

BOSWORTH CREEK MONITORING PROJECT

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Contact Information

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Introduction

Bosworth Creek originates at Hodgson (Jackfish) Lake, Tulita District, Sahtu Settlement Area (65° 18'N 126 41'W) and parallels the base of Discovery Ridge before changing course and joining the Mackenzie River within the municipal boundaries of the Town of Norman Wells. Bosworth Creek has played an important role in local history. Natural flow was impeded with the construction of a weir approximately 250 metres from its confluence with the Mackenzie River. The pond created behind this weir supplied both the oil refinery and the Town of Norman Wells with drinking water. The town abandoned this water source in 1991 and closure of the refinery in 1996 prompted channel flow reclamation as recommended by the Government of the Northwest Territories. The weir was removed and natural flow restored in 2005 under Imperial Oil Resources NWT Limited's Reclamation and Restoration Plan.

The Bosworth Creek Monitoring Project (BCMP) began in June 2006. The first year included fisheries habitat training by DFO, watershed habitat assessment, identification of potential industrial impact sites, and initial chemical analyses.

The second year expanded the water and soil chemistry analyses to include non-impacted habitat, as well as adding to the number of humanly impacted sites that are of concern to the RRC. The benthic community was intensely collected to create a comprehensive inventory.

The third and current year of the BCMP will complete the baseline chemical collections and produce a working document of watershed chemistry that will be used by the RRC to monitor soil and water chemistry. Benthic invertebrate studies will complete the baseline inventory and will expand this component through application of CABIN. Several reference sites will be established on Bosworth Creek that will add to one created by DFO approximately 1 kilometre upstream from the winter road crossing in 2006. This site will be sampled again in September 2009 to assess changes that may have occurred over the last three years. Several CABIN test sites will also be undertaken at humanly impacted areas.

The objectives of this project include assessing water quality during the development and utilization of two Borrow Sites proposed by Mackenzie Gas Project; monitoring possible contamination due to erosion that is occurring at a forest fire "fuel break" created several years ago by GNWT Forest Management Division near the stream bank; monitoring fish for contaminants; creating a comprehensive species inventory of selected areas; identifying specific aquatic habitats and their biological, chemical and morphological components; providing a long term record of water chemistry by building upon data previously collected from a specific sample site; creating the first Northwest Territories freshwater fish key; and tracking changes in streambed morphology and associated flora and fauna over time. Six High School students from Mackenzie Mountain School are now involved in this long-term project in addition to fieldtrips

and workshops with the Grades 6 to 12 classes. Portions of this project are being incorporated into the Grade 12 Experiential Science Program and will include long-term monitoring of the watershed with the assistance of permanent soil, water and weather monitoring equipment.

All field work and local laboratory exercises are facilitated by Glen Guthrie, Communications Officer, SRRB. Training and program delivery are ongoing with the assistance of Briar Young, Deanna Leonard, Bruce Hanna, and Neil Mochnac of DFO, Peter Brunette, Steve Kokelj, and Mike Palmer of INAC NWT CIMP, and Rob Phillips, Tara Paul, and Heather McDermott of Environment Canada (EC). Additional assistance will be provided by Dr. Danna Schock, Curator of Amphibians at the Detroit Zoo, Dr. John Acorn from the University of Alberta (riparian invertebrates), Dr. Donna Giberson, Chair, Department of Biology, University of Prince Edward Island (stoneflies and other aquatic insects), Dr. Erling Holm, Assistant Curator of Fishes, Royal Ontario Museum, and Dr. Douglas Currie, Senior Curator of Entomology from the Royal Ontario Museum and the University of Toronto. The BCMP employs two students, Mark and Yvonne Meulenbroek, year-round and is assisted by volunteers from the community. So far, the project has involved 23 community members.

This project employs a wide range of collection and sampling equipment and methods. Benthic invertebrate studies utilize dip nets, preservation techniques for genetic analyses, and identification keys. Fish habitat studies use minnow traps, a seine net, assorted aquarium nets, collection equipment, preservation techniques for genetic and contaminants analyses, and creating a local fish key based on literature from Alberta, Alaska and Yukon Territory. The forestry habitat component includes riparian and aquatic plant identification, the Christmas Bird Count (data from Environment and Natural Resources (ENR), GNWT), amphibian studies, and identifying terrestrial invertebrates associated with the creek. The water quality monitoring component employs sampling techniques and equipment supplied by Taiga Laboratories and ALS Laboratories and standard tissue collections techniques for contaminants analyses.

Many additional methods and procedures are necessary to undertake this investigation including laboratory techniques; geographic information systems and orienteering skills; wildlife safety; creating transects; identifying creek bed composition; and understanding erosional and depositional environments and associated taphonomy.

This study is focusing on two 250 m² locations called Sample Plots, as well as many other sites of biological and physical interest including side channels, channel depths, flow volumes and rates, substrates, vegetative cover and riparian habitats. Water quality data is being obtained from a number of sample locations and sediment baseline data is being collected throughout the creek system. Digital mapping and GIS analyses are on-going and enlist the assistance of staff from the Sahtu GIS Project (ENR) in Norman Wells.

The BCMP identified the need for collection of traditional knowledge from local residents of Norman Wells regarding creek habitat prior to the construction of the weir in 1960. Information was sought regarding past species distribution, subsistence utilization prior to obstruction, other environmental and personal observations about the creek, and the effects of industrial impact and subsequent mitigation. This workshop took place September 9, 2008 and included a focus group session and a field trip to the weir site where participants were able to see the mitigation undertaken by Imperial Oil Resources NWT Limited's Reclamation and Restoration Plan in 2005.

Some aspects of the BCMP are building upon previous works by both Government and Industry. For example, one of this project's sampling locations will continue to monitor water quality and composition from a site that was extensively sampled in 2002 by Imperial Oil

Resources Ventures Limited. However, the scope of this investigation exceeds any single project that has occurred on this creek and its long-term nature makes it The Larger Project.

Data generated by this study are being made available to a number of research institutions and fisheries habitat data is being added to baseline information on water crossings currently under investigation by DFO. The project is also contributing to the NWT species range inventory. The Christmas Bird Count has established new observation localities and is contributing to long-standing avian research. Information recovered from the forestry component will be added to regional wildlife and forestry baseline records and may include new species to local inventories. The benthic and amphibian components of this study are contributing to range distribution studies and genetic analyses at several post-secondary institutions. Meteorological and stream gauge data will be collected for INAC NWT CIMP and others following establishment of permanent stations.

Methods

Training was provided by a number of individuals from INAC, DFO, EC, and the University of Prince Edward Island (UPEI). These workshops included both field and laboratory components. Two workshops were provided by Dr. Donna Giberson, Chair, Department of Biology from UPEI. A water bug workshop was provided to elementary students and younger children on July 2, 2008 while the other instructed high school students on benthic invertebrate studies and included both field and lab components on July 4, 2008. A stream assessment workshop was provided by Peter Brunette (INAC) and Briar Young (DFO) to high school students on June 24 to 26, 2008 and included an electro-fishing component. Professional development was provided to Glen Guthrie by EC between September 30 and October 3, 2008. This workshop covered two components of the Canadian Aquatic Biomonitoring Network (CABIN) and has provided the basis for curriculum development for the Grade 12 Experiential Science program. This initiative is currently being co-developed by the SRRB, INAC NWT CIMP, DFO, EC, Aurora College and others. The benthic/stream assessment unit has been completed and the other three units (geology, limnology and resource management) will be completed by March 31, 2010.

This project was led by the SRRB and included several community volunteers, the Norman Wells Renewable Resource Council (NWRRC) and the Norman Wells Land Corporation. Two local youth were employed part-time. Two Elders and other community members participated in a Bosworth Creek History/Traditional Knowledge workshop. This allowed investigators to not only learn of past local subsistence practices but also added several new areas of concern identified by local organizations that are now under investigation.

Results

The BCMP fully compliments the objectives outlined by INAC NWT CIMP. This project supports both Monitoring and Research AND Capacity Building and Training. Monitoring is a major component of this study and includes water and soil quality monitoring for contaminants due to industrial activities and natural sources, as well as observing changes and interactions between local flora and fauna over time. The collection and evaluation of these data, along with the biological investigations will encompass the Research aspect of this category. The close

association between the investigators and professionals are ensuring that all data and methods are valid.

Education is the underlying principle of this investigation. Students are becoming proficient in freshwater aquatic sampling, identification, data recording and presentation of results. Skills include a wide range of standardized sampling methods for vertebrates, invertebrates and soil and water chemistries. The addition of a meteorological station and a hydrological station will allow permanent monitoring by the school while contributing real-time data to Federal agencies and others.

Presentations and articles about the project were provided by Glen Guthrie and include;

Canadian Water Resources Association, Gimli, June 19, 2008
Sahtu Renewable Resources Board Annual Meeting, Tulita, October 8, 2008
Bosworth Creek History Project, Norman Wells, September 9, 2008
Mackenzie Mountain School, Norman Wells, September 16, 2008
Northwest Territories Water and Waste Association, Norman Wells, November 1, 2008
Norman Wells Land Corporation, Norman Wells November 6, 2008
Sahtu Divisional Education Council, Norman Wells, January 16, 2009
Science 30 Curriculum Development Workshop, Yellowknife, January 20, 2009
Northwest Territories Water and Waste Association Journal, submitted February 4, 2009
Sahtu Renewable Resources Board Annual Meeting, Norman Wells, February 10, 2009
Norman Wells Renewable Resource Council, Norman Wells, February 17, 2009
Aboriginal Aquatic Resource and Oceans Management Program Workshop, Hay River, February 25, 2009
Alberta Environment, Northern Region, Edmonton, March 3, 2009
Canadian North Up Here Magazine, submitted March 20, 2009
Sahtu Renewable Resources Board Newsletters March 2008, September 2008 and January 2009

This project addresses the following Value Components:

- Water and Sediment Quality
- Water Quality
- Fish Quality
- Fish Habitat, Populations, and Harvest
- Birds
- Vegetation

The end result of this project will be a comprehensive understanding of the habitat associated with Bosworth Creek and the wildlife that resides in this watershed. Documents detailing the state of chemical and biological inventories and health will be provided to the Norman Wells Renewable Resources Council. These resources will assist the RRC with monitoring areas of special interest and habitat stewardship.

The investigators are utilizing every opportunity to identify new water sources and assess the quality of water, soil, permafrost and active layer within the watershed. Fish health and habitat identification and monitoring will incorporate a number of related biological communities and components including bird and vegetation studies. In addition, baseline information for benthic organisms and amphibians will compliment the project's contributions towards Value Components.

The project is teaching local residents about the effects of cumulative impacts due to industry and environment. The nature of physical cumulative effects is becoming the focus of

scrutiny by the NWRRC who understand the issues regarding cumulative effects on people by toxins in meat and fish. The BCMP took this understanding and projected it beyond biological systems to include geography. This has enabled the NWRRC to look at ranges of potential impacts to the physical environment that will affect the biological components that feed them.

The BCMP will have completed all baseline inventories by approximately March 31st 2010. The permanent nature of the monitoring stations, field equipment, resources, training, and curriculum will ensure on-going participation by Mackenzie Mountain School. The creation and evolution of this project has also guaranteed free access to information for local stewards, government agencies and academic institutions. Local stewards will have the ability to monitor on-going sources of concern and identify new or perpetual impacts to local habitat. As previously discussed, the project makes use of every opportunity to educate others about cumulative effects and the natural sciences. Reports are published at the SRRB website: www.srrb.nt.ca and Aurora Research Institute website: www.nwtresearch.com.