climate, and with potential development projects, such improved predictive ability is essential in order to properly manage future environmental change and to adapt to such changes. Our work in 2006 concentrated primarily on measuring total basin snowfall (by the middle of April), as well as our usual automated measurements of solar radiation, air and ground temperatures and summer rainfall.

Our ongoing work will compare results from a number of different years so that we can understand the variation from year to year, and will compare results from areas on either side of the tree-line. This work provides important data needed to test computer models, which are used to predict the impact of climate warming on these environments.

In addition to this ongoing study, 2006 saw a continuation of the researcher's work on lakes of the outer Delta which involved the measurement of energy fluxes, standard meteorological components, as well inflow/outflow to the lake, and water depth and temperature.

100**Physical Sciences****McCarthy, Daniel**Brock University
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dmccarth@brocku.ca**File No:** 12 404 650**Licence No:** 14042**Region:** DC**Location:** North Moraine Hill Glacier, headwaters of Bologna Creek and other glacier forefields in the Ragged Range**Glaciological Investigations in the Ragged Range 2006**

GPS instruments were used to establish topographic benchmarks and accurately map the North Moraine Hill Glacier (62° 15' N, 128° W) and an unnamed glacier at the headwaters of Bologna Creek (62° 07.39' N, 128° 02.451' W). A mass balance stake network was installed on the North Moraine Hill Glacier. Measurement of ice melt and snow accumulation at the stakes is now being monitored in late summer and in the spring to track annual and seasonal changes. Morainic ridges downvalley of the Bologna Creek and North Moraine Hill Glaciers were mapped and lichenometry was used to estimate the timing and volumetric change of the glaciers over the last few centuries. Repeat macrophotography was used to estimate the annual growth rates of slow-growing, long-lived *Rhizocarpon* spp. lichens. Satellite imagery and Geographic Information System software were used to develop an inventory of glaciers in the Ragged Ranges. This research will help complete existing databases and aid the Intergovernmental Panel on Climate Change. Regional assessments will help to estimate the costs of climate change and inform debates on Kyoto targets and the proposed expansion of Nahanni National Park Reserve.

101**Physical Sciences****Menounos, Brian**University of Northern British Columbia
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Licence No: 14033
Location: Eastern flank of the Nahanni Plateau (the main North Karst and the southwestern margin of the Ram Plateau)

Surficial Materials Investigations, South Nahanni Area

Investigators surveyed landslides in Nahanni National Park along the Tlogotsho Plateau, the Ram Plateau, Cathedral Creek and Wrigley Creek. Landslides occur along steep canyon and escarpment cliff faces, on steep mountain slopes, and low lying slopes. Landslides also occur on slopes that contained permafrost. The team also conducted the first field reconnaissance of soil types and their distribution in the Nahanni karst area. At 25 sites between the southwestern flank of the Ram Plateau and the rim of First Canyon on the South Nahanni River, they described and sampled soil profiles on representative landscape positions. Their key findings included: i) the widespread occurrence of a veneer of silty windblown sediments, often directly overlying bedrock with no cover of glacial deposits; ii) the limited soil development, based on their morphology, texture, and chemical properties; and iii) confirmation of the occurrence of the c. 1000-year-old White River volcanic ash.

102

Physical Sciences

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Licence No: 14029
Location: Richardson Mountains, Grizzly Gorge

Richardson Mountains Geological Field Program

Personnel from Devon Canada Corporation and Petro-Canada spent July 25 and 26 looking at the rock outcrops of the Kamik Formation on First Creek in the Richardson Mountains. The purpose was to investigate the similarities to the same age rocks which form the host reservoir rock of the Tuktoyaktuk gas field to the east and draw conclusions about the way the gas will produce from that field.

It was determined from the field investigation that the rock outcrops are very similar to the rocks hosting the Tuktoyaktuk gas field. The two most significant conclusions were that the basal sand unit is expected to be a continuous blanket-like sandstone, and that the sandstone has insignificant shale content which means there are no expected disruptions to gas flow which could be generated by thin shale layers in the sandstone. Combined, these two factors indicate gas should flow through this sandstone layer into the wells from anywhere in the trap area of the Tuktoyaktuk field.

103

Physical Sciences

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Region: IN

Licence No: 13999
Location: Eleven sites in the Kendall Island Bird Sanctuary

Relations between Surface Conditions and Near-surface Ground Ice at Kendall Island Bird Sanctuary, Mackenzie Delta, NWT

Permafrost composition and distribution at Kendall Island Bird Sanctuary in the Mackenzie Delta is unknown, and thawing as a result of disturbance may result in surface subsidence. The objective of this study was to determine near-surface permafrost conditions and distributions as they relate to vegetation and snow cover.

Research relating to this project occurred during the summer months, and went without incident. All sites were visited, many were cored, and all of the ground temperature data loggers were installed. Some of the sites were too wet to obtain successful cores, even by the end of the summer. Therefore, the researchers hope to return to the area in winter 2007.

Results generally indicated that the lowland terrain had excess ice contents between approximately 50% and 80%. Upland terrain had ice contents that varied with surface vegetation and soil materials, and ranged from saturation to 70 - 80% excess ice. The ground ice content was found to change considerably even over short distances in relation to the soil and surface variables. These data will be examined in more detail in the near future, and a report summarizing the results will be made available to Aurora Research Institute.

104

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Region: IN, GW

Location: Taglu, Reindeer Station, and Rengleng River

Spatial distribution of near-surface permafrost in the Mackenzie Delta

The objective of this research was to determine the proportion of the Mackenzie Delta underlain by near-surface permafrost. The most recent map of Permafrost in Canada classifies the Delta as being underlain by discontinuous permafrost, but most reports on permafrost distribution describe its ubiquitous occurrence as continuous permafrost. The difference in classification is important for the regulatory regime to be applied to engineering projects and land-use in the area. During summer 2006, fieldwork consisted of visiting over 50 sites throughout the Delta, and probing for the presence of permafrost by using water-jet drilling at sites representing different vegetation communities. These sites were classified with vegetation surveys, so that they may be used to develop a vegetation map of the Delta from SPOT-5 satellite images taken in July 2006, and from this to estimate the proportion of the Delta underlain by permafrost.

The majority of the vegetation communities identified in summer 2006 have clear associations with either near-surface permafrost or unfrozen ground. Analyses of satellite images are still in progress and the expected result of this research will be the production of a map of the Delta that will link vegetation communities classified by remote sensing techniques to the presence or absence of near-surface permafrost. These relations and this map will form the basis for a M.Sc. thesis which will be completed in September 2007.

105

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Region: DC, GW, IN, SA

Location: Sixty sites between Fort Simpson and the Beaufort Sea Coast

Active Layer Monitoring Network in the Mackenzie Valley

During August 2006, the 16th annual survey of the active layer monitoring system in the Mackenzie Valley was completed from Fort Simpson to the Arctic coast. Sites now number 51, and about half of these are located in the Mackenzie Delta. Ten have been selected for the Circumpolar Active Layer Monitoring program of the International Permafrost Association.

Along this 1400 km transect, active layer thickness varies more as a result of local factors, related to situation, than to regional climate, associated with latitude. Though both air and ground thawing degree days increase from Arctic through Sub-arctic to Boreal environments, active layer development is surprisingly similar, except where local factors override regional patterns. The thaw of 1998 was the greatest yet recorded, while the thaw in 1996 (north of Norman Wells) and others in the current century (at many sites) were notably less than during the late 1990s. This was also in a time period where temperatures and season lengths were significantly less than normals. The widespread response to these events builds confidence in the utility of the instrumentation for measuring response in the ground to atmospheric change. Data from this monitoring program has been used for Mackenzie gas pipeline designs and has assisted in the environmental assessment of project proposals. In the long term, measurements from this transect will be used to help model climate change impact on near surface permafrost in this fragile environment.

106

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Region: IN

Location: Eight lakes in the vicinities of Inuvik and Tuktoyaktuk, and six tree sampling sites in the vicinity of Inuvik

Environmental Change in the 20th Century, Mackenzie Delta region, Northwest Territories

The objectives of this study were to: increase understanding of environmental conditions in the Mackenzie Delta region; to examine the effects of global climate change on aquatic and terrestrial ecosystems in the area; and to develop a knowledge base that can be directly applied to environmental decision-making in the context of aquatic ecosystem functioning under changing climatic conditions.

Climate change is expected to have the greatest impacts in northern regions. Permafrost degradation is a likely outcome of warming temperatures. As temperatures increase and permafrost begins to melt, there is likely to be significant impacts on aquatic communities as nutrients and contaminants accumulated in permafrost are released into lakes. This study examined the impact of permafrost degradation on lake ecosystems through the analysis of diatom communities living in the lakes. Lake sites were sampled in the winter of 2006. At each site, a small auger hole was cut through the ice and sediment cores extracted from the lake bottom. A sample from the top 40 cm of sediment from each lake basin was taken.

Another part of this research focused on the forests of the Mackenzie Delta. Previous dendrochronology work indicates that some trees are growing slower. During the summer of 2006, the relations between tree growth and climate was examined using manual and automatic band dendrometers. Sampling focused at the site referred to as Blueberry. Six automatic dendrometers and twenty manual dendrometers were attached to trees at the site. The recent establishment of white spruce along a north-south transect in the Mackenzie Delta was also examined. These sites lie along the East Channel. At each site a number of 20 x 20 m plots were established and the number of white spruce saplings counted. Year of establishment for each sapling was also determined.

107

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Region: IN

Location: North Richards Island Source 6C-1, North Richards Island Source 4B-1, Lousy Point, Swimming Point, Ya-Ya Lake Esker complex, Tuktoyaktuk

Massive Ice Study in Granular Deposits

The aim of this research was to gain a better understanding of the presence of massive ground ice in the permafrost, particularly in areas of sand and gravel. Ice sites in granular deposits were mapped as part of this research, and sampling of ice and sediment was also conducted to form an understanding of the stratigraphic relationships between aggregates (sand, gravel and crushed stone) and massive ground ice. Detection of massive ice locations will assist in limiting the melting of permafrost.

Sand, gravel and crushed stone are valuable geological resources, collectively known as aggregates. They are essential bed, foundation and building materials. The presence of massive ice in aggregate deposits results in a series of resource management problems, particularly for the oil industry and its contractors who rely on local granular deposits as building material. From an environmental perspective, there is the problem of thermokarst and terrain instability that results when these deposits are disturbed. From a development perspective, there are problems of extraction and overestimation of reserves. Project work is being undertaken together with the Department of Indian Affairs and Northern Development, and the Inuvialuit in preparation for a regional granular resource management plan for the Inuvialuit Settlement Region.

In order to understand massive ice occurrence, the researchers mapped ground ice sites in granular deposits using a variety of remote-sensing and geophysical tools. Collection of ice and sediment samples from two or more sites also occurred allowing the researcher to understand the stratigraphic relationships between the aggregates and massive ground ice presence. In the winter, three types of passive, non-invasive surveys were conducted, consisting of a high resolution GPS (Trimble System), a Ground Penetrating Radar (GPR) survey and a capacitive-coupled resistivity geophysical tool (Geomatics Ohm-Mapper system). Project work included the calibration of geophysical equipment to all types of massive ice, and involved surveys on two sites, namely, Peninsula Point located 6km southwest of Tuktoyaktuk, and one of the smaller pingos located close to the winter road between Inuvik and Tuktoyaktuk. Small ice and sediment (~1L) samples were collected from natural massive ice exposures or by ice exposed as a result of granular extraction.

108

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Region: IN

Location: At 66 lakes located on a transect north of Inuvik

Sensitivities of high-latitude lakes to climatic & development disturbances

The second year of full-scale sampling for this project was completed in 2006, following initial full-scale sampling in 2005 and preliminary work in 2004. The goal of this work is to understand the effects of permafrost degradation on the supply of nutrients to tundra lakes, and on the biological communities within the lakes. Bathymetric measurements, catchment snow surveys, and meteorological instrument installations were completed to study the lakes' hydrological regimes. Samples of water column algae and zooplankton were collected between March and September. Lake water samples were analysed for major nutrient content, and other aspects of water quality. Analyses of lake water indicate that permafrost degradation is introducing a significant and distinct supply of carbon to these lakes. Biological production estimates and plankton abundances indicate that the effects of permafrost disturbance on the lakes alter primary (plant) production in a manner capable of altering energy flow and interactions within the food web. Analyses are ongoing, and should provide both important baseline information on the microclimate, bathymetry, and biological production in the lakes, and novel information regarding the impacts of permafrost degradation on the nature of relationships between nutrients and biological production.

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Region: GW, IN

Location: Middle Channel near Horseshoe Bend, East Channel (Scour Hole #10), and Mackenzie River at Tsiigehtchic

Evaluation of extreme events (ice jams) and deep scour holes on Mackenzie Delta Channels

During 2006, field surveys were made of scour holes, specifically Scour Hole #10 located on the East Channel south of the town of Inuvik. Analysis of sediment and hydraulic data collected from this hole has also continued in attempt to determine what controls the stability of these holes. Bathymetric data are also being compared to side-looking sonar surveys that were conducted in a previous year. The major obstacle is achieving a suitable level of accuracy in the geo-referencing of the various surveys to permit an evaluation of the magnitude of change over time. Current bathymetric data are being compared with those collected by Lapointe (1986) and Fassnacht and Conly (1992) at the same hole. Sediment analysis of material cored near and from the holes is being conducted at the Canadian Centre for Inland Waters to determine the cohesive nature of the depositional material in the holes and why the holes have not been infilled over time. Full results of the various analyses will lead to an understanding of the genesis of the holes and the role that

flow and/or ice action have played.

110

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Region: DC

Location: At Scotty Creek (61° 18'N 121° 18'W)

The hydrology of wetland-dominated basins in the zone of discontinuous permafrost near Fort Simpson, NWT

The central Mackenzie basin, is an extensive flat headwater region with a high density of open water and wetlands, that occupies the zone of discontinuous permafrost. This region is particularly sensitive to the effects of climatic warming, because pronounced changes in water storage and runoff pathways could occur with small additional ground heating.

The researchers found that the wetland-dominated terrain of the lower Liard River Valley is composed of three major cover types: flat bogs; channel fens; and peat plateaus. They also found that peat plateaus support a tree cover, rise slightly (~ 1 m) above the surrounding terrain, and are underlain by permafrost. The fens and flat bogs generally do not support trees, are at a lower elevation, and are free of permafrost. The differences among the three cover types described above means that each plays a different role in the cycling of water on the landscape. The peat plateaus have little ability to absorb snowmelt (because of the saturated-permafrost close to their ground surface), and have a deep snowpack, and therefore a large meltwater supply (since their tree cover tends to trap snow). As a result, the peat plateaus play an important role in providing runoff water to the flat bogs and channel fens. Water entering flat bogs remains on the landscape for extended periods, and will leave slowly by evaporation. Water entering the channel fens, slowly makes its way to streams and rivers. The single most important factor controlling the rate of runoff from the peat plateaus is the depth of thaw. This is because the ability of the organic soils to transmit water decreases with depth. For example, soils near the surface can transmit water 100 to 1000 times more rapidly than can deeper soils.

Aerial photographs of the wetland-dominated terrain of the lower Liard River Valley for the period 1950 - 2000, indicate a sharp decrease in area covered by permafrost (as indicated by the cover of peat plateaus). Because the peat plateaus, channel fens and bogs play different roles in the cycling of water on the landscape, a change in the relative proportions of the landscape occupied by each type of cover, will influence the amount of water reaching streams and channels. Aside from those changes to the landscape that are assumed to have resulted from a warming climate, it was also noted that wherever tree canopies were deliberately removed (e.g. road construction / mineral exploration), the permafrost below those areas rapidly disappears.

Current research is focused on developing methods to predict the amount and timing of runoff in streams and rivers in the wetland-dominated terrain of the lower Liard River Valley, and how this will change as the amount of permafrost in the region continues to decline.

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Region: SA

Location: Within the municipal bounds of Deline

Community-Based Climate Impacts and Adaptation Workshop

On March 21st, 2006, a Community Climate Change Impacts and Adaptation Workshop was held in Deline, NWT, in the Conference room of the Deline Land Board. The purpose of the workshop was to catalogue climate impacts that are already being felt in the Deline region, as well as to identify research and knowledge gaps that would contribute to a future research needs survey. Workshop participants included 20 elders from the community of Deline, and one representative from the Sahtu Renewable Resources Council. Commentary was given through a translator provided by the community.

Results from the session indicate that elders at least have observed environmental changes that can generally be attributed directly or indirectly to a changing climate. They have observed warmer temperatures, more precipitation, less long-range visibility, and changing ice conditions to name a few. Upon the request of the facilitators, participants attempted to prioritize these issues. The most important issue seemed to be the increased uncertainty around the winter road. Participants were concerned about becoming isolated from supply routes, and being unable to receive sufficient fuel for community needs. It was suggested that a bridge over the Great Bear River might prove an effective interim measure, until consensus could be achieved regarding the route for an all-weather road. More generally, participants noted that having access to reliable information concerning climate change, and its impacts on water quality, would greatly increase their adaptive capacity and responsive capacity.

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Region: SA

Location: On Lionel Island near Keith Arm, Great Bear Lake

**Modelling of Evaporation and Heat Balance of Great Bear Lake
Comparative Thermal and Energy Balance Regimes of Great Slave and Great Bear Lakes**

Great Slave Lake (GSL) and Great Bear Lake (GBL) have similar surface areas, volumes and high latitudinal position. They are dissimilar hydrologically. GSL, as part of the Mackenzie Basin through-flow system, derives 82% of its outflow volume from southern watersheds. GBL is hydrologically isolated and all of its inflow and outflow derives from its immediate watershed. GSL's outflow into the Mackenzie River is more than eight times that from GBL. GSL exhibits a longer open water period with higher temperatures at all depths than GBL. When the lakes are warming, each lake exerts a substantial local atmospheric cooling effect and when the lakes are cooling, each exerts a strong warming effect. This local warming and cooling is greatest over GBL.

The open water period for GSL is almost a month longer in spring and 3 weeks longer in early winter than for GBL. Annually, for both lakes, early ice break-up is matched with late freeze-up. Conversely, late break-up is matched with early freeze-up. Early thaw and break-up promotes low surface albedo during the high sun season which leads to high magnitudes of absorbed solar radiation. This heat energy keeps the lakes open later into the winter. The opposite cause-effect relationship exists with late ice thaw and break-up. The magnitudes of latent heat fluxes (evaporation) and sensible heat fluxes from GSL are about three-times larger than from GBL during their respective open water periods. GSL is very responsive to climatic variability because of the high correlation between time of lake ice breakup and magnitude of absorbed solar radiation. It is postulated that GBL will be affected in similar fashion.

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Region: IN

Location: At locations within Shallow Bay, Kittigazuit Bay, and in and around Camp Farewell

2006 Non-intrusive Biophysical and Engineering Studies in the Inuvialuit Settlement Region Camp Farewell Phase I and II Environmental Site Assessment Update

Phase I and Phase II environmental site assessments were conducted at Camp Farewell to identify changes in site conditions since 2000, confirm the co-ordinates for onsite features, install a groundwater monitoring well and collect soil and water samples. Bathymetric studies were performed in Shallow Bay and Kittigazuit Bay/Kugmallit Bay. Temporary water level monitoring stations were installed in the study areas for the duration of the bathymetry work where they collected water level and meteorological data. Aquatic studies were completed in Kittigazuit Bay and in the Niglintgak development area. During these activities,

hydrological, water quality and fish and fish habitat data were collected in Kittigazuit Bay and shoreline recession data was collected at Niglintgak. Other biophysical investigations in the Niglintgak development area involved: identification of landforms, soils and permafrost; classification and mapping of vegetation (including rare plants); and collection of baseline information on wildlife. A general site survey and heritage resource survey were also done for the Niglintgak development area

Sediment sampling and sediment transport studies in Kittigazuit Bay were not conducted during the summer of 2006. Kittigazuit sediment sampling will be conducted as part of the Niglintgak 2006/2007 winter field program, for which permitting is underway. Timing for the postponed Kittigazuit sediment transport study has not yet been determined.

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Region: SA

Location: Ten sites within the vicinities of Tulita and Norman Wells

Enhancement of Permafrost Monitoring Network and Collection of Baseline Terrain Information in the Mackenzie Valley Corridor

Due to delays with contracting and acquisition of land use permits, very little field work was conducted during 2006. However, boreholes were drilled in February at Steep Creek in collaboration with Enbridge just off the cleared pipeline right-of-way on land leased by Enbridge. Instrumentation was installed to monitor ground temperature and slope movement, and preliminary temperature data were collected. Temperature and soil data indicate that the underlying ground is unfrozen and mainly consists of clay. Reconnaissance during the summer facilitated further refinement of selection of sites at which drilling will take place in winter. Information on thaw depths was collected at some sites (north and south of Norman Wells, north of Fort Good Hope) by manual probing.

Community consultation with Fort Good Hope and Tulita was also a major activity in 2006.

Current activities involve preparation for the winter field program. The field program will include participation of community members and also usage of community services and supply. Project activities will provide new information on permafrost and soil conditions in the Sahtu region that will benefit communities, governments and industry and contribute to land use planning.

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Region: SA

Location: At twelve sites in the K'asho Got'ine District of the Sahtu Settlement Area

Enhancement of Permafrost Monitoring Network and Collection of Baseline Terrain Information in the Mackenzie Valley Corridor - K'asho Got'ine District, Sahtu Settlement Area

Due to delays with contracting and acquisition of land use permits, very little field work was conducted during 2006. Boreholes were drilled in February at Steep Creek in collaboration with Enbridge just off the cleared pipeline right-of-way on land leased by Enbridge. Instrumentation was installed to monitor ground temperature and slope movement, and preliminary temperature data were collected. Temperature and soil data indicate that the underlying ground is unfrozen and mainly consists of clay. Reconnaissance during the summer facilitated further refinement of selection of sites at which drilling will take place in winter. Information on thaw depths was collected at some sites (north and south of Norman Wells, north of Fort Good Hope) by manual probing.

Community consultation with Fort Good Hope and Tulita was also a major activity in 2006. Current activities involve preparation for the winter field program. The field program will include participation of community members and also usage of community services and supply. Project activities will provide new

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116 **Physical Sciences**

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Region: GW

Location: Norris Creek, Campbell Lake, North Caribou, and Thunder River airstrip

Enhancement of Permafrost Monitoring Network and Collection of Baseline Terrain Information in the Mackenzie Valley Corridor - Gwich'in Settlement Area

Due to delays with contracting and acquisition of land use permits, establishment of permafrost monitoring sites was postponed to 2007.

Site reconnaissance in October 2006 facilitated further refinement of selection of sites at which drilling will take place in the near future. A Gwich'in beneficiary was hired as an environmental monitor during this reconnaissance. Information on thaw depths was collected at some sites by manual probing. The thaw depth or active layer depth was 40-50 cm at Norris Creek, 55-68 cm at Campbell Lake, and 49-62 cm at the North Caribou site. At Thunder River airstrip, the thaw depth was 62cm in unburned areas and 100 cm in burned areas.

In addition, a GSC representative visited Inuvik (February and October) and Tsiigehtchic (February) to meet community leaders, present information to the public and inform relevant regulatory organizations.

All activities completed to date and those to be completed in the coming year will provide new information on permafrost and soil conditions in the Gwich'in Area that will benefit communities, governments and industry and contribute to land use planning.

117 **Physical Sciences**

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Region: DC

Location: Twenty sites within the vicinities of Fort Simpson, Wrigley and Trout Lake

Enhancement of Permafrost Monitoring Network and Collection of Baseline Terrain Information in the Mackenzie Valley Corridor-Deh Cho Region

Due to delays with contracting and acquisition of land use permits, the field work related to establishment of permafrost monitoring sites and collection of soil information was postponed until 2007.

Site reconnaissance conducted on May 23 and 24, 2006 facilitated further refinement of selection of sites at which drilling will take place. The reconnaissance was carried out with a local environmental monitor, resulting in a reduction in the number of total sites from 20 to 18 in the Deh Cho region. The refined site coordinates were used in Land Use Permit application and 2007 scientific licence application.

In addition, a GSC representative visited pertinent communities May and September and met with community leaders, presented information to the public and consulted with elders and regulatory organizations. The communities visited include: Fort Simpson, Wrigley, Jean Marie River, Trout River, Kakisa, Fort Providence and Hay River. The information and feedback collected was used to relocate the proposed monitoring sites and plan the field drilling and installations.

118 **Physical Sciences**

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Location: In the immediate vicinity of Inuvik and Tuktoyaktuk where patterned ground and thermokarst are present

Possible Arctic Analogues of Utopia Planitia, Mars

This field work occurred in June 2006 and comprised two parts. The first part focused on sampling the massive ice and pingo-core exposures at Peninsula Point, south of Tuktoyaktuk. The aim was to identify the isotopic character of the ice in order to evaluate the various emplacement theories associated with the origin of the ice. The second part of the study focused on using ground penetrating radar to identify the possible presence of ice-veins and wedges beneath two drained thermokarst lakes (alases) just south of the Inuvik Airport. The size, distribution and depth of these features are markers of recent and long-past periglacial and hydrological activity. As we have identified possible evidence of massive ice, pingos and alases in Utopia Planitia, Mars, the data collected at Peninsula Point and Inuvik could be of analogical use in trying to understand the development of the Martian landscape.

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Location: At an unnamed lake (74° 50' N, 113° 30' W) on Dundas Peninsula, Melville Island

Climate forcing factors and the record of climatic variability in the western Canadian Arctic during the past 2000 years

The working hypothesis of this study was that climatic variability in the western High Arctic and the factors influencing it can be identified, and their changes over time can be examined by using the varved (annually-laminated) sedimentary record of a lake on Melville Island, NWT. The main objectives of this study were to: 1) develop a 2000-year varve thickness record; 2) identify climatic influences on lake sedimentation by statistically comparing the varve measures to regional instrumental data; 3) reconstruct these climate parameters to examine their variability; and 4) compare the reconstructed records with those developed by a colleague from two lakes at Cape Bounty (115 km east) to determine the regional climate signal. The results of the study provide more information about how the Canadian Arctic responds to climatic forcing (natural and human-induced) and how it may respond to future environmental change. This research was done by using lake sediment records to examine changes in weather conditions and river discharge in the western Canadian Arctic during the past 2000 years.

The cores were collected from the lake using a vibracore (concrete vibrator) coring system during the winter months. Approximately 100 kg of sediment in a series of sediment cores (7 cm diameter and 20 cm to 3 m in length) was extracted.

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File No: 12 404 622
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Licence No: 13966
Location: Green Cabin, Mould Bay and Isachsen

Biocomplexity of Frost-Boil Ecosystems

In May 2006, the researchers conducted spring snow surveys and measurements of frost heave at Isachsen, Ellef Ringnes Island and Mould Bay, Prince Patrick Island and Inuvik. These measurements were not recorded at Green Cabin, Banks Island because of an early snow melt. In August, measurements of active layer depth were taken at the study sites at Isachsen, Ellef Ringnes Island; Mould Bay, Prince Patrick

Island; Green Cabin, Banks Island and Inuvik. 2006 was an exceptional warm summer. Average thaw exceeded 80 cm on all grids with many areas over 100 cm. By late summer the wettest site at Green Cabin was totally dry. Considerable collapse and desiccation cracking was evident along ice-wedges and surrounding non-sorted circles at all sites. This was the final year for this project. Researchers involved in the project met in December 2006 at San Francisco to synthesize results. A set of papers on the project is being written that will be published in a special issue of the Journal of Geophysical Research Biogeosciences.

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Region: GW

Location: mainly around a landslide on a small lake (N67°40.0' W131°31.8') located southeast of Travaillant Lake

Mackenzie Valley Landslide Geotechnical Investigations - 2006 - GSA

The GSC team conducted geotechnical site investigations near an active landslide around 5 km east-southeast of Travaillant Lake (N 67° 40' W 131° 31.8') as part of the field investigations aimed at understanding landslide triggering mechanisms in the Mackenzie Valley region. The major goal of the investigations has been to examine the ground conditions changes due to excessive heat penetration reflected by reducing the thickness of the active layer that undergoes annual free-thaw cycles. The investigations mainly involved removing a layer of surface soils from an area of 4 m by 4 m to depths ranging from 0.25 m, 0.50 m and 0.75 m at three test locations in adjacent to the existing active landslide. Three boreholes were drilled to a maximum depth of 2.5m in each test pit and an undisturbed location. The test locations were instrumented with geosensors to monitor the temperature, moisture, and pore water pressure changes. A mini-weather station with a datalogger set was installed on site. Soil samples were obtained for laboratory testing aimed at characterizing the existing soil. In addition, some field tests, e.g., vane shear strength tests using a small hand held apparatus, were performed to get some soil parameters.

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Region: IN

Location: Mainly around a landslide located on the west side of East Round Lake (N68°41.3' W133°54.1') on Crown land, approximately 35km north of Inuvik

Mackenzie Valley Landslide Geotechnical Investigations - 2006 - ISR

The GSC team continued its geotechnical site investigations near an active landslide west side of East Round Lake on Crown land (N68°41.3' W133°54.1'). The objective of the project was to understand the landslide triggering mechanism in the Mackenzie Valley permafrost region. The site work in 2006 mainly included drilling boreholes, taking soil samples, and installing some geotechnical instruments with a datalogger and a mini-weather station to monitor ground conditions changes within and next to a test plot in adjacent to the existing active landslide. Eight boreholes were drilled with geotechnical instruments installed to depth between 0.5 m to 5.5 m using a light weight drill rig which was transported to the site by helicopter. The geotechnical instruments include piezometers for measuring pore water pressures, thermistors for measuring ground temperatures, Frequency Domain Reflectometers for measuring soil moisture changes and inclinometers for measuring slope movements. Some field tests, e.g. vane shear strength tests with a small hand held apparatus, were also performed to get some soil parameters. Further site observations, data collection, instrument monitoring and soil sampling at this site are required for the coming thaw seasons.

123

Physical Sciences

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Region: SS

Location: In the Slave River Delta (61°N 133°W), near Fort Resolution

Paleohydrology and Paleoecology of the Slave River Delta

No work pursuant to this program was conducted in 2006.

124

Physical Sciences

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Region: IN

Location: Big Lake and Middle Channel

Integrated Geoscience Studies of the Mackenzie Delta and Nearby Coastal Environments

Research activities were carried out in August 2006 and October 2006 to document the physical morphology of three active methane seeps east of Middle Channel. Seep geometry, gas flux, sediment bearing strength, acoustic bubble plume properties, and gas concentrations were recorded to identify the major features of these seeps.

The researchers intend on returning to the site in August 2007 to repeat gas flux measurements to determine whether discharge rates are consistent over time. Two manuscripts relating to this research are being prepared for submission to peer-reviewed journals. Preliminary findings were presented at GAC-MAC in Yellowknife in May 2007, and at the Yellowknife Geoscience Forum in November 2006.

SOCIAL SCIENCES

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Social Sciences

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Region: IN

Location: Inuvik and Aklavik

Local and Regional-Scale Societal Dynamics in Grizzly Bear Conservation in Canada

Grizzly bear conservation is a significant challenge for wildlife managers, and the human dimensions of grizzly bear management remain poorly understood. This study aims to provide empirical and theoretical knowledge of how local and regional-scale social and cultural context influence grizzly bear conservation efforts, with particular focus on understanding the knowledge, perceptions, and actions of people inhabiting areas affected by grizzly bear conservation policies.

This project used multiple qualitative research methods to compare four case studies of grizzly bear management: the Foothills Model Forest region, west-central Alberta; the Kluane region, southwest Yukon; Baker Lake, Nunavut; and the Inuvialuit Settlement Region (Yukon/ NWT). Case comparison showed that conventional approaches to grizzly conservation are vulnerable to failure, especially in co-management situations such as Kluane. In those situations, cross-scale institutional networks and the efforts of individuals strongly influence outcomes. Aboriginal perspectives on “respect for bears” differ considerably from non-Aboriginal views, and point towards an alternative paradigm for grizzly bear conservation, that of “respectful coexistence”. To achieve respectful coexistence, conventional bear management must be re-defined as coping within complex, linked social-ecological systems – rather than trying to control them.

126

Social Sciences

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Location: Within the municipal bounds of Inuvik, Aklavik, Holman, Sachs Harbour and Tuktoyaktuk

Planning for Community Health: A Comparative Study in the Inuvialuit Settlement Region

In 2006, preliminary research was conducted in the Inuvialuit Settlement Region (ISR). This involved becoming familiar with the region and doing research into available data sources for indicators and measures of community health and well-being as well as available data sources on community infrastructure in the ISR.

Initial research findings indicated that there was a lack of information about the influence of community infrastructure on the health and well-being, which prevented a quantitative analysis and comparison on this basis.

After further research work back at the University of Waterloo, modifications were made to the research design. Specifically, interview questions were made qualitative and open-ended in order to better explore the connection northern residents see between land use and health and well-being. The research ethics approval process has also been initiated through Aurora Research Institute (ARI) for approval of this modification, and further work on this project is being postponed until approval is granted.

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Social Sciences

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Location: Inuvik and Holman

"Thick description" of the culture of Canada's Inuit between tradition and modernity: Discussion of Clifford Geertz's anthropological approach based on field studies in Northern Canada

This doctoral study in philosophy aimed to explore Clifford Geertz's approach towards understanding culture and humanity. Geertz's methodology of "thick description" was used to understand the issues of identity, culture and change among indigenous peoples in Canada. Research done in 2006 focused on working with the Inuvialuit communities of Inuvik and Holman. The researchers endeavoured to spend time with the people rather than coming into the community and asking questions (a method which was found to be problematic and sometimes unethical). The alternative approach allowed the team to get a better understanding of the difficulties Inuvialuit face due to the experience of "colonial stress".

Researchers worked with the Inuvialuit Regional Corporation (IRC), specifically with the Program Coordinators of the Aboriginal Healing Foundation, in order to better assess the core symptoms of a culture having lost major parts of the tradition shifting into modern times. The researchers, with Clifford Geertz, argue that human beings create culture as a web that provides a sense of security, orientation and hold. Once that web undergoes substantial damage or is lost, the stability and balance provided by that web becomes threatened. They also argue that without people having control over their lives they lose their *sense of meaning*, an inherent part of being identical, or being who they are, feeling whole. Having lost that meaning, that cannot be created from outside, it seems to be very hard to start working on a new web that makes sense, or to give new hope to future generations that are undoubtedly facing another wave of change (with the Mackenzie pipeline coming, for example).

In the end it doesn't make sense to fill the holes of a culture with things that are based on Western thinking, colonial ethnocentric philosophies. In order to gain sustainable stability for the Inuvialuit, a foundation is needed for the people to find their meaning, to create their ways of dealing with symptoms that create even more cultural stress. More, closer research together *with* (not about) the Inuvialuit is needed in order to find out how this foundation could be created.

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Social Sciences

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Location: Yellowknife and Hay River

Local attitudes of the Anglican Church towards its Aboriginal membership in the Yukon/NWT

What is the relationship between Aboriginal and non-Aboriginal Christians in the Northwest Territories (NT) within the Anglican (ACC) and United (UCC) churches after the residential schools? Residential schools had minimal impact on members of these churches, primarily because (1) the UCC operated no residential schools in the NT and has only two congregations in the territories; (2) the ACC in the NT has a strong Aboriginal base, including approximately 70% of clergy, and a history exemplifying respect for Aboriginal peoples; (3) no claims of abuse have been filed against the ACC-run schools in the NT; and (4) non-Aboriginal members of both churches have Aboriginal colleagues who talked favourably about the schools; many have Aboriginal relatives.

Members are proud that their relationship is so positive, however, feel more should be done in predominantly non-Aboriginal areas, such as Yellowknife, to reach out to Aboriginal peoples. Cultural differences tended not to be emphasized. The good relationship, however, is at some risk. Few programs exist to safeguard the relationship against an influx of Aboriginal people, perhaps from other denominations, with different experiences of residential schools, or of non-Aboriginal people from other parts of Canada with little knowledge of Aboriginal ways.

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Location: Within the municipal bounds of the Village of Fort Simpson

Swimming Against the Mainstream: The NWT Aquatics Program 1967 - 2006 in Fort Simpson, NWT

The goals of this study were to: document the history of the Northwest Territories Aquatics Program in Fort Simpson; expand understandings of Dene practices concerning water; examine whether a Shallow Water Pool Lifeguard certification is viable; and examine the potential for the creation of documents and presentations that can decrease water-related fatalities and physical inactivity.

Interviews regarding local employment revealed that community members believe that there are many benefits to hiring local staff, as they feel that these individuals are more familiar with the children and parents, that they provide strong role models, and that they attract adults and children to the pool who would not regularly participate in pool activities.

When asked about drowning prevention, interview participants all expressed the desire for more ice, boat, and water safety in the community. Many interviewees felt that this information should be delivered by experienced community members, and particularly Aboriginal peoples, rather than from non-residents. The role of traditional knowledge (such as offering tobacco to the water) was also deemed to be very important.

Most participants suggested that they need greater incentives to take safety precautions, such as making it illegal to boat without a personal floatation device (PFD) and also having the fear that they will get a fine or ticket from the RCMP. It was suggested that inadequate RCMP resources result in limited water patrols and that an increase in patrols might decrease unsafe and illegal behaviours.

Stronger partnerships with the RCMP, schools, and Aboriginal organizations and the incorporation of traditional knowledge into existing programs would help to ensure that important water safety information reaches all community members.

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Social Sciences

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An Ethnographic Sketch on How Diamond Mining Affects Life in Fort Smith, NWT

Research was conducted in Fort Smith in order to find out more about how diamond mining in the Northwest Territories influences life there. The results of this project were summarized in a thesis for a Master's degree. The thesis is written through an environmental lens, presenting information on several aspects of the mining. In it the researcher discusses how diamond mining alters the ecology of the Lac de Gras region, and describes, in general terms, changes that are taking place on the land. It was found that despite these alterations, Dene people from Fort Smith have found ways to benefit from the industry economically, socially, and culturally. However, the long-term and cumulative environmental affects of diamond mining could undermine Dene peoples' ability to gain from the industry. Therefore, one cannot separate the environmental affects of diamond mining from the Dene peoples' well being. The two are inexorably linked, given an understanding that Dene peoples' well being is tied directly to the land.

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Social Sciences

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Location: Within the municipal bounds of the Hamlet of Holman and Winter Cove (near Walker Bay, Prince Albert Peninsula, Victoria Island)

Close Encounters: Continued Investigations into 19th-20th Century Copper Inuit and European Intersocietal Interaction

2006 was the fourth year of this sociocultural investigation. Research occurred between July 4 and August 22, 2006, in the Hamlet of Ulukhaktok, Victoria Island, Northwest Territories. Oral interviews with elders and other community members were conducted throughout July and August, with very good results. Local community members and staff of the Ulukhaktok Community Corporation provided superb assistance in research and related activities. All interviews were initiated and carried out according to strict professional and ethical standards/protocols and are now being analyzed according to project plans and schedule.

Additionally, a presentation of project findings and activity to date was delivered to board members and staff of the Ulukhaktok Community Corporation/Inuvialuit Land Association at a regular meeting in Ulukhaktok on July 12. The presentation was organized by the Ulukhaktok Community Corporation, the above organization has provided outstanding support to the project and have agreed to endorse the continuation of the project activities in coming years.

Additionally, much information was collected concerning cultural sites throughout the Walker Bay, greater Minto Inlet area and southwards through the Ulukhaktok area and throughout Prince Albert Sound. This information will be included in the planned cultural sites inventory component of this ongoing project. Plans for field observations in the Minto Inlet area, where cancelled due to logistical and weather problems. It is hoped that this field work will begin in 2007.

132

Social Sciences

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Location: Within the municipal bounds of the Hamlet of Fort McPherson

Wildlife and Land Use Data Collection for the Peel Watershed

In cooperation with the Gwich'in Land Use Planning Board, the Peel Watershed Planning Commission conducted a workshop in Fort McPherson with approximately 15 local hunters and trappers. The participants identified important wildlife and harvesting areas, cabins and camps, as well as cultural sites. Wildlife and harvesting questions focused on a number of focal species: caribou, moose, sheep, furbearers, waterfowl and a variety of fish species. The gathered information is being spatially digitized for GIS analysis. The data will complement other information that was gathered at a similar workshop in Dawson City, and through interviews in Mayo. Ultimately, the data will assist the Commission in assessing key ecological and cultural values in the Yukon portion of the Peel watershed.

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Social Sciences

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Mental Health and the Natural Environment: A Qualitative Study of the Inuvialuit Practice of "Going Out on the Land"

This study involved a literature review on the benefits attributed to spending time in nature. It also involved interview based research with the Inuvialuit of the Beaufort Delta Region. This was to determine whether or not there were any implications of 'going out on the land' for the mental health and well being of these peoples. Results showed that all subjects spoke of the positive effects that being out on land had on their cognitive, spiritual, and emotional states. Caregiver results concurred. By implementing and supporting programs that integrate on the land experiences with other therapies, a sustainable mental health and addictions program and overall resource could be developed. Such program offerings would have a strong potential to sustain this community through the challenges that are yet to come.

134**Social Sciences****Krogman, Naomi**

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File No: 12 410 660**Licence No:** 13926**Region:** SSA**Location:** Deline. On occasion, interviews with government officials will be conducted in Hay River, Fort Smith, Yellowknife and Norman Wells**The construction of community-based natural resource management: Social perception and cognition in the development of new resource management institutions in Deline, Northwest Territories**

The objective of this study was to examine how people perceive natural resource management practices in the Canadian North. Researchers participated in the Deline Knowledge Centre action group, and in the Great Bear Lake Watershed Management Plan (GBLWMP) and Sahoyúé-Ehdacho processes. These two working groups were studied in order to examine the ways outside resource managers from federal and territorial governments, environmental non-government organizations, and Deline community members perceive, negotiate and practically apply one another's diverse understandings of natural resource management.

Interviews were conducted with community and government members in Deline, Yellowknife, Hay River, Fort Smith, and Winnipeg. Continued participation and research follow-up is planned for 2007. Results of this study will be summarized in a PhD thesis and the results will be presented to the community before the final draft is submitted. Results of this project indicate that Deline is using a variety of tools to remain at the center of resource management (power), influence how people understand their traditional Dene ways (stories), and in such a way that conservation and economic development objectives are reached. This allows for the Dene way of management to be seen as adaptive and resilient.

135**Social Sciences****Loovers, Jan**

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File No: 12 410 667**Licence No:** 13936**Region:** GW**Location:** Fort McPherson and Teetl'it Gwich'in traditional lands**Dwelling with Power: An Ethnography with Teetl'it Gwich'in Harvesters**

From December 2005 through December 2006, the researcher lived with the Gwich'in People of Fort McPherson, going out on the land with elders who demonstrated their traditional practices in hunting, fishing, trapping, traveling during the six seasons. The researcher worked at the Gwich'in Language Center and with the Gwich'in Social and Cultural Institute in Fort McPherson with the help of a local research assistant.

The land (Nan-kat-tthak), source of life, remains central in the lives of Gwich'in People. Vadzaih (caribou) plays a key role, both traditionally and in a contemporary manner. Almost every part of Vadzaih is used and is essential for the well-being of the community. Nan-kat-tthak heals, as Elders pointed out, and one has to respect it. This is also the place where many Gwich'in feel free and joyful, where histories and the Old Stories are, where the old trails are. Many have said: 'This is our country, God's country'. Government and tribal policies concerning Nan-kat-tthak have often included traditional knowledge of Gwich'in harvesters, but have also excluded the rich field of relations between Gwich'in, animals, ancestors, and other beings.

136**Social Sciences****Martin, James**

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Location: Yellowknife, Inuvik and Fort Simpson

Separating the Grey from the Green: A case study examining the use of full-cost accounting principles as a decision-making tool for determining the costs and benefits associated with mining in the North

All participants within the Northwest Territories regulatory regime have a heightened awareness of the need for additional evidence based information (factual, quantifiable and defensible proof) of the benefits and costs associated with resource development activities. This is particularly true in light of increasing non-renewable resource development activities, and the recognized need to respond to a legacy of past resource development project environmental liabilities. Based on publicly available information and confidential surveys, this research thesis concluded that full cost accounting principles, despite current limitations, have the potential to become another utility tool that should be employed in cost benefit analysis and the final approval process for resource development projects in the NWT, and indeed elsewhere. Ultimately, it is the preponderance of evidence made available by a range of defensible analytical tools respecting project benefits and costs that should facilitate an informed and accountable decision-making process committed to delineating the practical politics of net benefits or costs.

Finally, the intent of this research was not to be judgmental of any resource development decision past or present but rather to contribute to the emergent dialogue of the utility of FCA as a decision support tool.

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Location: Within the municipal bounds of Deline

People, Land and Pipelines: Perspectives of Resource Decision-Making Processes in the Sahtu Region, Northwest Territories

The purpose of this project was to investigate the ways that people in the Sahtu participate in decision making processes about oil and gas activities on their lands. In August and September 2006, time was spent in Deline talking to people about their experiences of resource development, and about their experiences participating in consultation and environmental assessment processes like the Joint Review Panel (JRP) for the Mackenzie Gas Project. Research was conducted primarily through interviews and focus groups. Participants expressed concern over several issues, including: the differing perceptions of industrial impacts; the need to uphold beneficiaries' rights to participate in decisions relating to lands and resources; the protection of the environment for subsistence and cultural activities; and the need to foster economic sustainability. Preliminary fieldwork has suggested that the role of public participation in resource decision making processes may be limited by the practices, complexity, and overall structure of large scale environmental assessment regimes such as the JRP. However, participation may also be limited as a result of local processes and institutions. These include the timing of Access and Benefits Agreements, and the use of Traditional Knowledge studies in land-use applications. Additional fieldwork is planned for the communities of Tulita and Colville Lake in 2007.

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Dene discourse on industrial development and the Process of Environmental Impact Assessments

From August to October 2006 the team conducted semi-structured and narrative interviews with Dene, Métis and Euro-Canadians during and outside the public hearings for the Mackenzie Gas Project of the Joint Review Panel in Yellowknife, NWT.

The data from this work allows for two main conclusions. First, Dene attitudes towards industrial development are determined by their relationship between the social and natural world which is distinctly different from the one of Euro-Canadians. Subsistence hunting and trapping is an integral ingredient to Dene physical and psychological well-being. If not practiced by everybody, networks of sharing provide the whole community with country food and it is emphasized that at least everybody including future generations should have the possibility to live a life on the land. Industrial development, such as the Mackenzie Gas Project, is perceived as severely damaging to the environment upon which Dene lifestyle depends.

Second, even though the legal framework for political participation of indigenous people in Canada is based on respect for equality, the practical realization of the environmental impact review process and Dene involvement in resource management and revenue sharing is characterized by hierarchical structures. This neo-colonial context prevents effective participation of indigenous people and restricts their efforts and prospects for self-determination.

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Social Sciences

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Location: Municipal bounds of Inuvik

Industrial Development and Indigenous Peoples of the Russian and Canadian North: Interaction, Losses, Acquisitions

The aim of the study was to investigate the correlations between economical and political (including legal) components in the development of the north. Studying the traditional knowledge (including customary law) of indigenous peoples, as well as of the possibilities of their more active involvement in the use of natural resources made up a special part of the project.

The main part of the research was held among Inuvialuit in Inuvik. Interesting materials on two topics were collected. First, the activity of Community Justice in Inuvik was studied. Interviews with all participants and organizers of the alternative justice in relation to juvenile crime were recorded, and the committee's sessions were attended.

The second research topic was connected with the study of the problems of socio-economic and cultural development of Inuvialuit in connection with the preparation to the gas pipeline construction in the Mackenzie River Valley. Researchers attended the public hearings on this project, which took place in Inuvik for several days, and met with the audience, including representatives of oil and gas companies and officials from Ottawa and Yellowknife. Moreover, interviews on the activities of Inuvialuit Development Corporation and its different divisions were conducted. Interviews with Inuvialuit touched upon the issues of land use, exploitation of hunting and fishing resources, development of reindeer herding. Discussions and interviews with representatives of the First Nations immediately involved in the work of the company on the preparation to the pipeline construction, including the organization of educational courses by the orders of industrial companies, were particularly important for my research.

The interviews and observations collected will be used for a number of publications.

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Social Sciences

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Things Change, We Change: Planning for Resilience in the Canadian Arctic

This collaborative study explores how local planning and development functions might serve to build community resilience. Engaging Arctic coastal community members in knowledge-sharing and planning around ongoing adaptations to local environmental changes was the immediate objective of the research with the longer-term goal of developing of a "learning" practice of planning that takes greater account factors the community sees as fundamental to its sustainability.

At the outset of 2006, community consultations were completed as planned in both Sachs Harbour and Tuktoyaktuk. The researcher also assisted in the coordination of a variety of activities in conjunction with the Coastal Zone Canada Conference which took place in Tuktoyaktuk in August. The information contributed over this period by local residents and community organizations addressed general community development concerns, recollections of prior development practice, observations respecting institutional difficulties, apparent geohazards and environmental change, and ideas about how their respective communities might address the issues at hand.

While contending with medical problems during the second half of the year, the researcher did attend a meeting of the Arctic Coastal Dynamics working group in October where plans were discussed for an circum-Arctic observatory network that it is hoped will include either or both of Tuktoyaktuk and Sachs Harbour. She also produced a poster entitled "Things Change, We Change: Community Planning for Resilience in Tuktoyaktuk" that won the inaugural ITK/ICC Inuit Partnerships of Excellence Student Poster Award at the 2007 ArcticNet Conference in December.

(see: http://www.arcticnet-ulaval.ca/pdf/posters_2006/parewick_and_catto.pdf).

141

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Dissemination of Research Findings in Ulukhaktok

Between July and August, 2006, the research team communicated the findings of their research project "Managing Change: Environmental Change, Risks, Management and Infrastructure in Ulukhaktok", which documented how community members in Ulukhaktok are experiencing and adapting to climate change, to community members in Ulukhaktok. The aim of these communications was to share research findings with community members, verify that the collected information was correct, and obtain feedback on the research project.

Before visiting the community, the researchers worked with Inuit Tapirrit Kanatami (ITK), Inuvialuit Joint Secretariat, Ulukhaktok Hunters and Trappers Committee and other community organizations to develop the most appropriate methods of sharing the research findings in the community. The methods that were used included: discussing the findings with each interviewee who contributed their knowledge to the project, and collecting their feedback; hosting a feast, drum dance, and a slideshow for elders; giving presentations at the school; providing research finding booklets (in English and it is presently being translated into Inuinnaqtun) to community organizations and the public; and presenting the research findings to community organizations (Hamlet, Youth Council, Hunters and Trappers Committee). Researchers spent two months in the community to allow sufficient time for community members to discuss the research findings, and give feedback to the research team.

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Location: Yellowknife

Assessing the Effectiveness of Impact and Benefit Agreements in the Canadian North

The emergence of Impact and Benefit Agreements (IBAs) in the Canadian minerals sector has been read by many as a positive innovation in environmental governance. Negotiated directly between mineral resource developers and Aboriginal communities with limited state interference, IBAs serve to manage impacts associated with the mine project and deliver tangible benefits to local communities. Notwithstanding their increasing use and potential significance, limited systematic analysis has been undertaken to determine whether they are meeting their intended aims. This research reports on one such analysis from the Northwest Territories, Canada. While some deficiencies were apparent and perceptions of effectiveness varied somewhat by community, the IBAs were generally found to be meeting their objectives. Most significantly, there is considerable evidence that they are delivering positive outcomes for Aboriginal communities affected by mineral resource development in the Canadian North, which represents a significant change to typical outcomes of the past.

143

Social Sciences

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Region: NS

Location: Within the municipal bounds of Yellowknife

Community-Based Climate Change Impacts and Adaptations Workshops

On March 8th, 2006, a Community Climate Change Adaptation Workshop was held in Yellowknife, NWT, in room #205 of Northern United Place. The workshop highlighted the existing and potential impacts of climate change on various municipal services (specifically water services, power services, and municipal roads and related infrastructure), and also proposed measures to increase the adaptive capacity of the Yellowknife municipality.

Workshop participants were drawn from the North Slave Métis Alliance, the Federal government, the Government of the Northwest Territories, local and territorial business, non-governmental organizations, the University of Alberta, and the City of Yellowknife.

The morning session provided clarification regarding the mechanisms of climate change, general circulation models, permafrost dynamics, and adaptation. In contrast, the afternoon session applied the issue of climate change to various municipal sectors, including adaptations that have been attempted, implemented, or researched.

Results generally indicated that adaptive measures are at least being considered for all municipal services, and that there has been some successful implementation of these strategies. It was also indicated that more emphasis needed to be placed on both appropriate resource allocation and the linkage between monitoring efforts and their applications for municipal services.

144

Social Sciences

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Region: IN, GW

Location: Inuvik, Paulatuk, Ulukhaktok, Tuktoyaktuk, Aklavik, Tsiigehtchic, Fort McPherson, Norman Wells, Deline, Tulita, Fort Good Hope and Colville Lake

Developing Support Systems for Community Adult Educators

The objective of this research was to assess the Aurora College Community Adult Educators working in remote communities in the Northwest Territories, with the goal of discovering strategies and procedures to improve the delivery of guidance and support to these individuals. Specific objectives of the project included: 1) assessing the current satisfaction levels, with regard to leadership and support offered to Community Adult Educators by Aurora College; 2) recommending initiatives to enhance the experience of leadership and support offered to Community Adult Educators by Aurora College in an effort to increase job satisfaction

on the part of Community Adult Educators; 3) improving retention rates of Community Adult Educators by providing increased levels of support and leadership.

An appreciative inquiry approach was used in the research, which involves the use of two research tools: one-on-one interviews; and an on-line forum instrument. Overall, data was gathered from approximately twenty individuals involved in providing adult education services at the Aurora College Community Learning Centres in Inuvik, Paulatuk, Ulukhaktok, Tuktoyaktuk, Aklavik, Tsiigehtchic, Fort McPherson, Norman Wells, Deline, Tulita, Fort Good Hope and Colville Lake. Interviews followed a semi-standardized format with a set of questions common to all participants. One-on-one interviews were conducted with six current Community Adult Educators and two former Community Adult Educators, as well as with the Chairperson of Community Programs and two former Chairpersons of Community Programs. In addition, these interviews included two regional coordinators, and one administrative assistant. The six Community Adult Educators who did not participating in the one-on-one interviews took part in the online forum instrument.

145

Social Sciences

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Region: IN, GW

Location: Within the municipal bounds of Inuvik

A Community-Based Participatory Action Research Video-Making Project to Celebrate and Promote Family Literacy in the Western Arctic

The main goal of this project has been to create a locally produced video featuring local people. The open-ended interview format has been designed to allow community members to have the chance to tell their stories and express their views about how education and learning are an important part of their families. The goal has been to celebrate what is already happening and promote greater participation in family literacy.

Video is a powerful and accessible medium. It is also becoming more economical to produce video projects with high-quality digital video cameras and computer editing available and accessible for the novice user. If this process is successful other groups may be inspired to make videos expressing their interests and views.

This project is on-going. Data collection and feedback will extend into 2007. The feedback process for this project is important because it not only brings the video out into the community but it invites the community to respond.

146

Social Sciences

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Region: SS

Location: Fort Smith and Yellowknife

The Dark Side of Captain Al Cohol: Race and Social Control in the Northwest Territories

Captain Al Cohol was a cartoon designed and published by the Territorial Alcohol Education (TAE) in the early 1970s in order to reach northern youth and educate them about the dangers of alcohol. The "hero" appeared in four governmentally issued comics and appeared in a CBC radio program. Stories presented in the series presented alcohol addiction under the medical model and presented Alcoholics Anonymous as the means of realizing sickness and obtaining help. Although the comic was launched in the 1970s its origin can be traced to the 1960s when the TAE stressed the need for material that would target their "the Eskimo and the Indians, who are not always able to read" (Legislative Assembly of the NWT. Feb. 8-17, 1965:328).

The project consisted of a critical analysis of the series of comic books and radio plays in order to investigate the way in which "race" worked in cultural texts in the north around First Nations and alcohol. My specific interest is in how the racialized category of "Indian" was blurred with that of the medical model "alcoholic," and subsequently imported into debates and discussions surrounding alcohol policy in the North West Territories. Publication of this research is expected in the near future.

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File No: 12 410 675**Licence No:** 14005**Region:** NS**Location:** Bechoko (Edzo), Chief Jimmy Bruneau School**Sharing Our Success: More Case Studies in Aboriginal Schooling**

Based on detailed studies of schools creating tangible progress for their students, the researchers have developed several promising approaches with Aboriginal populations in ten diverse settings from Nunavut to Newfoundland. Analysis of the data gathered in 2006 from school administrators, teachers, students, parents, elders, and governing authorities yields valuable insight into practices for improving educational outcomes. Researchers examined leadership and governance, expectations, strategic partnerships, holistic approaches to curriculum and programming, instructional strategies, professional development, assessment, and the integration of Aboriginal language and culture at each school and identified patterns found across the set. In the Northwest Territories, Chief Jimmy Bruneau School in Bechoko was featured in the study. Key success factors at this school were identified as visionary leadership, integrated linguistic and cultural programming, and diverse funding partnerships. In a report of their project, the researchers identify prominent success factors across the schools, and then address systemic challenges of funding, special education, literacy and language, and performance reporting. They also lay out a set of recommendations for policy makers based on their findings.

TRADITIONAL KNOWLEDGE

148

Traditional Knowledge

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Region: IN

Location: Within the municipal bounds of the Hamlet of Holman

Researching Forms of Aboriginal Literacy in a Northern (NWT) Community

As part of developing an understanding of northern aboriginal ways of learning, teaching and communicating, the goal of this study was to examine the traditional (pre-contact), historical (post-contact) and contemporary forms of literacy in the Inuinnaqtun-speaking community of Holman. During 2006, 14 life history interviews were conducted with elders. In addition, two more interviews on storytelling were conducted, which provided more in-depth information on this theme. Each interview was translated into English. At the same time, key Inuinnaqtun terminology was documented. Information was reviewed and verified with elders, where necessary. The researchers also conducted an investigation of contemporary literacies in the community as a whole, at various community events, with different age groups present.

The two community-based researchers reported back to various groups in the community on a regular basis. As well, they prepared a one-page plain language summary of the project's progress to date, and provided it to various community groups, such as the Hamlet Council, the Ulukhaktok Community Corporation, the Aboriginal Healing Foundation, and the Elder & Youth Group. The community gathering has been postponed several times but is still planned to take place in the near future.

Analysis of the information collected to date indicates different models to literacy development. In educational institutions, the dominant model is decoding and creating, usually by means of printed materials. In the broader community, literacy development occurs through practice and lived experience, and narrative, which remains the key Inuinnaqtun literacy in identity formation.

149

Traditional Knowledge

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Region: SA

Location: Within the municipal bounds of Fort Good Hope

Documenting the Cultural Values of Ts'ude'hililine-Tuyetah

Ts'ude niline Tu'eyeta Candidate Protected Area is a special natural and cultural place. The Dene and Métis have a long history in this area and it is well known for providing everything needed to make a living. Since 2001, the community of Fort Good Hope, the Yamoga Land Corporation, Ducks Unlimited Canada and the Canadian Wildlife Service has worked to protect *Ts'ude niline Tu'eyeta* for the future, using the NWT Protected Areas Strategy (PAS).

In 2006 PACTeam Canada Inc. was contracted to conduct a cultural assessment of *Ts'ude niline Tu'eyeta*, as per step five of the PAS. In June 2006 traditional use and occupancy mapping interviews were undertaken with 19 knowledgeable residents. Approximately 637 features were mapped, with an additional 75 noted, but not mapped as participants could not pinpoint exact locations. This information, together with existing documented cultural information will be used to define and manage *Ts'ude niline Tu'eyeta* as a future National Wildlife Area.

The final cultural assessment report has not yet been released to the public. It is currently in the draft form and needs to be reviewed and verified by the community.

150

Traditional Knowledge

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Region: GW

Location: Within the municipal bounds of the Hamlet of Fort McPherson

Caribou Leaders Project

During the past 15 years, protecting caribou leaders from hunting when crossing the Dempster Highway has become a management concern for the Porcupine Caribou Herd (PCH). However "let the leaders pass" regulations have received mixed approval from First Nation members across the Canadian PCH user communities. During the summer of 2006, 29 interviews were conducted with elders and hunters with First Nation members of Dawson City, Old Crow and Fort McPherson. These interviews aimed to document the meaning of caribou "leaders" in traditional knowledge to better inform future management of the PCH and subsistence hunting activities.

Overall, the interviews showed that caribou leaders cannot be identified only as animals of a certain age or by sex. It was also not possible to distinguish leaders by a certain number of animals. Instead, traditional knowledge has more context specific definitions of caribou leaders, dependent on the time, place, and activities of the animals and hunters.

151

Traditional Knowledge

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Region: IN

Location: Within the municipal bounds of Aklavik and Inuvik

Public archaeology for the 21st century: Collaboration with an Arctic community

This field season represented a continuation of a collaborative oral history project with Inuvialuit Elders begun in 2005. The objective of the research is to work toward an Indigenous Archaeology in the Canadian Western Arctic through the development of a program of community-based archaeology with the Inuvialuit community in Inuvik and Aklavik, Northwest Territories. Over the course of the summer of 2005, 25 Inuvialuit Elders from Inuvik and Aklavik were interviewed about the form, function and interpretation of artifacts from the Yukon North Slope, and more generally about the Elders' memories and experiences of being raised on the coast and in the delta. Researchers returned to verify this information in April and May 2006. They were able to discuss the project and verify information with the majority of Elders, although a small number were ill, and sadly, two had passed on. This underscores the urgency of conducting oral history research in the Inuvialuit Settlement Region, as the current generation of Elders is the last to be born on the land. The information gathered by this project will ultimately be used to develop resources directed towards educating Inuvialuit youth about their Elders' way of life.

152

Traditional Knowledge

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Region: DC

Location: Parts of K'at'l'odeeche First Nation traditional lands susceptible to potential effects from the Mackenzie Gas Project

2006 Traditional Knowledge Studies with the K'atl'odeeche First Nation

Traditional Knowledge (TK) study activities focused on completing a literature review, and conducting interviews with holders of TK to identify relevant TK, analysing the data, and report writing. A final report was completed in January 2006. These activities were completed by the K'atl'odeeche First Nation under contract to Imperial Oil Resource Ventures Ltd. All activities complied with licence conditions. As this report is deemed confidential by the K'atl'odeeche First Nation, a copy will not be provided to the Aurora Research Institute. Information obtained from this report will be incorporated into the various project permit applications.

153 Traditional Knowledge

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Region: DC

Location: Parts of Fort Simpson Métis traditional lands susceptible to potential effects from the Mackenzie Gas Project

2006 Traditional Knowledge Study Follow-up Activities with the Fort Simpson Métis

Traditional Knowledge (TK) study activities focused on completing a literature review, and conducting interviews with holders of TK to identify relevant TK, analysing the TK data, and report writing. A final report was completed in January 2006. These activities were completed by the Fort Simpson Métis Nation under contract to Imperial Oil Resource Ventures Ltd. As this report is deemed confidential by the Fort Simpson Métis, a copy will not be provided to the Aurora Research Institute. Information obtained from this report will be incorporated into the various project permit applications.

154 Traditional Knowledge

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Region: SA

Location: In the vicinity of Fort Good Hope and community traditional lands susceptible to potential effects from the Mackenzie Gas Project

2006 Traditional Knowledge Study in Fort Good Hope

In 2006, MGP and community organisations in Fort Good Hope continued to discuss contractual arrangements and study research methods. No other work pursuant to this program was conducted in 2006.

155 Traditional Knowledge

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Region: GW

Location: Tsiigehtchic

Traditional Knowledge Study of Arctic Red and Mackenzie River Fisheries

The Arctic Red River and the lower Mackenzie River (Northwest Territories) are two very important fishing rivers for the Gwich'in people and non-aboriginal residents alike. The goal of this study was to collect traditional knowledge on fish species in these two rivers. This was accomplished in two ways. First, during January and February 2006, a detailed database search was conducted on available literature. Second,

community interviews were conducted during March 2006. Through a standardized questionnaire, knowledgeable fishers were asked to identify upstream and downstream migration patterns and spawning periods of each species. Researchers recorded text information and geographic information on maps. The information obtained in interviews was then summarized into maps and graphs. It was found that fishers were very familiar with the migration patterns and the spawning season of fishes in both the rivers. It was also found that traditional knowledge was similar to information collected in fisheries netting studies. This is the first study to document the extensive traditional knowledge of fisheries in this location.

156 **Traditional Knowledge**

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Region: IN

Location: Within the municipal bounds of Aklavik

Yukon North Slope Grizzly Bear Project-Traditional and Local Knowledge Component

This project is a part of a six-year research project conducted conjointly by Parks Canada, the Aklavik Hunters and Trappers Committee, the Wildlife Management Advisory Council (North Slope) and the Department of Environment, Yukon Territorial Government. The aim of the project is to gather information on grizzly bear activities, numbers and distribution through interviews with local hunters and land users. Information was gathered on current and past uses of grizzly bears to identify any ongoing changes in use patterns. A final objective of this project is to identify where problematic bear/human encounters occur and to provide some possible reasons for these encounters. This information will assist in informing and shaping grizzly bear management decisions in the Inuvialuit Settlement Region.

157 **Traditional Knowledge**

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Region: SA

Location: Within the municipal bounds of Deline

The Words of Our ancestors are our Path to the Future: Mapping Dene Language, Narrative and Governance in Deline, Northwest Territories

This year's activities focused on three projects. First, more than 100 audio recordings of interviews were digitized and documented as part of an oral history archive. Second, a three day focus group was hosted as part of the Barren-Ground caribou traditional knowledge project. Audio compilations and transcriptions were made of caribou narratives and key Dene terms. Third, key narratives surrounding the George Kodakin project were transcribed into the Dene language. Training took place throughout the year. The second year of the project will involve more transcription, analysis, community consultation, and development of community educational tools.

158 **Traditional Knowledge**

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Region: SA

Location: Within the municipal bounds of Fort Good Hope

Fort Good Hope Traditional Knowledge Pilot Project: K'ahsho Got'ine Ways of Respecting the Land

This project began during the summer of 2006 with an Elders Council meeting to discuss the objectives of this project. A search was conducted for documented traditional ecological knowledge (TEK) related to K'asho Got'ine, and links were made with researchers on the Fort Good Hope-Colville Lake TEK Pilot Project. The community-based research was disrupted by the sudden death of the President of the Elders Council who was also the community researcher for the study. Work is planned to resume in January 2007 with a focus on barren-ground caribou traditional knowledge

159 **Traditional Knowledge**

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Region: SS **Location:** Hay River

Hay River Métis Traditional Knowledge Survey for the Pine Point Pilot Project.

This study reports Traditional Knowledge gathered from Hay River Métis residents. The study was conducted during October, 2006 for continued planning and incorporation into Tamarlane Ventures Inc.'s developer's assessment report as required by the Mackenzie Valley Environmental Impact Review Board's environmental assessment process.

Qualitative interviews were used as the method of observation for the Traditional Knowledge study. Individuals with extensive land-use experience and knowledge of the South Great Slave Region were the preferred sample population. The final sample included 12 participants. Questions included in the qualitative interviews were loosely structured to encourage conversation and designed to gather participants': 1) knowledge about the environment; 2) knowledge about the use and management of the environment; and 3) values about the environment. The interviews explored information specific to Tamarlane's proposed project area and information applicable to the entire South Great Slave Region.

The study results report participants' Traditional Knowledge of seven specific topics including: terrain; climate; vegetation (berry picking areas); wildlife (hunting and trapping); water (fishing); significant sites (culturally important sites); and traditional use.

160 **Traditional Knowledge**

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Region: SS **Location:** Fort Resolution

Fort Resolution Traditional Knowledge Survey for the Pine Point Pilot Project.

This study reports Traditional Knowledge gathered from Fort Resolution Deninu Ku'e and Métis residents. The study was conducted during October, 2006 for continued planning and incorporation into Tamarlane Ventures Inc.'s developer's assessment report as required by the Mackenzie Valley Environmental Impact Review Board's environmental assessment process.

Qualitative interviews were used as the method of observation for the Traditional Knowledge study. Individuals with extensive land-use experience and knowledge of the South Great Slave Region were the preferred sample population. The final sample included 17 participants including 11 Deninu Ku'e and 6 Métis individuals. Questions included in the qualitative interviews were loosely structured to encourage conversation and designed to gather participants': 1) knowledge about the environment; 2) knowledge about the use and management of the environment; and 3) values about the environment. The interviews explored information specific to Tamarlane's proposed project area and information applicable to the entire South Great Slave Region.

The study results report participants' Traditional Knowledge of seven specific topics including: terrain; climate; vegetation (berry picking areas); wildlife (hunting and trapping); water (fishing); significant sites (culturally important sites); and traditional use.

161 **Traditional Knowledge**

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File No: 12 410 681**Licence No:** 14066**Region:** SS**Location:** Fort Resolution**Adapting to Environmental Change in the North: Traditional Knowledge, Social Capital and Adaptive Capacity in the Slave River Delta**

Field activities in 2006 involved two trips to Fort Resolution, NT (March - May and November), to build on research carried out in 2004 and 2005. A number of activities were undertaken in collaboration with community members, including: meetings with the Fort Resolution Environmental Committee and other local leaders to discuss progress and present results; four guided trips on the land; 15 semi-structured interviews with community leaders, harvesters and elders; a social capital survey of 104 heads of household; a scenario-based workshop with community leaders; two scenario-based classes on environmental change with Deninu School students; an open-house community presentation and research presentation at Deninu School with physical science research collaborators; and many informal discussions.

Preliminary results about past, current and potential future changes and vulnerabilities indicate that land and water resources continue to provide a significant food source for residents, and access to traditional harvesting areas remains important for social and cultural integrity. The simultaneous occurrence of environmental and socio-cultural changes has made these relationships more complex. Past adaptations have generally been reactive and undertaken on an individual basis; however increasing rates of change may require community-level response. While survey data indicates that contemporary socio-cultural change has disrupted traditional social bonds, a form of latent cohesion based on kinship ties and shared history may offer a vehicle to facilitate collective action. Important foci for capacity-building include local institutional development, improving community-level education, and increasing access to financial and technical resources.

Prince of Wales Northern Heritage Centre

ARCHAEOLOGY PERMITS

162

Archaeology

Benson, Kristi

Department of Transportation, GNWT

Permit No: 2006-985

Class: 2

Location: Km 34 of the Dempster Highway

Archaeological Impact Assessment for the Department of Transportation: Km 34 of the Dempster Highway

The Gwich'in Social & Cultural Institute was contracted by the Department of Transportation to conduct an archaeological impact assessment of a proposed gravel pit on the Dempster Highway. The proposed gravel pit is located at Kilometre 34 (KM34, 34 kilometres from the Yukon Border), on the north side of the highway. The proposed pit is approximately ten kilometres west of Midway Lake. It was identified as having an increased potential for buried archaeological remains due to landforms and proximity to a creek.

The work was carried out on June 5th, 2006 by Kristi Benson from the Gwich'in Social & Cultural Institute's Inuvik office with assistance from Woody Elias, an elder from Fort McPherson, and Arvind Vashishtha, from the Inuvik office of the Department of Transportation, GNWT.

The proposed gravel pit, in the Bonnet Plume Flats region, is within the traditional territory of the Teet'it Gwich'in of Teet'it Zheh (Fort McPherson). The Teet'it Gwich'in travel through this area to and from the mountains hunting Porcupine caribou and Dall sheep. Traditionally, the Teet'it Gwich'in would move to the mountains for caribou hunting in the winter, summer, and fall, and return to the Peel River and its tributaries for fishing in the summers. The proposed gravel pit is about 15 kilometres north of Vitreekwaa viteetshik, or Vitrekwa River, a tributary of the Peel River and an important travel corridor.

The proposed gravel pit is a small area, and was surveyed completely by foot. Two shovel tests were excavated. Approximately 40 disturbances were examined for cultural materials.

No cultural remains were discovered, and no impacts to archaeological materials are anticipated from the development of this gravel pit.

163

Archaeology

Bussey, Jean

EBA Engineering Consultants Ltd. On behalf of North American Tungsten Corporation Ltd.

Permit No: 2006-988

Class: 1

Location: Map Sheet 105O08, within 1km of the Yukon/NWT border in the Mackenzie Mountains (Sahtu Settlement Area)

MacTung Project

In August 2006, Jean Bussey of Points West Heritage Consulting Ltd. conducted an archaeological assessment of the proposed North American Tungsten Corporation Ltd. mine, known as the MacTung Project, which is located northwest of Macmillan Pass. The mine is situated near the Yukon/Northwest Territories border and potential development areas were identified on both sides although the ore deposits are in the Yukon. Jean was assisted by Brian Apland, of Points West, and Harold Dick of the Ross River Dena Council. The work was conducted under a Class 1 permit in both territories (Yukon Archaeological Sites Regulations permit 06-01ASR and NWT Archaeologists permit 2006-988).

The 2006 work was intended as a preliminary assessment to determine if more detailed archaeological investigation was required and was originally restricted to the Yukon. Due to terrain constraints, alternate development areas in the NWT were identified and a second permit was applied for. In the Yukon, two possible mill locations, a waste rock dump and a potential tailings pond divided into an upper and lower section were identified. No previous archaeological investigation has been conducted in these areas. In the NWT, an alternate mill location and a single proposed tailings pond were identified. Similar developments in the NWT had previously been examined for archaeological resources with one site, KhTg-1, recorded within the proposed tailings pond.

Prior to conducting any ground reconnaissance, a series of low and slow helicopter overflights were

completed. A series of traverses were then walked on landforms judged to have moderate or greater archaeological potential. Most proposed development areas within the Yukon portion of the project were characterized by heavy vegetation cover while some were in disturbed upland areas. Because it is not possible to conduct shovel testing under a Class 1 permit, the objective was to examine natural exposures. No archaeological sites were discovered, but potential for such was identified. The tailings pond in the NWT was also characterized by heavy vegetation cover, but the alternate mill location was in a rugged, upland area that had good exposure. No new archaeological sites were discovered, but previously recorded KhTg-1 was relocated and photographed.

The investigations conducted in 2006 suggest that the Yukon mill location, a few landforms south of the waste rock dump and portions of the upper tailings pond have sufficient archaeological potential to justify additional field investigation. Although some previous archaeological work has been conducted in the NWT portion of the study area, it is not known where testing was undertaken and further investigation is recommended near the proposed tailings pond. During this reconnaissance, the archaeological significance of KhTg-1 should be reassessed.

164

Archaeology

Bussey, Jean

De Beers Canada Inc.

Permit No: 2006-982

Class: 2

Location: Kennaday Lake area; 75N01-16, 75N08, 09, 15, 16

Gahcho Kue Project

Points West Heritage Consulting Ltd. conducted limited archaeological investigations for De Beers Canada Inc. at their Gahcho Kué Project in 2006. This was a continuation of work initiated in 2004. The study area is located at Kennaday Lake, which is approximately 300 km east/northeast of Yellowknife and 80 km southeast of Snap Lake. Jean Bussey directed the field investigations and was assisted by Misty Lockhart, also of Points West, and Arthur Rabesca of the Lutselk'e First Nation.

The major objective of the 2006 field investigations was to monitor sites in the vicinity of activities conducted during the winter of 2005-2006. A secondary objective was to conduct archaeological inventory along a possible new road route located west of the proposed waste rock storage area, an area that had not been previously examined.

The archaeological monitoring primarily involved low and slow helicopter reconnaissance. During these aerial investigations, the full length of the winter access road between Gahcho Kué and Mackay Lake, the land based portions of the southwest gravel pit access road and the vicinity of the proposed southeast gravel borrow pit were examined. In addition, limited ground reconnaissance was conducted in the vicinity of an area being used to store a mobile camp. This area is east of Mackay Lake near the start of the winter access road to Gahcho Kué. Placement of one unit of this camp has likely impacted a previously recorded archaeological site. This occurrence was reported to the Prince of Wales Northern Heritage Centre (PWNHC). The site is a small lithic scatter that was discovered in 1999 during an inventory conducted for the Gahcho Kué Project. As a result of discussions with the PWNHC, De Beers proposes to conduct further archaeological investigation at this site once the trailer units have been removed. The 2006 archaeological monitoring has confirmed that all other sites located near activities that took place in the winter of 2005-2006 have been avoided.

As a result of the inventory of the proposed waste storage access road, one new archaeological site was discovered. It is a small lithic scatter with over 25 flakes of quartz visible in one exposure. Scattered within a 10 m radius of this small concentration were a number of other quartz fragments, which in conjunction with the moderate vegetation cover, suggests potential for additional archaeological material. Site assessment through shovel testing will be conducted prior to any development activity. As a result of the archaeological inventory conducted in association with the Gahcho Kué Project, a total of 242 archaeological sites have been recorded.

165

Archaeology

Bussey, Jean

EBA Consulting Engineers Ltd., on behalf of NorthwTel

Permit No: 2006-981

Class: 2

Location: 4 land-based locations required for communication systems between YK and Ekati/Diavik mines: Paterson Lake area, Brown lake area, Mackay Lake area and Courageous Lake area.

NorthwesTel Repeater Stations

In 2006, Points West Heritage Consulting Ltd. conducted archaeological investigations directed toward determining the archaeological potential of four proposed NorthwesTel repeater stations located between Yellowknife and the diamond mines in the Slave Geological Province. The four stations were given names based on nearby lakes: Paterson, Brown, Mackay and Courageous. The archaeological investigations were directed by Jean Bussey, who was assisted by Kim Banner, a resident of Yellowknife and member of the Métis community. The archaeological work was conducted concurrently with habitat assessment undertaken by EBA Engineering Consultants Ltd.

All four proposed repeater stations were examined from the air and via a series of foot traverses. The terrain characteristics and amount of surface exposure evident at each location determined how many traverses were walked and their spacing. There are no archaeological concerns at three of the proposed repeater station locations: Paterson, Brown and Mackay. No further archaeological investigation is required at these locations provided there are no changes to the development plan and all construction activities are within the identified footprint.

An archaeological site was discovered at the proposed Courageous repeater station. A small lithic scatter was discovered near the northern portion of the footprint. It is approximately 10 m by 10 m in area and consisted of around 10 flakes of quartz. Since the site is avoidable and no archaeological material was found in areas adjoining the station footprint, it was recommended that the development be relocated slightly to ensure a substantial buffer zone between the site and any activity.

166

Archaeology

Bussey, Jean

Diavik Diamond Mines Inc. on behalf of the Tibbit to Contwoyto Winter Road Joint Venture

Permit No: 2006-980

Class: 2

Location: A linear corridor (previously known as the Lupin winter road) between Tibbit Lake and Pellatt Lake in the NWT: 85J09, 85I11, 85P03-09, 75M11-16, 76D01,08,09,16, 76C13

Tibbit to Contwoyto Winter Road Project

In 2006, Jean Bussey of Points West Heritage Consulting Ltd. conducted archaeological investigations for the Joint Venture that operates the Tibbit to Contwoyto (formerly the Lupin) winter road. The main winter road runs from the south end of Tibbit Lake near Yellowknife to almost the north end of Contwoyto Lake in Nunavut. In late 2006, a secondary route was identified at the southern end of this winter road. If used, this secondary route will head west from West Bay on Gordon Lake to the vicinity of the old Discovery Mine and then south to Prosperous Lake, which is accessible by paved road. This is an existing winter road that is currently operated under permit to Robinson Trucking Ltd. (RTL). Because it is an existing route and was not identified to Points West until October, archaeological field investigations were restricted to a proposed new portage at the south end.

The proposed portage will cross a narrow (maximum 250 m) peninsula of land north of McMeekan Bay and south of the main body of Prosperous Lake. The portage will only be 15 m in width, but because a final route has not been selected, a much wider low-lying area between two elevated bedrock outcrops was examined. It was determined that provided the bedrock outcrops are avoided, the low lying terrain between them is suggestive of low archaeological potential and no further archaeological investigation is required.

The work was conducted on October 18 in company with Jonas Sangris of the Yellowknives Dene First Nation and four other individuals who were undertaking environmental and route feasibility studies. Since the portion of this proposed secondary route from Prosperous Lake to the old Discovery Mine was examined for archaeological resources by Gabriella Prager of Points West in 2005, no further work is required along this portion of the existing RTL route. However, if this secondary route is used, the portion that connects with West Bay on Gordon Lake should be examined in 2007 when weather conditions are favourable.

167

Archaeology

Bussey, Jean

RESCAN Environmental Services Ltd., on behalf of BHP Billiton Diamonds Inc.

Permit No: 2006-979

Class: 2

Location: Coppermine River Basin, 300 Km northwest of Yellowknife in the vicinity of Lac De Gras

EKATI Diamond Mine Project

Jean Bussey of Points West Heritage Consulting Ltd. has conducted archaeological investigations for BHP Billiton Diamonds Inc. (BHPB) in its claim block north of Lac de Gras since 1994. Each year, she has undertaken to provide archaeological potential assessments, complete archaeological inventories, assess and mitigate sites or conduct tours of archaeological resources for interested groups. Archaeological sites located near development areas have been tested and mitigated through systematic data recovery consisting of subsurface excavation and/or surface collection. Sites well removed from such activity areas have been recorded and are periodically revisited, but are otherwise avoided.

The majority of the recorded sites in the BHPB claim block are associated with eskers, but sites are also found on other terrain types, usually near the larger lakes. There are still many portions of the claim block that have not been inventoried because no development or exploration activity has been identified in the vicinity. The majority of the sites near EKATI are best described as lithic scatters, sites that are characterized by unworked flakes of stone and may include an occasional tool. The most common lithic or stone material is quartz, which is found naturally as veins in the bedrock of the Lac de Gras area. Quartz cobbles are also found naturally in the numerous eskers in the claim block and it is suggested that both sources of quartz were used prehistorically for stone tool manufacture.

A number of the sites in the BHPB claim block have yielded small chert tools suggestive of the Arctic Small Tool tradition, which may date 2500-3500 years before present, but the majority of the archaeological sites probably relate to activities conducted in the last 2500 years. Although most sites are associated with the prehistoric period, a number of traditional use sites have also been identified with the assistance of interested First Nations.

Mitrelle Lockhart, of Points West, and Peter Sangris of the Yellowknives Dene First Nation assisted with the archaeological field work conducted at EKATI in July. The 2006 field investigations involved examination of 16 proposed exploration locations, two potential wind turbine farm localities and three possible options for access routes to an advanced exploration area. Archaeological investigations involved a combination of aerial examination using a helicopter and ground reconnaissance. Areas with moderate or greater archaeological potential were traversed on foot and exposures and bedrock outcrops within the development areas were closely examined. No new archaeological sites were discovered in 2006, but in total there are 199 sites recorded in the BHPB claim block.

168

Archaeology

MacKay R, Glen

Prince of Wales Northern Heritage Centre, GNWT

Permit No: 2006-986

Class: 2

Location: Projects may take place anywhere in the NWT.

Archaeological Impact Assessments for GNWT Departments

On behalf of the Department of Transportation, GNWT, Glen MacKay, Assessment Archaeologist at the Prince of Wales Northern Heritage Centre, conducted an archaeological impact assessment of the proposed Great Bear River Bridge Project.

The proposed Great Bear River Bridge (GBRB) Project, located in Tulita, NT, will require several project components, including the bridge, the right-of-way for the bridge approaches and tie-ins to the Mackenzie Valley Winter Road, and the camp and stockpile areas required to support bridge construction. The development of these project components will involve clearing and/or excavating by heavy machinery, leading to significant ground disturbance in areas of high archaeological potential, thus warranting a pre-construction archaeological impact assessment.

A detailed investigation was conducted for all of the high potential zones in the project footprint, including all development areas immediately adjacent to the banks of the Great Bear River, which exhibit high potential for campsites and travel routes, and the edges of oxbow ridges found on both sides of the river, which were likely used as lookouts for large game hunting.

The assessment of these high potential areas included walking transects across the development area to locate any surface features, and inspecting subsurface exposures (i.e. tree-throws and eroded sections of the riverbank) and excavating shovel tests to detect evidence of buried archaeological deposits. The areas of lower archaeological potential – in general, the wetter areas between the riverbanks and oxbow ridges – were visually inspected by walking the winter road alignment right-of-way.

As a result of the assessment undertaken for the proposed Great Bear River Bridge, four archaeological sites were recorded. Archaeological Site LfRq-16 is a small precontact campsite located at the confluence of an ephemeral drainage channel with the north bank of the Great Bear River. This campsite is centred on a small hearth feature containing fire-cracked rock and highly fragmented large mammal bone. Lithic tools include a cobble-spall hide scraper and three refitting core fragments. Archaeological Site LfRq-17 is a

small precontact campsite located at the confluence of a small drainage channel with the north bank of the Great Bear River. This campsite is centred on a small hearth feature containing numerous pieces of fire-cracked rock and highly fragmented bone (small and large mammal). Archaeological site LfRq-18 is a low-density lithic scatter located at the confluence of a small drainage channel with the north bank of the Great Bear River. The site assemblage includes a graver, a biface fragment and two flakes. Archaeological site LfRq-19 consists of a large flake found on the surface of the Enbridge Pipeline right-of-way. The primary context of this artifact is unknown but it likely belongs to an archaeological deposit disturbed during construction of the pipeline.

Site management plans were designed for these sites to ensure that they are adequately mitigated prior to construction of the proposed Great Bear River Bridge.

169 **Archaeology**

MacKay R, Glen

Prince of Wales Northern Heritage Centre

Permit No: 2006-984

Class: 2

Location: Trout Lake area, NWT: 95A11

Sambaa K'e Archaeology Project

Glen MacKay of the Prince of Wales Northern Heritage Centre continued an archaeological survey of Trout Lake, NT under Archaeological Permit 2006-984. Edward Jumbo (Sambaa K'e Elder), Phoebe Punch and Dennis Deneron (project guides/translators) and Jessica Jumbo (research assistant) were partners in this project. Several community students also participated in the fieldwork. I also conducted archaeological work at Sambaa Deh Falls Territorial Park under permit 2006-984.

A collaborative effort between Elders, students and archaeologists, the Sambaa K'e Archaeology Project involved visiting several important cultural places identified by the Elders of the Sambaa K'e Dene Band, and documenting them as archaeological sites. The project had a strong educational component for high school students from the community, with students receiving instruction in archaeological survey methods and learning about important cultural places from community elders.

We recorded fourteen archaeological sites, including sacred sites, historic sites, traditional trails and precontact sites, during the Sambaa K'e Archaeology Project. Working in close collaboration with Sambaa K'e Elders, we were also able to document some of the oral histories and traditions associated with these sites. Contextualized in this way, archaeological data illustrates how 'history is written on the land' at cultural places, and how these places are linked with other places, to form a cultural landscape.

Highlights of this year's project include the documentation of a spruce-plank canoe building workshop, used by Sambaa K'e Elder Edward Jumbo in the 1950s, on the north bank of the Paradise River, two sacred moose wallow areas at the southwest end of Trout Lake, a historic camp from which a musket barrel, tentatively identified as a "Northwest Gun", was recovered, and several precontact sites. We conducted test excavations at two precontact sites in the vicinity of the community of Trout Lake. At the first, located on the south bank of the Island River, we investigated a lithic scatter associated with a small hearth feature containing abundant fish bone. An arrowhead was found associated with this hearth, indicating that this site is less than 1200 years old. Located on the north bank of the Island River, at its confluence with Trout Lake, the second site also consisted of a small lithic scatter associated with a hearth feature containing fish bone. A radiocarbon date obtained for this hearth indicates an age of 825 before present for this site.

Archaeological work at Sambaa Deh Falls Territorial Park, located at the junction of the Trout River with Highway 1, resulted in the initial characterization of a large lithic workshop, which was likely associated with the quarrying of tool stone embedded in the local limestone.

The Sambaa K'e Archaeology Project seeks to integrate cultural and archaeological understandings into an integrated history of the Sambaa K'e cultural landscape. We hope to continue this project in future years.

170 **Archaeology**

Thomson, J. Callum

Peregrine Diamonds Ltd.

Permit No: 2006-983

Class: 2

Location: 76C05, Near Thonokied Lake

Preliminary Heritage Resources Inventory and Impact Assessment, DO27/18 Project Area, Thonokied Lake, NT

Two areas affected by Peregrine Diamonds Ltd. mineral exploration project in the vicinity of Thonokied Lake were assessed for potential conflicts between exploration activities and heritage resources from July 4-6, 2006. The work was conducted by Callum Thomson, Thomson Heritage Consultants, and a team from the Yellowknives Dene First Nation including Alfred Baillargeon, Peter Sangris, Paul MacKenzie and Morris Martin. They undertook a pedestrian survey of the exploration area around the Peregrine camp, a 2 x 2 km block centered on the north end of the camp lake and including all activity areas and areas considered to have some archaeological potential, such as bedrock outcrops, level gravel terraces, elevated points and lake shores. In addition, the researchers flew the winter spur road alignment to the lake informally called Gravel Pit Lake, 11 km west northwest of camp, where it joins the main Tibbett to Contwoyto winter road, formerly called the Lupin Road, observing the light imprint of the spur road on the overland portages. They landed to survey around the esker.

Eight new archaeological sites were found. Most sites contained only scatters of lithic (stone) materials, and one also contained an exploited quartz vein. Two other quartz veins were encountered but not recorded, as there was no positive evidence of exploitation. At only one site was any evidence found of any habitation features or structures used in hunting or processing - one tent ring. Modern or historic period campsites were not encountered. No sites were found to lie directly within any of the activity areas around the camp. The five sites that were found around the camp lake are relatively distant from these activity areas and located on high points so they do not appear to be at risk from the present project activities. Similarly, none of the four archaeological sites associated with the esker at Gravel Pit Lake appear to have been directly affected yet by activities in this area such as construction, maintenance and use of the winter spur road or gravel extraction from the esker. One site previously recorded adjacent to the esker (LcNr-1) appears to be intact and not at risk. One new site is located on a bedrock outcrop on the north side of the esker, so should not be at risk. Another is located within 15 m of gravel extraction activities on the esker, so is at considerable risk from continuing activities, presumably by the contractor responsible for construction and maintenance of the Tibbett to Contwoyto winter road. The third new site is located about 100 m from the esker and separated from it by a small bay, so is not at risk. Of these four sites, one appears to be of high significance due to the presence of the exploited quartz veins and associated workshop; the other three are of low to moderate significance. As the winter spur road from the DO 27 exploration area runs across a portage between the last lake on the spur route and Gravel Pit Lake, north of the esker, none of the four sites are at risk from operation of the Peregrine winter spur route; however, mitigation recommendations were proposed to safeguard the quartz quarry/workshop site from continuing gravel extraction on the esker.

171

Archaeology

Unfreed, Wendy

Devon Canada Corporation

Permit No: 2006-990

Class: 2

Location: 107C, just south of Tuktoyaktuk

Devon Canada Corporation Tuk2 Development

On behalf of KAVIK-AXYS Inc., as agents for Devon Canada Corporation (Devon), FMA Heritage Resources Consultants Inc. conducted an archaeological investigation for a proposed production facility and three alternative pipeline routes on the Tuktoyaktuk Peninsula. The potential production facility will lie adjacent to the existing Tuk2 M-18 well, 12 kilometres southeast of Tuktoyaktuk. The pipeline will be used to connect the proposed facility to a different proposed facility at Parsons Lake.

The archaeological investigation was part of a larger program of biophysical study that was designed to provide background data to aid in planning for future exploration and development activities. The specific purpose of the archaeological assessment was to help identify the heritage resource sensitivity of a 20-kilometre wide corridor between the two proposed production facilities, and to provide recommendations regarding the need for mitigation and further work.

To conduct the assessment, archaeologists Wendy Unfreed and Alan Youell were assisted by wildlife monitor Ernest Cockney of Tuktoyaktuk. Field reconnaissance consisted of pedestrian traverse, surface examination and shovel testing to determine the presence of unrecorded archaeological or cultural sites. Fifty shovel tests were excavated in 12 Target Areas within the proposed development corridor.

Although no new archaeological sites were identified during the assessment of the development corridor, two previously recorded sites (prehistoric Inuvialuit cache site NhTp-1 and precontact artifact scatter NgTq-1) were revisited as the result of the assessment. These sites were identified in the Western and Central Route alternatives, respectively, which were found to cross more hummocky ground than the Eastern Route alternative. Of these, NhTp-1 is significant, as previous investigations in 1991 and 1993 revealed that it

contained artifacts representative of the Arctic Small Tools Tradition. At that time, however, a discrete component of this period could not be isolated.

Based on the results of the assessment, including the ground inspection and shovel testing of the Target Areas and the aerial overflight of all three routes, it was found that the Eastern Route alternative was the most preferable for avoiding impact to archaeological resources. This was based on three criteria: (1) the lack of previously identified archaeological sites within the general footprint area; (2) the fact that the majority of the route follows intermediate and lower lying ground with lower archaeological site potential and (3) the fact that large parts of the Eastern Route alternative follow or will parallel apparent winter road disturbance. It was felt that use of this area would result in fewer additional impacts to archaeological sites in the region. The area of the M-18 production facility was considered to have low archaeological site potential, due to the fact that it lies in low wet terrain that has been previously impacted through wellsite development. Likewise, the area of the tie-in to the proposed Parsons Lake facility is also of low archaeological site potential, even though it is located in slightly higher and more hummocky terrain. In this case, the low potential is the result of the fact that it has already been subject to large-scale industrial impact.

If it proves impossible to use the Eastern Route alternative, it was strongly recommended that the final routing of the Tuk2 pipeline be designed to avoid impact to the previously known sites. This is particularly important with respect to site NhTp-1, which is considered to have regional significance due to the occurrence of materials representing the Arctic Small Tools tradition, and the potential that undisturbed components with this Tradition may be found at this site or in its immediate area.

As the plans for the Devon Tuk2 Gas Development project are still very preliminary, and no final routing of the pipeline between the M-18 production facility and the proposed Parsons Lake facility have been finalized, it is recommended that the work conducted under this assessment be considered as part of a preliminary field overview that can be used to narrow down the selection of important archaeological areas that could be recommended for use. As a result, once the final routing for the Devon Tuk2 Gas Development project has been selected, it is recommended that a full and final archaeological assessment of the route be conducted to ensure that all locations containing cultural deposits can be fairly and accurately evaluated and mitigated relative to potential development impacts. This investigation will include the evaluation of a location identified during the 2006 vegetation survey for this project, which requires verification as to whether it contains significant cultural information.

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Archaeology

Unfreed, Wendy

BP Chevron Mackenzie Joint Venture

Permit No: 2006-989

Class: 2

Location: NTS 107C, North Mackenzie Delta

Chevron Canada Limited Proposed 2006/2007 Summer Field Assessment Program

On behalf of KAVIK-AXYS Inc., as agents for Chevron Canada Limited and their Mackenzie Delta Joint Venture (MDJV) with whom they are partners with BP Canada Energy Company, FMA Heritage Resources Consultants Inc. conducted archaeological investigations for three sweet natural gas drilling locations and one remote sump associated with the Proposed 2006/2007 Summer Field Assessment Program. The investigation is part of a larger program of biophysical study that is designed to conduct both follow-up study for previous development as well as investigation of potential future development locations. Its purpose is to provide background data to aid in planning for future exploration and development activities. The specific purpose of the archaeological study in this Proposed 2006/2007 Summer Field Assessment Program was to assess the heritage resource potential of future drilling and sump sites.

As part of the Proposed 2006/2007 Summer Field Assessment Program, archaeologists Wendy Unfreed and Alan Youell were assisted by wildlife monitor Rufus Tingmiak in conducting assessments of drilling locations on Langely Island near the Reindeer Channel (Attick North, Langely South B) and a drilling (Kumak South) and sump location on Richards Island, near Trench Lake and the Yaya River, respectively. Prior to the assessment, it was determined that 31 recorded archaeological and cultural sites were within the general region of the developments. None of these, however, were located in any potential impact areas associated with the developments.

Field reconnaissance of the areas consisted of pedestrian traverse, surface examination and shovel testing to determine the presence of additional unrecorded archaeological or cultural sites. Fifty-one shovel tests were excavated across the footprints, but yielded no cultural deposits. The proposed locations on Langely Island and near the Reindeer Channel (Attick North, Langely South B) were found to be located on areas of relatively active alluvial plain that is subject to seasonal flooding. Continuous remodelling of this area, combined with shallow sediments and underlying waterlogged and silty clays, rendered this area as possessing a low potential for the identification of archaeological or cultural sites.

In the Proposed 2006/2007 Summer Field Assessment Program development locations on Richards Island (Kumak South, remote sump), although the developments will be situated in areas of more elevated morainal deposits which are sometimes associated with the presence of archaeological or cultural sites in the region, surface inspection and shovel testing of the developments did not result in the identification of archaeological or cultural sites.

Based on the results of the assessment on Langely and Richards islands for the three proposed sweet natural gas drilling locations (Attick North, Langely South B, Kumak South) and the remote sump of the Proposed 2006/2007 Summer Field Assessment Program, there appears to be no potential conflicts between archaeological and cultural sites and the development footprints. As a result, it is being recommended to representatives of the Prince of Wales Northern Heritage Centre that these four developments locations associated with the Chevron MDJV Proposed 2006/2007 Summer Field Assessment Program be granted heritage resource clearance relative to the physical archaeological and cultural site concerns in this region.

173

Archaeology

Webster, Sean

Golder Associates Ltd.

Permit No: 2006-978

Class: 2

Location: Mackenzie Gas Pipeline Proposed Corridor

Mackenzie Gas Project 2006 Heritage Resources Program

The 2006 Heritage Resources Program represents the fourth field season associated with the Mackenzie Gas Project. The project is being proposed by a consortium of companies including Imperial Oil Resources Ventures Ltd., the Aboriginal Pipeline Group, ConocoPhillips Canada Ltd., Shell Canada Limited, and ExxonMobil Canada Properties Ltd.

At present, the project includes plans to develop natural gas production facilities at Taglu, Parsons Lake, and Niglintgak; a gathering system that will collect the natural gas and associated gas liquids from these three fields and transport them to facilities in the Inuvik area; a natural gas liquids pipeline from the Inuvik area to Norman Wells; a natural gas pipeline (the Mackenzie Valley Pipeline) from the Inuvik area south via Norman Wells that will connect to an existing pipeline in north-western Alberta allowing access to the market; and a number of infrastructure locations that will be required to support the construction and continued operation of the pipeline.

The 2006 field program was conducted by a team of archaeologists from the Mackenzie Project Environment Group. Numerous local assistants were also involved with the fieldwork and included:

- Inuvialuit Region: Dennis Chicksi, Robert McLeod
- Gwich'in Area: Allen Firth, Fred Jerome
- K'ahsho Got'ine Sahtu Area: Alfred Orleas, Barthy Kotchile, Jean Marie Rabisca, Leon Taureau
- Tulita Sahtu Area: Frederick Andrew, Pearl Lennie, Shawn Etchinelle
- Pehdzeh Ki First Nation - Deh Cho Region: Darcy Moses, Justin Clillie, Katie Antoine, Lawrence Nayally
- Trout Lake Dene Band - Deh Cho Region: Tony Jumbo, Fred Punch
- Liidlii Kue First Nation - Deh Cho Region: Edward Cholo
- Jean Marie River First Nation - Deh Cho Region: Tod Minoza

The 2006 field program focused primarily on conducting heritage resource impact assessments at a number of potential infrastructure and granular resource extraction sites that are situated along roughly 1,400 kilometres of proposed pipeline route stretching from the tip of the Mackenzie Delta to the Alberta border. Investigations were also conducted in areas that are planned to be geotechnically tested during the 2007 winter drilling program. Investigations were completed by three crews of three to four people including a local assistant. Ground based assessments were conducted at over 215 locations resulting in the discovery of 55 new heritage resource sites. Fourteen previously recorded heritage sites were also re-visited.

Both prehistoric and historic sites were recorded as a result of these investigations. Archaeological sites recorded include both large and small lithic scatters, several exposed hearths, four burials, an isolated projectile point and several historic trails. One of the sites also included a microblade and several microblade cores. Traditional land use sites were also commonly recorded and include a number of trails, traplines, cabins, camps, and wood gathering areas.

Department of Environment and Natural Resources

WILDLIFE RESEARCH PERMITS

174

Wildlife

Barnett, Tara

Kavik-Axys Incorporated
300, 805-8 Ave. SW
Calgary, AB T2P 1H7

Permit No: 3308

Region: IN

Species: Wildlife and vegetation

Location: Inuvialuit Settlement Region

Summer Field Assessment Program-Biophysical and Archaeological Study.

The program assessed the biophysical, archaeological and cultural resources located within the Taktuk, Langley and Farewell areas for future winter drilling, sump, or barge sites.

175

Wildlife

Bayne, Erin

University of Alberta
CW 405 Biological Sciences Center
Edmonton, AB T6G 2E9

Permit No: 4953

Region: DC, SS

Species: Birds and small mammals

Location: Enbridge Pipeline

The influence of the linear features created by the energy sector on nest predation and small mammal abundance.

Performed live trapping of small mammals that will be marked for identification to delineate abundance and territorial ranges of individuals, high school students and/or local harvesters be utilized.

176

Wildlife

Branigan, Marsha

ENR - Inuvik region
Bag Service #1
Inuvik, NT X0E 0T0
marsha_branigan@gov.nt.ca

Permit No: 3113

Region: IN, GW

Species: Wolverine (*gulo gulo*)

Location: Inuvik Region

Wolverine Carcass Collection

No report available, contact the researcher for more information.

177

Wildlife

Branigan, Marsha

ENR - Inuvik Region
Bag Service # 1
Inuvik, NT X0E 0T0
marsha_branigan@gov.nt.ca

Permit No: 3307

Region: IN

Species: Grizzly bear

Location: Inuvialuit Settlement Region

Grizzly Bear Population Study: Phase 1 Satellite Tracking

This project is designed to obtain current information on the distribution and movements of adult male and

female bears in the Inuvialuit Settlement Region.

178 **Wildlife**

Carriere, Suzanne

ENR Wildlife
PO Box 1270, 600 5102-50th Ave.
Yellowknife, NT X1A 3S8,
suzanne_carriere@gov.nt.ca

Permit No: 5602
Region: NWT

Species: Small mammals and Hare
Location: Gwich'in, Sahtu, Deh Cho, North Slave, South Slave

NWT Small Mammal and Hare Survey

Conducted small mammal and hare surveys throughout the Northwest Territories.

179 **Wildlife**

Croft, Bruno

RWED North Slave
PO 2668
Yellowknife, NT X1A 2P9

Permit No: 3097
Region: NS

Species: Caribou
Location: Bchchoko, WhaTi, Gameti, Wekweeti, Detah and Lutsel K'e

Bathurst Herd Collaring

Acquired and logged satellite collars location data from 20 Bathurst caribou cows, measure calf survival in March-April 2006 and measure fall sex ratio in October 2006.

180 **Wildlife**

Derocher, Andy; Mark Edwards & John Nagy

Univeristy of Alberta
CW405, Department of Biological Sciences
Edmonton, AB T6G 2E9

Permit No: 3122
Region: GW, IN

Species: Grizzly bear
Location: Mackenzie Delta

Ecology of Grizzly Bears in the Mackenzie Delta oil and Gas Development Area

No report available, contact the researcher for more information.

181 **Wildlife**

Elkin, Brett

RWED, Wildlife and Fisheries
5th Floor, 600 - 5102 50th Avenue
Yellowknife, NT X1A 3S8

Permit No: 3091
Region: NWT

Species: General Wildlife
Location: Various Locations of the NWT

Wildlife Health Survey

Conducted wildlife health and genetic monitoring by testing samples from sick/dead animals.

182 **Wildlife**

Ellsworth, Troy

ENR Wildlife
PO Box 390
Fort Smith, NT X0E 0P0

Permit No: 4954
Region: DC

Species: Bison
Location: Liard Valley

Research on Bison in the Liard Valley.

Conducted research on Bison in the Liard Valley, including classification survey in order to calculate density and distribution of Bison in the Liard Valley.

183

Wildlife

Graf, Linda

ConocoPhillips Canada (North) Limited
PO Box 130, 401-9th Avenue SW
Calgary, AB T2P 2H7

Permit No: 3311

Region: IN

Species: Grizzly Bear, Peregrine Falcon, Short-eared Owl, BG Caribou

Location: Parsons Lake Development Area - Inuvik, Tuktoyaktuk, Aklavik

Environmental Studies for the Proposed Parsons Lake Development Area

Conducted wildlife studies and collect baseline information in the proposed Parsons Lake field development area.

184

Wildlife

Hines, Jim

Canadian Wildlife Service
Suite 301 5204-50th Ave
Yellowknife, NT X1A 1E2

Permit No: 3125

Region: IN

Species: Swans and Geese

Location: Inuvialuit Settlement Region

Population management of geese and swans in the Inuvialuit Settlement Region using aerial surveys and banding studies.

All species of geese, swans, dabbling ducks, diving ducks, sea ducks, loons and raptors present on the study area were recorded during aerial surveys. Any goose species (White-fronted, Canada, Sno, Ross's or Brant) were banded.

185

Wildlife

Hines, Jim

Canadian Wildlife Service
5204-50th Avenue
Yellowknife, NT X1A 1E2

Permit No: 3120

Region: IN

Species: Lesser Snow Geese

Location: Anderson River Delta

Factors causing declining numbers of lesser snow geese and bant at Anderson River Bird Sanctuary

Monitored numbers and locations of migrating, staging, nesting and non-breeding snow geese and brant within the outer delta of the Anderson River and determined grizzly bear use and impacts on goose productivity at Anderson River.

186

Wildlife

Hines, Jim

Canadian Wildlife Service
5204 50th Ave.
Yellowknife, NT X1A 1E2

Permit No: 3124

Region: IN

Species: Snow Geese

Location: Banks Island

Snow Goose Population and Habitat Studies in the Inuvialuit Settlement Region

Monitored migration routes, harvest rates and survival rates of the Banks Island Snow geese colony; and monitored goose effects on lowland habitat on Banks Island.

187 **Wildlife**

Hines, Jim

Canadian Wildlife Service, Environment Canada
5204-50th Ave Suite 301
Yellowknife, NT X1A 1E2

Permit No: 3121

Species: Snow Geese

Region: IN

Location: Anderson River Bird Sanctuary

Monitoring cumulative environmental impacts of gas and oil development in the Mackenzie Delta Region using Tundra Swans as an indicator species

Examined factors causing declining numbers of lesser snow geese and brant at Anderson River Bird Sanctuary.

188 **Wildlife**

Huculak, Darren

Northeast Territories Energy Corporation
5102-50th Ave, Suite# 206
Yellowknife, NT X1A 3S8

Permit No: 3094

Species: Caribou and Muskox

Region: NS

Location: Lutselke

Ungulate and Carnivore Winter Surveys - Taltson Expansion Project Transmission Line

Studied the habitat and migration patterns of keystone species such as caribou and muskox along the proposed corridor. Study was composed of a winter survey for caribou, muskox, moose and carnivores.

189 **Wildlife**

J.Nagy/A.Gunn, John/Anne

ENR - Inuvik Region
Bag Service # 1
Inuvik, NT X0E 0T0,
john_nagy@govt.nt.ca

Permit No: 3309

Species: Peary Caribou

Region: IN

Location: Banks, Northwest Victoria and Melville Islands

Productivity of Peary Caribou on Banks, Northwest Victoria and Melville Islands

This research estimated calf production, recruitment, and overwinter survival of Peary caribou on Banks Island, Melville Island, and NW Victorial Island over an extended time series.

190 **Wildlife**

Johns, Brian

Canadian Wildlife Service
115 Perimeter Rd
Sakatoon, SK S7N 0X4

Permit No: 3023

Species: Whooping Crane

Region: SS

Location: South Slave area

Whooping Crane Ecology and Rehabilitation Study

No report available, contact the researcher for more information.

191 **Wildlife**

Johnson, Deborah

RWED South Slave
PO Box 900
Fort Smith, NT X0E 0P0

Permit No: 3016

Species: Caribou

Region: SS, DC

Location: Cameron Hills Area

Boreal Caribou Research in the Cameron Hills Area

Conducted basic health, survival, calf recruitment studies including radio-tracking on boreal caribou in Cameron Hills and Hay River lowlands.

192

Wildlife

Johnson, Deborah

RWED South Slave

PO Box 900

Fort Smith, NT X0E 0P0

Permit No: 3019

Species: Caribou

Region: IN, GW

Location: Beverly herd late winter range

Beverly Caribou Herd Collaring

Deployed 20 GPS-ARGOS collars on female barren ground caribou of the Beverly herd to conduct study of movement rates, seasonal ranges and range delineation as per WRP application.

193

Wildlife

Johnson, Vicky

Canadian Wildlife Service

5204-50th Ave, Suite 301

Yellowknife, NT X1A 1E2

Permit No: 3301

Species: Arctic Shorebirds

Region: IN

Location: Kendall Island Birds Sanctuary, Swimming Point, NWT/YT border to Anderson River Delta

Arctic Shorebird Monitoring Program

No report available, contact the researcher for more information.

194

Wildlife

Johnston, Vicky

Canadian Wildlife Service, Environment Canada

Suite 301, 5204-50th Ave

Yellowknife, NT X1A 1E2

Permit No: 5601

Species: Shorebirds

Region: SA

Location: Norman Wells to Fort Simpson

Mackenzie Valley Shorebird Monitoring Program

Conducted aerial and ground count surveys of shorebirds (phalaropes, sandpipers, plovers, yellowlegs and snipe).

195

Wildlife

Lambert, Catherine

Gwich'in Renewable Resource Board

PO Box 2240

Inuvik, NT X0E 0T0

Permit No: 3119

Species: Dall's Sheep (*Ovis dalli dalli*) and grizzly bear

Region: IN, GW

Location: Northern Richardson Mountains

Dall's Sheep, Grizzly Bear and Wolf Project in the Richardson Mountains

No report available, contact the researcher for more information.

196

Wildlife

Lambert, Catherine

Gwich'in Renewable Resource Board
PO Box 2240
Inuvik, NT X0E 0T0

Permit No: 3115
Region: IN, GW

Species: Moose
Location: Land around Aklavik, Inuvik, Fort McPherson and
Tsiigehtchic

Moose Aerial Survey in the Gwich'in Settlement Area

No report available, contact the researcher for more information.

197

Wildlife

Lambert, Catherine

Gwich'in Renewable Resource Board
PO Box 2240
Inuvik, NT X0E 0T0

Permit No: 3306
Region: IN, GW

Species: Dall's Sheep (*Ovis dalli dalli*)
Location: Richardson Mountains

Dall's Sheep Aerial Survey in the Richardson Mountains

Obtained estimates of Dall's sheep recruitment rate and estimated population abundance and sex/age structure.

198

Wildlife

Lambert, Catherine

Gwich'in Renewable Resource Board
PO Box 2240
Inuvik, NT X0E 0T0

Permit No: 560
Region: IN, GW

Species: Dall's Sheep (*Ovis dalli dalli*)
Location: Northern Richardson Mountains

Dalls Sheep Aerial Survey

A dalls sheep aerial survey was conducted in the Northern Richardson Mountains to locate and classify sheep.

199

Wildlife

Latour, Paul

Canadian Wildlife Service
5204-50th Ave
Yellowknife, NT X1A 1E2

Permit No: 3098
Region: SA

Species: Songbirds, small and large mammals
Location: Ts'ude'hiline Tuyetah Candidate Protected Area west of Fort
Good Hope

2006 Ecological Assessment of Ts'ude'hiline-Tuyetah Candidate Protected Area

Conducted songbird surveys, as well as wildlife and vegetation observations.

200

Wildlife

Lee, Sunnie

Kavik-Axys Incorporated
300, 805-8 Avenue SW
Calgary, AB T2P 1H7

Permit No: 3310

Species: Grizzly Bear

Region: IN

Location: Tuktoyaktuk Peninsula

Devon Tuk 2 Gas Development 2006 Field Assessment Program

Collected data from four separate surveys: grizzly bear denning; vegetation; terrain, soils and permafrost; and heritage resource surveys.

201

Wildlife

Machtans, Craig

Canadian Wildlife Service, Environment Canada
#301, 5204-50th Ave
Yellowknife, NT X1A 3S8
craig.machtans@ec.gc.ca

Permit No: 3099

Region: DC, GW, IN, SA

Species: Rusty Blackbird

Location: Fort Simpson to Inuvik

Rusty Blackbird Surveys: Historical comparison through the Mackenzie Valley

Determined: the presence/absence and number of Rusty Blackbirds at historical survey sites; determined if rusty blackbirds have declined over the last 35 years in the Mackenzie Valley; and assisted national and international conservation plans.

202

Wildlife

Matthew, Wilson

US Geological Survey
505 Azuar Drive and I Street
Vallejo, CA 94592

Permit No: 5604

Region: NS, SS, SA

Species: Surf Scoters

Location: Great Slave and Great Bear Lakes

Cross-Seasonal Contaminant Effects and Breeding Ground Habitat Associations of Surf Scoter

No report available, contact the researcher for more information.

203

Wildlife

Mattson, Inge-Jean

University of Northern British Columbia
333 University Way
Prince George, BC V2N 2Z9

Permit No: 3093

Region: GW, IN

Species: Caribou

Location: The winter area of Bathurst Caribou herd

Vulnerability of Barren-Ground Caribou to Predation During Winter - Limitations and Implications to Populations and Distributions Dynamics.

No report available, contact the researcher for more information.

204

Wildlife

Moore, Steve

EBA Engineering Consultants Ltd.
#201, 4916-49 Street
Yellowknife, NT X1A 2P7

Permit No: 3022

Region: SS, DC

Species: Owls, other breeding birds and vegetation

Location: Pine Point

Baseline environmental studies on owls, breeding birds, amphibians and rare plants

Prepared a baseline environmental assessment on owls, breeding birds, amphibians and rare plants.

205

Wildlife

Naggy, John

ENR - Inuvik Region
Inuvik, NT X0E 0T0

Permit No: 3118

Region: GW

Species: Boreal Woodland Caribou

Location: Gwich'in Settlement Area

Ecology of Boreal Woodland Caribou in the Lower Mackenzie Valley, NT

No report available, contact the researcher for more information.

206

Wildlife

Nishi, John

RWED South Slave
PO Box 900
Fort Smith, NT X0E 0P0

Permit No: 3095

Region: SS

Species: Bison

Location: Fort Resolution

Hook Lake Wood Bison Recovery Project 2006

Carried out work as per the salvage and propagation of the Hook Lake Project WRP application.

207

Wildlife

Savignac, Carl

Canadian Wildlife Service
157 Riverside Road
Chelsea, QB J9B 2M6
savignacc@sympatico.ca

Permit No: 5603

Region: SA

Species: Songbird

Location: Colville Lake

Establishing baseline densities and diversity of forest birds in the Colville Hills, NWT

Assessed the breeding songbird densities among different habitat types in the Colville Lake area.

208

Wildlife

Shopik, Tim

Mackenzie Gas Project: Imperial Oil Res.Ven.Ltd.
237 4th Ave SW
Calgary, AB T2P3M9

Permit No: 3302

Region: GW

Species: General Wildlife

Location: Gwich'in Settlement Area

Wildlife Studies within the Gwich'in Settlement Area.

This was the continuation of the wildlife studies conducted by AMEC from 2002 to 2004. Wildlife studies were conducted from June to October 2006 on Raptor Nest, Wildlife Habitat and Breeding Songbirds.

209

Wildlife

Shopik, Tim

Mackenzie Gas Project: Imperial Oil Res.Ven.Ltd.
237 4th Ave SW
Calgary, AB T2P 3M9

Permit No: 3303

Region: IN

Species: Raptors and Breeding Birds

Location: Inuvialuit Settlement Region

Wildlife Studies in the Inuvialuit Settlement Region

This was the continuation of the wildlife studies conducted by AMEC from 2002 to 2004. Wildlife studies were conducted from June to October 2006 on Raptor Nests, wildlife habitat and breeding songbirds.

210

Wildlife

Slattery, Stuart

Ducks Unlimited
PO Box 1160
Stonewall MB R0C 2Z0

Permit No: 3123

Species: Duck Species

Region: GW

Location: Cardinal Lake

Breeding Duck Study at Cardinal Lake area in the Gwich'in Settlement Area

Examined demographic rates and factors limiting breeding duck populations in the Mackenzie Valley, with special emphasis on scoter and scaup.

211

Wildlife

Sterling, Ian

Canadian Wildlife Service
5320 127 Street
Edmonton, AB T6H 3S5

Permit No: 3117

Species: Polar Bear

Region: IN

Location: Beaufort Sea and Amundsen Gulf

Population assessment of polar bears in the Beaufort Sea and Amundsen Gulf

Re-assessed the boundary between the North Beaufort (NB) and the South Beaufort (SB)'s polar bear population.

212

Wildlife

Stirling, Ian

Canadian Wildlife Service
5320 122 Street
Edmonton, AB T6H 3S5

Permit No: 3116

Species: Polar Bear

Region: IN

Location: Coastal regions of the outer islands of the Mackenzie Delta

Assessment of possible impacts of oil and gas activities on polar bears in the outer Mackenzie Delta and nearshore Southern Beaufort Sea

No report available, contact the researcher for more information.

213

Wildlife

Veitch, Alasdair

Environment of Natural Resources - Sahtu Region
PO Box 130
Norman Wells, NT X0E 0V0

Permit No: 3096

Species: Barren Ground Caribou

Region: SA

Location: Range of the Cape Bathurst, Bluenose-West and Bluenose-East barren ground caribou herds

Caribou Collaring

Conducted a photocensus of late winter recruitment and post-calving productivity surveys of the Cape Bathurst, Bluenose-West and Bluenose-East barren-ground caribou.

214

Wildlife

Virgl, John

Golder Associates Ltd.
145 First Avenue North
Saskatoon, SK S7K 1W6

Permit No: 3024
Region: SS

Species: General Wildlife
Location: Screech Lake

Wildlife Research Permit - WL003024

Conducted baseline studies on terrestrial mammals in the Screech Lake project area.

215

Wildlife

Wiacek, Richard

Kavik-Axys Incorporated
PO Box 2320
Inuvik, NT X0E 0T0
rwiacek@axys.net

Permit No: 3305
Region: IN

Species: Wildlife and Vegetation
Location: Inuvialuit Settlement Region

Wildlife Studies

Conducted wildlife studies such as shorebird surveys, waterfowl surveys targeting tundra swans and wildlife habitat reconnaissance-level surveys targeting SARA.

216

Wildlife

Wiacek, Richard

Kavik-Axys Incorporated
PO Box 2320
Inuvik, NT X0E 0T0
rwiacek@axys.net

Permit No: 3304
Region: IN

Species: Wildlife and Vegetation
Location: Inuvialuit Settlement Region

Wildlife Studies

Conducted wildlife studies such as shorebird surveys, waterfowl surveys targeting tundra swans and wildlife habitat reconnaissance-level surveys targeting SARA.

217

Wildlife

Wiacek, Richard

Kavik-Axys Incorporated
203, 4208-97 St.
Edmonton, AB T6E 5Z9
rwiacek@axys.net

Permit No: 4956
Region: IN

Species: Vegetation
Location: Inuvialuit Settlement Region

Rare plant study

Conducted a vegetation study of rare plants along the Pipeline ROW. Samples were collected.

218

Wildlife

Wiacek, Richard

Kavik-Axys Incorporated
203, 4208-97 St
Edmonton, AB T6E 5Z9
rwiacek@axys.net

Permit No: 4955
Region: IN

Species: Raptors
Location: Inuvialuit Settlement Region

Raptor nest and wildlife habitat surveys

Conducted raptor nest and wildlife habitat surveys. Aerial disturbances were kept to a minimum.

Department of Fisheries and Oceans

FISHERIES SCIENTIFIC LICENCES

219

Fisheries

Lois Harwood

101 5204 50th Avenue
Yellowknife, NT X1A 1E2

Permit No.: S-06/07 4000- I N

Potential Effects of Industry Activity on Ringed and Bearded Seals in the near shore Beaufort Sea

Using a twin otter equipped with bubble windows at the second rear seats behind the bulkhead, the reserachers flew a systematic aerial survey on the lines shown below between June 1-7, 2006. The survey altitude was 500 ft and the survey speed was 108 kts. All marine mammals sighted were recorded, as well as ice conditions, weather conditions, and survey conditions. 237 ringed seals and 2 beared seals were seen.

220

Fisheries

Lois Harwood

101 5204 50th Avenue
Yellowknife, NT X1A 1E2

Permit No.: S-06/07 4001- IN

Assessment of reproduction, condition disease and contaminants of ringed seals and bearded seals through harvestbased monitoring at Holman and Sachs Harbour, NT, 2006

Samples were collected through subsistence fishing. In Mashyook/Safety Channel from June 1 through August 3, 100 ringed seals and 3 bearded seals were caught using gillnets. In Sachs Harbour, from June 13 to August 5, 38 ringed seals and 13 bearded seals were caught also using gillnets.

221

Fisheries

Tim Shopik

Imperial Oil Resource Venture Ltd.
237 Fourth Ave. SW
PO Box 2480 Station M
Calgary, AB T2P 3M9

Permit No.: S-06/07 4002-IN

An Aquatic Baseline Study for the ISR with a Goal of Developing a Suitable Knowledge Base for Planning, Assesment of Impacts and Development of Environmental Protection Plans

Detailed aquatics assessments in the Inuvialuit Settlement Region were conducted between July 19 and July 29, 2006. The assessments were conducted at five proposed stream crossings and 16 lakes/ponds. Summer aquatic surveys were undertaken by one field crew consisting of four people including local assistants. Fish encountered during the summer included seven species (Arctic grayling, Arctic lamprey, burbot, least cisco, ninespine stickleback, northern pike and trout-perch). Other information collected included: presence; age; length and weight of various species and fish habitat assesments.

222

Fisheries

Tim Shopik

Imperial Oil Resource Venture Ltd.
237 Fourth Ave. SW
PO Box 2480 Station M
Calgary, AB T2P 3M9

Permit No.: S-06/07 4003-IN

An Aquatic Baseline Study for the GSA with a Goal of Developing a Suitable Knowledge Base for Planning, Assessment of Impacts and Development of Environmental Protection Plans

Detailed aquatic assessments in the Gwich'in Settlement Area were conducted between July 29 and August 2, 2006. The assessments were conducted at five proposed stream crossings and 16 lakes/ponds. Summer aquatic surveys were undertaken by one field crew consisting of four people including local assistants. Northern pike was the only fish species encountered in the GSA.

223 Fisheries

Gary Stern

DFO

Freshwater Institute

501 University Cr.

Winnipeg, MB R3T 2N6

Permit No.: S-06/07 4004-IN

Assessment of contaminants and disease in beluga whales through harvest-based monitoring at Hendrickson Island, NT

Community beluga samplers took biological measurements and collecting sample tissue (e.g. blubber, liver, kidney, skin etc) during regular subsistence hunts at their respective whaling camps. The hunters permitted access to their landed whales for sampling (aging structures, tissues for contaminants testing, and disease testing, stomachs, lungs) and measuring (girth, length, fatness). Samples collected were frozen for preservation. Samples were examined for mercury, methyl mercury and organic contaminants, in addition the samples were analyzed for fatty acids and stable isotopes to assist with the determination of diet of the Beaufort Sea belugas in efforts to determine diet sources of contaminants and links to climate change.

224 Fisheries

Nathan Miller

Gwich'in Renewable Resource Board

PO Box 2240

Inuvik, NT X0E 0T0

Permit No.: S-06/07 4005-IN

To collect information on the Fish stocks of the Arctic Red River

68 fish were collected in total including: burbot; cisco; inconnu; northern pike; whitefish (broad); whitefish (lake); and Arctic grayling.

225 Fisheries

Michael Papst

DFO

Freshwater Institute

501 University Cr.

Winnipeg, MB R3T 2N6

Permit No.: S-06/07 4006-IN

To examine the use of Ichthyoplankton Species Assemblages as possible Indicators of Biodiversity and Habitat Productivity in the Beaufort Sea Shelf

226 Fisheries

Ross Tallman

DFO

Freshwater Institute

501 University Cr.

Winnipeg, MB R3T 2N6

Permit No.: S-06/07 4007-IN

Modeling of migratory patterns to spawning and over-wintering refugia of harvested fish species in rivers along the Mackenzie Valley

32 fish were collected in total including: 21 broad whitefish; 8 lake whitefish; and 3 northern pike. Of those caught, 19 broad whitefish and 8 lake whitefish were tagged.

227 Fisheries

Sandra Marken
EnCana Corporation
150 9th Ave. SW
Calgary, AB T2P 2S5

Permit No.: S-06/07 4008-IN

To Identify Areas of High Fish Habitat Potential that might be Affected by Proposed Development on Richards Island (2006)

228 Fisheries

Takizawa Takatoshi
Japan Agency for Marine-Earth Science and Technology
2-15 Natsushima
Yokosuka, NA 237-0061 Japan

Permit No.: S-06/07 4009-IN

Examine Ecology and Biology of Planktonic Protozoans to Monitor the marine Organisms Related to Climate Change

229 Fisheries

Lois Harwood
101 5204 50th Avenue
Yellowknife, NT X1A 1E2

Permit No.: S-06/07 4010- IN

Assessment of reproduction, condition disease and contaminants of beluga whales through harvest-based monitoring at Kendall Island, NT

Community whale samplers took measurements and samples from beluga whales taken in the regular subsistence harvest at the Kendall Island whaling camps. The hunters permitted access to their landed whales for sampling (aging structures, tissues for contaminants testing, tissues for disease testing, reproductive tracts, stomachs, lungs) and measuring (girth, length, fatness). Samples are either frozen or preserved in formalin. A veterinary pathologist from Abbotsford, BC was present and took additional biological samples from the landed whales. During July 4-15, 11 different belugas were sampled.

230 Fisheries

Laurie Chan
University of Northern British Columbia
9-397, 3333 University Way
Prince George, BC V2N 4Z9

Permit No.: S-06/07 4011- IN

Linking Neurochemistry to Contaminant Exposure in Belugas of the Mackenzie Delta

To determine whether neurochemical parameters in beluga whales of the western Arctic are correlated to contaminant exposure.

231 Fisheries

Marlene Evans
National Hydrology Research Centre
11 Innovation Blvd.
Saskatoon, SK S7N 3H5

Permit No.: S-06/07 4012- IN, S-06/07 4013-IN, S-06/07 4014-IN

A Biological Study of Waters, within the ISR, along the Proposed Mackenzie Gas Pipeline Route

No research was pursued under these licences.

232 Fisheries

Jim Johnson
DFO
501 University Cr.
Winnipeg, MB R3T 2N6

Permit No.: S-06/07 4015- IN

Examination of the trophic structure of the Beaufort Sea ecosystem through stable isotope analysis

Three sites were fished along the outer coast of Tuktoyaktuk Peninsula. At each site a small base camp was established for a few days while fishing was conducted. In addition to large fish, a number of smaller fish and invertebrates were collected using beach seines at each of the sampling sites. These have yet to be sorted so exact counts are not available, but sample sizes would be no more than a couple of dozen specimens per species per location. At McKinley Bay small specimens included: isopods; and amphipods. At Kukjuktuk Bay small specimens included larval rainbow smelt, very small least cisco and mysids. At Canayanek Creek small specimens included: small suckers; sticklebacks; very small broad whitefish; larval rainbow smelt; mysids; amphipods; and isopods. 238 fish were collected in total including: burbot; arctic cisco; least cisco; Pacific herring; saffron cod; inconnu; whitefish (broad); whitefish (lake); fourhorn sculpin; rainbow smelt; Arctic flounder; and starry flounder.

233 Fisheries

Nathan Miller
Gwich'in Renewable Resource Board
PO Box 2240
Inuvik, NT X0E 0T0

Permit No.: S-06/07 4016-IN

To determine the biological characteristics and relative abundances of fishes in the Travailant River and Lake System

655 fish were collected in total including: whitefish (broad); whitefish (lake); cisco; lake trout; and northern pike.

234 Fisheries

Lois Harwood
101 5204 50th Avenue
Yellowknife, NT X1A 1E2

Permit No.: S-06/07 4017- IN

Assessment of Dolly Varden stocks of the Rat River, NT through harvest-based monitoring of subsistence catches

121 Dolly Varden fish were collected in total. 40 were taken from the Big Eddy subsistence fishery, 41 from Mouth of Rat River subsistence fishery and 40 from Destruction City subsistence fishery.

235 Fisheries

Lois Harwood
101 5204 50th Avenue
Yellowknife, NT X1A 1E2

Permit No.: S-06/07 4018- IN

Assessment of Arctic char at the Hornaday River NT through harvest-based monitoring of subsistence catches

108 Arctic char were caught from the Hornaday River subsistence fishery.

236

Fisheries

Marlow Pellatt

Parks Canada
300-300 W Georgia St.
Vancouver, BC V6B 6B4

Permit No.: S-06/07 4019- IN

Pilot Ecological Integrity Monitoring Project for Coastal Environments in Parks Canada Northern Bioregion

237

Fisheries

Christine McClelland

Canadian Museum of Nature
1740 Chemin Pink
Gatineau, PQ J9J 3N7

Permit No.: S-06/07 4020- IN

To examine the benthic community throughout a wide range of bottom features with the purpose of gathering data relative to proposed oil and gas activities

238

Fisheries

Ross Tallman

DFO
Freshwater Institute
501 University Cr.
Winnipeg, MB R3T 2N6

Permit No.: S-06/07 4021- IN

To Examine the role of water velocity in fish habitat selection

124 fish were caught in total using short term gill nets. The fish include: pike; pickerel; burbot; inconnu; whitefish (broad); and whitefish (lake). 23 of these fish were sacrificed.

239

Fisheries

Serge Metikosh

Golder Associates Ltd.
1000, 940-6th Ave SW
Calgary, AB T2P 2H5

Permit No.: S-06/07 4022- IN

To gather information on the marine fish and fish habitat resources of the S-Bends region of the Mackenzie River Delta in Kittigazuit Bay, especially along the proposed dredging route associated with the Mackenzie Gas Pipeline project

In total, 187 fish representing 12 species and seven families were captured. Captured fish species were broad whitefish, lake whitefish, round whitefish, least cisco, Arctic cisco, inconnu, Arctic flounder, burbot, spoonhead sculpin, longnose sucker, pacific herring, and northern pike. Arctic cisco and broad whitefish were the most abundant fishes present. Inconnu and lake whitefish were also common.

240

Fisheries

Ken Reimer

Royal Military College
PO Box 17000 Stn Forces
Kingston, ON K7K 7B4

Permit No.: S-06/07 4023- IN

To assess the risk of contaminants at a former DEW line site to humans and the environment

In total, 6 sculpin samples were actually collected and were immediately euthanized upon retrieval through the use of a fish stick. Sampling was performed in the evenings and at night. Although jigging was attempted, it proved to be unsuccessful; all samples were caught using the beach seine method.

241 Fisheries

Martin Fortier

Pavillion Alexandre-Vachon
Local 2078 University Laval,
Quebec, PQ G1K7P4

Permit No.: S-06/07 4024- IN

To better understand the impacts of climate change variability and change on the Canadian Arctic marine environment. This work is part of an ArcticNet Integrated Regional Impact Study

A total of 183 fish were caught including: Arctic cod; aligatorfish; sand lance; and liparidae. Samples were taken from the Amundsen Gulf, Franklin Bay, Beaufort Sea and the Mackenzie Shelf.

242 Fisheries

Linda Graf

ConocoPhillips Canada
PO Box 130
401-9th Avenue SW
Calgary, AB T2P 2H7

Permit No.: S-06/07 4025- IN

Environmental Studies for the Proposed Parsons Lake Development Area During Summer 2006

Detailed fish and fish habitat studies were conducted at 5 locations in the Parsons Lake Development Area between August 11 and August 14, 2006. The assessments were conducted at 3 stream crossing locations related to the proposed all weather road and at two small lakes (Lake 2.028P1 and 2.028P2) located within the granular resource borrow area. Arctic grayling, ninespine stickleback, and northern pike were the only three fish species captured during the surveys of the stream crossing locations. No fish were captured at Parsons Lake Stream Crossing #3 or in either lake 2.028P1 or lake 2.028P2.

On August 11, 9 Arctic grayling, 2 ninespine stickleback, and 1 northern pike were sampled.

243 Fisheries

Burton Ayles

Fisheries Joint Management Committee
PO Box 2120
Inuvik, NT X0E 0T0

Permit No.: S-06/07 4026- IN

To develop a greater scientific understanding of the environmental conditions and biological resources of the key spawning and overwintering habitat of the Big Fish River, to introduce students to the scientific tools of fisheries resource management in a field setting and to pass on traditional knowledge and skills relating to the fishery and the Big Fish River area.

Glossary

Abiotic - Not living

Active layer - The area where the soil continually freezes and thaws above the permafrost

Adaptation - A process by which a living organism (human, animal or plant) changes to become better suited to a new environment. This generally on an evolutionary timescale however, in the human context, it may be over a short period.

Aerial - In the air

Aeromagnetic survey - Surveys from aircraft that make use of the magnetic field caused by magnetized rocks in the Earth's crust to make estimates about underlying geology of a given area such as distribution of potential resources

Algae - Simple living aquatic single or multi celled plant organisms that contains chlorophyll

Algorithm - A procedure or formula for solving a problem

Alkali - A basic substance that can range in strength

Analytical - A detailed examination of the structure or some other parameter of a substance or thing

Anoxic - A situation where oxygen is present in very low amounts or not at all, common in water

Annual - Occurs every year

Anthropogenic - Caused by a human action

Anthropology - The study of the human beings including their origins, cultures, evolution

Aquatic - Of water

Aquatic Biota - All living organisms in the aquatic environment

Archaeology - The study of past human life and culture by looking at remains and artifacts like tools

Archean - A period of geologic time from about 3.9 billion years to 2.5 billion years ago

Archival - Pertaining to a collection of documents, normal over long periods of time

Arsenic - A chemical element that is gray in color and that is highly poisonous with no taste

Artifact - A historical tool, weapon or other human-made object that can be studied

Asexual - An organism that reproduces without the aid of a partner and who passes on all of its genetic information

Atmosphere - The layers of gases that surround and protect the Earth

Attributed - To explain by indicating a cause

Bacteria - A large and varied group of single-celled microorganisms

Baseline - A set of information and data serving as a basis for comparison into the future

Bathymetry - Underwater topography. Mapping the underwater contours of the bottoms of water bodies

Beaufort Gyre - The major ice and ocean current circulation of the Arctic Ocean

Benthic - Organisms that live at the bottom of a body of water

Benthos - The bottom of the ocean or body of water

Biochemistry - The study of chemical processes in living organisms

Biodiversity - Pertaining to the variety of species in an area

Biogenic - Produced by living organisms or biological processes

Biogeography - The study of the geographical distribution of organisms

Biomass - The total amount of all living material within a specific volume of the environment

Biomes - Distinct areas of the Earth that are common in climate conditions, life forms and physical features like the tundra or woodland

Biostratigraphy - Identification and differentiation of rocks based on the types of fossils they contain

Biotic - Having to do with living organisms

Carbon¹⁴ - A radioactive form of carbon used to date ancient rocks and artifacts

Carnivore - A flesh/meat eating animal

Characterized - To describe an object or idea

Chlorophyll A - A pigment in plants that give them their green color and which absorb energy from the sun. Plants use Chlorophyll to change carbon dioxide and water into food and oxygen

Classification - Organize into groups or categories

Climate - Typical weather patterns of a region

over long time periods

Community - All organisms in a particular environment

Comprehend - Being able to understand

Comprehensive - Conveying or including everything or almost everything

Coniferous woodland - A wooded area that is dominated by evergreen trees

Conifers - A group of woody plant commonly known as evergreen trees such as pine, spruce or fir that bears cones

Connectivity - As something is able to connect or relate with another thing

Core - A part removed from the interior of a mass especially to determine the interior composition

Correlated - A mutual relation between two comparable things

Cumulative - Objects or ideas that add together

Deciduous - A plant that lose their leaves during one season, usually winter

Deducing - To draw a conclusion

Deformation - A measurable change in structure, normally for the worse

Degradation - To reduce something or to place something at a lower level

Delta - The land formed where a river deposited silt as it enters into a larger water body, classic example, the Mackenzie Delta

Dendrochronology - A system of dating wooden objects by studying the tree growth rings

Density - a quantity of mass per unit volume

Discontinuous - Not continuing or linked

Diversion - A changing of the direction an object is going

Ecology - The science that deals with how living organisms live in relation to each other and their environment

Ecological integrity - Ensuring the relationship in plant and animal communities remains healthy

Ecosystem - The organisms present in a defined area and how they interact with the non-living surrounding (the biotic and the abiotic)

Effluent - A pollutant that flows out from a main source, such as sewage or waste matter

Ekman Grab - A box core type of sediment sampling device.

ELC data - Ecological Land Classification data

Electrofishing - Using electricity to stun and kill fish, usually used during scientific scenarios

Electromagnetic - Magnetism that is caused by electricity

Emissions - A water product that is radiated outward or discharged from a source

Environment - An organism's physical surroundings

Epoch - A period of time during which something important developed or happened

Erosion - Group of natural processes (weathering, disintegration, abrasion, corrosion, transportation) where the Earth's surface is worn away and removed

Eskers - A long, narrow ridge of coarse gravel deposited by a stream flowing under a decaying glacial sheet of ice

Estuary - A place where coastal seawater comes into contact with the current of a freshwater stream

Eutrophication - The enrichment of aquatic systems, promoting dense algal and plant growth in a body of water, depriving the water of oxygen and forcing change in species composition

Evolution - A process where different species come into existence by differentiation and genetic mutations from common ancestors over a long period of time.

Excavated - Extracting or revealing something by removal of the surrounding earth

Fauna - Animal life of a particular region, environment, or geological period

Fault - A fracture in a rock along which the rocks move; the place of origination of seismic activity; types include: strike-slip and thrust

Flora - The plants of a particular region, environment or geological region

Fluvial - Pertaining to something's existence or growth around a stream or river

Fossil - Trace of an organism of a past age, embedded and preserved in the Earth's crust

Fungi - A kingdom of heterotrophic organisms that produce spores

Gender - One's characteristics or traits determined socially as a result of one's sex

Genetic - Pertaining to an organism's traits or characters being linked to genes

Genera - A group of organisms that share common characteristics

Geochemistry - The science that deals with the chemical composition of and chemical changes in the solid matter of the Earth

Geochronological - The chronology of the earth's history as determined by geologic events and not by human history

Geomorphologic - Pertaining to the physical features of the Earth's surface

Grams (g) - A unit of measurement for mass

Habitat - A place where organisms live

Heterogeneous - A situation where something is in a mixed composition

Holocene - The most recent 11,000 years of the Earth's history starting at the end of the last major ice age, which has been relatively warm

Hydraulic - Pertaining to movement caused by water

Hydroacoustic survey - An echo-sounding (SONAR) survey used for measuring such things as fish stocks, water velocity, etc.

Hydrocarbon - A molecule containing hydrogen and carbon, often petroleum, natural gas and coal

Hydrograph - A graph showing the water level, discharge, or other property of river volume with respect to time

Hydrology - Science dealing with the properties, distribution and circulation of water

Igneous - A rock or mineral that solidified from molten or partly molten material, i.e. from magma; one of three rock types with metamorphic and sedimentary

Implement - To put into effect

Iron - A metallic element used for making tools and essential for all living organisms' survival

Kimberlite - An igneous that forms in volcanic pipe, an indicator of diamond deposits

Larvae - A premature stage for an insect where it feeds before becoming a pupa

Latitude - A measurement of the from the equator to a given point on the Earth's surface in the north and south direction

Ligotrophic (oligotrophic) - The opposite of

eutrophic. Waters having very low levels of primary productivity and (usually) low concentrations of nutrients; good, clear water quality

Limestone - A sedimentary rock that contains mostly calcium carbonate and can be formed by either inorganic or organic processes

Limnology - The scientific study of the life and phenomena of fresh water, especially lakes and ponds

Lithic - Of, like, or made of stone. Archaeological artifacts made of stone

Metamorphic rock - Any rock derived from pre-existing rocks by changes in response to environmental factors such as temperature and pressure over a long period of time; one of three types of rocks with igneous and sedimentary

Methane - The simplest hydrocarbon that is the main ingredient in natural gas (CH₄)

Microclimate - The climate of a small area that is different due to changes in geography

Microorganisms - Organisms that must be viewed under a microscope, such as bacteria or a virus

Migration - The long range movement of a group of animals based on the seasons

Molecular analysis - A detailed look at the chemical structure and properties of a molecule

Moraine - A mound of rock debris carried and deposited by a glacier

Multicellular - Composed of more than one cell

Nutrient - Any chemical that an organism removes from the environment to aid with growth and development; common nutrients include nitrogen and phosphorus

Organic - Material pertaining to plants or animals

Outcrop - A portion of bedrock or other stratum protruding through the soil level

Overlie - Sedimentary or volcanic rock that lies on top of older rock

Paleoecological - A relationship or study of ancient organisms and how they related to their ancient environment

Paleoenvironmental - An environment that existed in the past

Parameter - One set of measurable factors, such as the temperature and pressure that define a system and determine its behavior and are varied in an experiment

Permafrost – The permanently frozen layer of soil that characterizes the Arctic's ground; there are two various types: continuous and discontinuous

Pertinent – An object, idea or concept that is relevant to the topic

Phylogeography - The study of the geographic distribution of phylogenetic lineages, usually within species and to reconstruct the origins and diffusion of lineages

Physiological - Pertaining to the physical structures and functions of living organisms

Phytoplankton - A group of plant-like plankton that all sea animals depend on either directly or indirectly

Pingo – A large frozen mound covered with vegetation in permafrost areas

Pleistocene - An age of notable ice ages and development of humans between 2,000,000 and 10,000 years ago

Postglacial - Relating to or occurring during the time following a glacial period

ppm – An abbreviation of parts per million

Precipitation – Water (in the form of rain, snow, hail, etc) falling from the atmosphere

Qualitative – A complete detailed descriptions usually taken from a small sample that allows for distinctions to be drawn from the data

Quantitative - Use of large amounts of data where statistics can be applied to interpret the data

Qiviuk - The soft downy undercoat of muskoxen

Radiocarbon dating - The determination of the approximate age of an ancient object, such as an archaeological specimen, by measuring the amount of carbon¹⁴ it contains

Raptor - A bird of prey such as an eagle, falcon or osprey

Remote Sensing – A technique used to study locations using technology that does not require the researcher to be in the field

Revitalization - To give new life or vitality to something

Satellite imagery - Computer images generated by a satellite which allow researchers to look at a specific area and monitor surface features such as vegetation

Sediment - Solid fragment material that occurs from the weathering of rocks. In water it is material that has settled from a state of suspension

Sedimentary rock - Rock derived from loose particles that have accumulated over time

Sedimentation - The process where small particles are moved and deposited to accumulate into layers

Seismic - Pertaining to vibrations in the Earth, both natural and induced

Shovel testing - A simple test where a sample of ground is taken by use of a shovel and examined

Species - A group of organisms that share common characteristics that group them together and also distinguish them from others

Stone flakes/chards - debris left over from a rock while making tools

Stratified - A system that is set up in layers or strata

Stratigraphic - Formation of rock where different layers can be picked out based on type and age of the rock

Succession - A progressive change in the biological community as a result of a response from species to the changing environment

Surficial - Pertaining to something that is on the surface

Suspension - A situation where the medium is able to support the weight of the particles trapped inside it, example: silt in a river.

Systematic - Done according to a plan

Thermokarst - Sinking holes, caves and underground drainage that are produced in regions with permafrost from melting of ground ice and settling of the remaining ground

Thermocline - Layer in a large body of water that sharply separates regions differing in temperature. An abrupt temperature gradient in a lake

Topography - A description of the surface of a given area

Trace metals - A metal that is not essential in the sample but is found in small quantities

Transect - An imaginary line across a surface where observations are made

Tributary - A stream or river which feeds into a larger body of water

Turbid - Stirred up material suspended in a medium leaving it unclear and opaque

Ungulate – Hoofed animals

Velocity - Rate of change of position; quickness of motion

Volatile – Unstable; a substance that easily vapourizes

Watershed - A region draining into a river, river system, or other body of water

Weather – Daily variable changes in temperature, precipitation, wind and other atmospheric conditions

Zooplankton - Microscopic animal organisms floating in water

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