

North Yukon Planning Region
Resource Assessment Report

OCTOBER 2007

Produced by

NORTH YUKON PLANNING COMMISSION

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NICHIH GWANAŁ'IN • LOOKING FORWARD

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About our Logo

The logo of the North Yukon Planning Commission depicts the significance of the Porcupine Caribou Herd to the people of North Yukon. The Mother and calf signifies the responsibility of parents and the older generation to their young and to the future. The circle shows how we are all inter-connected and dependant on a healthy environment. *Looking Forward -Nichih Gwanal'in* is a value inherent in the Vuntut Gwitchin culture; it is the responsibility of all to work towards a sustainable future for generations to come.

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October 31, 2007

Letter of Transmittal for:
North Yukon Planning Region Resource Assessment Report

The North Yukon Planning Commission (NYPC) is pleased to present the North Yukon Planning Region Resource Assessment Report. This report represents over two-years of information compilation and analysis. The report and information collection was completed to support the production of the Draft North Yukon Regional Land Use Plan.

This report and the accompanying 54 resource maps will provide a valuable source book for resource managers, regulatory agencies, industry and researchers. Key information from this document has been summarized in relevant sections of the Draft North Yukon Regional Land Use Plan. Much of this information was also utilized to populate the North Yukon ALCES® model, which allowed different future land use scenarios to be examined and evaluated for the North Yukon Planning Region.

The resource maps contained in Appendix One were originally produced in July 2006 and posted to our website at that time; some maps were recently updated to reflect current land dispositions and status. Revisions are noted in Appendix One. The major conclusions and interpretations of this resource assessment were presented at public open houses in Old Crow and Whitehorse in April 2006.

The NYPC worked closely with several plan partners and the community of Old Crow to collect, create, analyze and interpret North Yukon resource information. A list of acknowledgements is included in this report. While every effort has been made to validate the accuracy of information and interpretations with contributing partners and domain experts, the NYPC ultimately accepts final responsibility for the accuracy of information in this report, and its interpretation and conclusions.

Next Steps

This report is currently presented in 'draft' form and the NYPC encourages stakeholders and agencies to comment on this document. However, at this time, NYPC is not seeking formal review comments. This document explains the major information sources and assumptions used in the development of the Draft North Yukon Regional Land Use Plan and Land Use Scenarios. Based on comments received during the Draft Plan consultation, NYPC will revisit the information in this report if major assumptions appear to be questioned or invalidated. Editorial and organizational items will also be addressed at a future date.

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Resource assessments are dynamic; they change in response to new information and understanding that results from research or new discoveries. Land status and land use patterns change over time. Natural disturbances such as wildfire can radically alter landscapes and habitat conditions in a single season. Climate change may alter existing land use conditions and assumptions.

To account for the dynamic nature of land and resource information, the land use, ecological, heritage/cultural and economic resource information displayed in Appendix One, Maps 1-53 is being incorporated into an internet-based mapping (GIS) system, the Yukon Planning Atlas. The Atlas provides users with the ability to query and explore relationships between map layers presented in this report, and additional user-defined information. The Yukon Planning Atlas is an initiative of the Yukon Land Use Planning Council and can be accessed at http://atlas.planyukon.ca. Key data layers will be posted throughout 2008.

Where to Get More Information

The entire North Yukon Resource Assessment Report and Maps are available for download in .pdf format from the NYPC website at www.nypc.planyukon.ca. For further information or to submit comments on this report, please contact the NYPC office:

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To the many plan partners and contributors who assisted in the information collection, analysis and writing, the NYPC extends a special Mahsi' Choo (Thank you). Should you have any questions about this document or the North Yukon regional land use planning process, please do not hesitate to contact our office.

Sincerely, on behalf of the North Yukon Planning Commission,

Shawn Francis, M.Sc., P.Biol.
Coordinator / Senior Land Use Planner

Executive Summary

The North Yukon Planning Region Resource Assessment Report was prepared by the North Yukon Planning Commission (NYPC) to support the production of a draft regional land use plan for the North Yukon Planning Region. The plan is being prepared under the mandate of Chapter 11, Land Use Planning, of the Vuntut Gwitchin First Nation Final Agreement (VGFNFA).

The report provides a description of the social/cultural, heritage, economic, and ecological resources and interests in the planning region. Sources of scientific and local/traditional knowledge were collected and considered equally in this assessment. Significant management issues are highlighted. Fifty-four resource maps accompany this report; they are included in Appendix One.

The NYPC worked with several plan partners and Old Crow Elders and land users to collect, create, analyze and interpret resource information. The NYPC accepts final responsibility for the information contained in this report, and its interpretation and conclusions.

Objectives

This report has the following objectives:

- describe the natural, human and economic resources of the region;
- describe historical, current and potential future land uses and patterns; and
- discuss potential issues relevant to current and future land use for consideration in the production of the regional land use plan.

Report Organization

The report is organized into five major sections: background and stakeholder interests (Section 1), a description of the regional setting and ecology (Section 2), human history, heritage resources and First Nations land use (Section 3), a regional assessment of economic activities, existing land use impacts and conservation priorities, and how they may affect Sustainable Development considerations (Section 4), and conclusions and major planning issues (Section 5).

Key Findings

1. Land Use

Levels of land use and economic activity in the region are currently low, but interest in the oil and gas and mineral sectors is increasing. While changed from decades ago,Vuntut Gwitchin participation rates in traditional economic activities and subsistence harvesting remains high.

Given the current situation, the level of human-caused change in the region is expected be relatively low over the next 5-10 years. Increasing levels of oil and gas and mineral exploration activity may continue, but major infrastructure development and production are not anticipated in the coming decade. Levels of wilderness and cultural tourism may increase, but growth is expected to be modest. Large-scale hydroelectric developments are unlikely. The existing road transportation network will not grow significantly without large increases in the level of industrial land use activity.

The highest level of land use activity will continue to be focused along the Dempster Highway corridor, and adjacent areas. The area around Old Crow will continue to be the focus for VGFN traditional economic and cultural activities, with most activities occurring along the Porcupine River, Bluefish Wetlands and Old Crow Flats.

At present, the region does not appear to have experienced or be experiencing critical levels of cumulative habitat-related impacts. The current levels and types of human-caused surface disturbances, while visible, are not compromising the ecological integrity of the region. The highest levels of habitat impacts are along the Dempster Highway and in the Eagle Plain oil and gas basin.

Of the land uses and economic sectors examined, potential future natural gas exploration and production-related activities have the greatest potential to cause landscape-level change in the coming decades. This activity would require associated land uses, most notably all-season road construction, aggregate (gravel) extraction and potential surface water withdrawals. Most, if not all energy sector activity is anticipated to be focused on the southern portion of the Eagle Plain oil and gas basin. Some level of exploration and possibly development could expand across the entire Eagle Plain oil and gas basin, if natural gas production were to occur. While Eagle Plain natural gas production may eventually be realized, its future remains highly uncertain, and is influenced by developments in adjacent jurisdictions, most notably the Mackenzie Valley Pipeline in NWT.

2. Conservation

The identification of priority conservation areas focused on wildlife, their habitats and significant heritage and cultural areas. Residents consider the Porcupine Caribou Herd, wetlands, lakes and rivers to be the most significant ecological resources in the region. Given the close relationship between Vuntut Gwitchin culture and traditional economy, these ecological resources are also cultural values.

Approximately 40 species of mammals, 150 species of birds and 18 species of fish are present in the region, on a seasonal or annual basis. Four wildlife species of national conservation concern, the Grizzly bear, Wolverine, Peregrine falcon and Short-eared owl, are present, but there are no immediate conservation or management concerns regarding these species in the region.

The Porcupine Caribou Herd occupies the entire region, primarily during the winter season. The Richardson Mountains and foothills and all areas north of the Porcupine River are significant caribou habitats. Porcupine caribou have occupied the Eagle Plains area less often, consistent with findings dating back to the 1970s. Most of the region is occupied by moose, with abundance highest during summer. Freshwater fish and salmon are important ecological and traditional economic resources; over-wintering and spawning areas are the most significant and sensitive habitats for fish.

The region contains heritage resources of global significance; most are linked to the history of Beringia and the first people of North America. More recent heritage resources include two fur trade era Yukon Historic Sites – Rampart House and Lapierre House. Important Gwich'in fur trade era villages are Whitestone and Johnson Creek.

Three general areas contain most of the identified significant ecological and cultural resources: 1) major wetland complexes – Old Crow Flats, Bluefish-Cadzow and Whitefish, 2) major river corridors – Porcupine, Eagle, Bell, Whitestone, Miner, Old Crow and Fishing Branch, and 3) Richardson Mountains and foothills.

The region's existing protected areas, Vuntut National Park, Old Crow Flats SMA and Ni'iinlii'njik (Fishing Branch), protect many of the identified heritage, cultural and ecological resources and values. All lands north of the Porcupine and west of the Bell rivers are not currently available for resource exploration. This area, the North Yukon Interim Land Withdrawal, also contains many of the identified resources and values.

At this time, the Richardson Mountains and foothills, other areas of Porcupine Caribou Herd concentrated use, and the Bluefish-Cadzow and Whitefish wetland complexes have no formal conservation designation or status. The future status of the North Yukon Interim Land Withdrawal within the planning region is also uncertain.

3. Conclusions

The management of important Porcupine Caribou Herd habitats and wetlands, lakes and rivers outside of existing Protected Areas should receive special consideration in the land use plan. In particular, Whitefish Wetlands, the Richardson Mountains and foothills, and the major river corridors require appropriate conservation measures. The future status of the North Yukon Interim Land Withdrawal should also be considered.

The combined, or cumulative, effect of multiple land use activities is of great concern to residents of the region – greater than any single development project or sector activity. Existing development assessment and review processes are not able to adequately manage the long-term, cumulative nature of multiple land uses. The land use plan should take steps to understand the pace, scale and location of future land use activities, and consider and recommend measures to manage potential cumulative effects. Sustainable Development, an important goal of Chapter 11 of the VGFNFA (11.1.1.6), cannot be achieved without managing cumulative effects.

Potential future natural gas exploration and development-related activities in Eagle Plains have the greatest potential to cause adverse cumulative impacts within a significant portion of the region. Whitefish Wetlands, the area around Whitestone Village and river, and the major river corridors within the Eagle Plain basin (Eagle, Porcupine and Bell) have the highest potential to sustain significant impacts from energy sector-related activity. These areas may require specific recommendations. Potential land use conflicts are anticipated to occur between future oil and gas activities, wilderness/cultural tourism, and subsistence use/harvesting in the vicinity of Eagle Plain, the Dempster Highway, and major river corridors. Future transportation, gravel and water requirements must also be considered with energy sector activities.

Climate change is expected to be a major factor affecting both the ecology and future land use in the region. Climate-induced changes will result in habitat change, wetland loss or alteration, changes in stream water flow, permafrost degradation, increasing fire rates and highly variable winter temperature and snow conditions. While the magnitude of impacts are uncertain, climate change will impact wildlife, fish and their habitats, people’s ability to travel on and use the land (both for subsistence and transportation), and the length of the winter work period available for industrial land uses. The land use plan should consider potential climate change impacts on land and resource management.

Meeting economic development objectives that do not undermine the social and ecological systems of the region will require a land management regime capable of making pro-active and integrated land use decisions. The land use plan can recommend tools and approaches that foster integrated and coordinated decision-making within and among governments, key components of integrated land management and cumulative effects management.

Acknowledgements

The North Yukon Planning Region Resource Assessment Report was produced with the assistance of a number contributing agencies, the community of Old Crow, and other domain experts.

To support the development of the Draft North Yukon Regional Land Use Plan, a large amount of land and resource-related information had to be created, compiled and analyzed. This included regional biophysical classification and mapping, a large amount of wildlife, fish and habitat-related analysis, climate change impact prediction, development footprint mapping, and a variety of economic assessments, most notably tourism, oil and gas, and minerals. These would not have been possible without the spirited contributions of the following people and agencies:

Biophysical Classification and Mapping
- John Meikle, Marcus Waterreus and Val Lowen (YG, Environment)
- Nancy Steffen, Gartner Lee Ltd.
- Jim Hawkings, CWS
- Shawn Francis, NYPC
- Jeff Hamm, YLUPC
- Yukon Biophysical Mapping Group

Wildlife and Wildlife Habitat
Caribou
- Philippa McNeil, Wendy Nixon, Don Russell (CWS)
- Rick Farnell, Dorothy Cooley, John Miekle and Bruce McLean (YG, Environment)
- John Nagy (Government of NWT)
- John Ryder, NYPC
- Tom Paragi and Tara Wertz (US Fish and Wildlife Service, Alaska)
- Brad Griffith (USGS Cooperative Research Units)

Moose
- Rick Ward, Susan Westover, John Miekle, Bruce McLean and Mark O’Donoghue (YG, Environment)
- John Ryder (NYPC)

Waterbirds
- Amy Leach, Stuart Slattery and Bob Hayes (DU)
- Jim Hawkings and Debbie van de Wetering (CWS)
- John Ryder (NYPC)

Raptors, Forest birds and Songbirds

- Pam Sinclair (CWS)
- Cameron Eckert (YG, Environment)
- Dave Mossop (Yukon College)

Other Species

- David Henry (Parks Canada)
- Tom Jung, Ramona Maraj and Barney Smith (YG, Environment)
- Tom Seaton (Alaska Fish and Game Department)

Fish and Fish Habitat

- Al von Finster, DFO
- Isaac Anderton, Environmental Dynamics Inc.

Climate Change

- Jill Johnstone, (Yukon College)

Plant Species and Status

- Bruce Bennett (YG, Environment)

Heritage and Cultural Resources

- Megan Williams and Mary Jane Moses (VGG)
- Ruth Gotthardt (YG, Heritage)
- Mary Ann Ross (Gwich'in Tribal Council)

Oil and Gas Resources

- Lee Pigage (YGS)
- Richard Corbet, Deb Wortley and Kirstie Simpson (YG, EMR)

Tourism

- Cathryn Paish and Shanna Epp (YG, Tourism)
- Megan Williams and William Josie (VGG)

Mineral and Coal Resources

- Geoff Bradshaw, Lee Pigage and Grant Abbott (YGS)

Aggregate (Gravel)

- Jeff Bond and Grant Abbott (YGS)

Transportation

- Wally Hidinger, (YG, Community Services)

Human Development Footprints

- Kirstie Simpson, Dave Laxton (YG, EMR)
- Lauren Crooks and Bailey Staffen (YG, Geomatics)
- Richard Vladars (NYPC)

Vuntut Gwitchin Elders and Old Crow Community Members
Vuntut Gwitchin Elders shared their traditional knowledge, wisdom and humour during workshops and throughout the entire planning process. Several Elders passed on during production of the Draft Plan but their legacy, spirit and teachings remain. To them, we extend a special Mahsi' Choo (thank you). Many Old Crow community members and land users made significant contributions to our understanding of regional wildlife, fish and heritage resources.

Old Crow community members who made significant contributions to wildlife, fish and heritage workshops, and other information contributions, include the following:

- Ellen Bruce, Robert Bruce Jr., Shawn Bruce, Alfred Charlie, Fanny Charlie, Donald Frost, Freddie Frost, Stephen Frost Sr., Edith Josie, Peter Josie, Danny Kassi, Harvey Kassi, John Joe Kyikavichik, Irwin Linklater, Hannah Netro, Stan Njootli Sr., Stan Njootli Jr., Dick Nukon, Joel Peter, Victor Peterson, Esau Schaeffer, Joe Tetlichi, Kenny Tetlichi, Patti Tetlichi, Charlie Thomas, Lydia Thomas, and Peter Tizya.

Workshop Assistance
A number of individuals also assisted in Old Crow workshop coordination and information collection. These include:

- Jennifer Smith (Old Crow Habitat Steward)
- Melissa Valja and Sonja Foss (VGG)
- Birch Howard, Beverly Brown, Darcie Mathiessen, and Angela Street (NYRRC)

In Memory - Geoff Bradshaw
Geoff Bradshaw of the Yukon Geological Survey provided the Commission with an assessment of the region's mineral potential, which greatly assisted the production of this resource assessment, and the land use plan. Geoff died in a tragic helicopter accident in the summer of 2006. His energy, enthusiasm and dedication will be greatly missed.

North Yukon Planning Region Resource Assessment Report

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List of Acronyms

ABEKC	Arctic Borderlands Ecological Knowledge Co-op
ANWR	Arctic National Wildlife Refuge
ALCES	A Landscape Cumulative Effects Simulator
BMPs	Best Management Practices
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Service
CYFN	Council of Yukon First Nations
DFO	Department of Fisheries and Oceans
DU	Ducks Unlimited
EMR	Energy, Mines and Resources (Yukon Government Department)
FN	First Nations
GIS	Geographic Information System
GTOR	General Terms of Reference
GTC	Gwich'in Tribal Council
HPA	Habitat Protection Area
Ha	Hectares
IMA	Integrated Management Area
IUCN	International Union for Conservation of Nature
IPA	Interim Protected Area
ISR	Inuvialuit Settlement Region
LMU	Land Management Unit
MMbbls	Million barrels (oil)
NND	First Nation of Na-cho Nyak Dun
NWT	Northwest Territories
NY	North Yukon
NYPC	North Yukon Planning Commission
NYRRC	North Yukon Renewable Resources Council
O & G	Oil and Gas
OCF	Old Crow Flats
OIC	Order in Council

PCH	Porcupine Caribou Herd
PCMB	Porcupine Caribou Management Board
RRC	Renewable Resource Council
R.S.Y.	Revised Statutes of Yukon
SARA	Species at Risk Act
SDL	Significant Discovery License
SMA	Special Management Area
Tcf	Trillion cubic feet (natural gas)
TGFN	Tetlit Gwich'in First Nation
THFN	Tr'ondek Hwech'in First Nation
TWG	Technical Working Group
UFA	Umbrella Final Agreement
VG	Vuntut Gwitchin
VGFN	Vuntut Gwitchin First Nation
VGFNFA	Vuntut Gwitchin First Nation Final Agreement
VGG	Vuntut Gwitchin Government
YESAA	Yukon Environmental and Socio-Economic Assessment Act
YESAB	Yukon Environmental and Socio-Economic Assessment Board
YG	Yukon Government
YLUPC	Yukon Land Use Planning Council
VNP	Vuntut National Park

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Section 1: Background and Stakeholder Interests

1.1 Introduction

Under the mandate of Chapter 11 of the Vuntut Gwitchin First Nation (VGFN) Final Agreement, the North Yukon Planning Commission (NYPC) is responsible for developing and recommending a regional land use plan for the North Yukon Planning Region (Figure 1.1). The NYPC is an arms length commission jointly appointed by the Yukon and Vuntut Gwitchin governments. The North Yukon Planning Region encompasses 55,568 km^2 of the Vuntut Gwitchin traditional territory in northern Yukon.

General goals of the North Yukon regional planning process, as described in the VGFN Final Agreement, are to:

- ensure that social, cultural, economic and environmental policies are applied to the management, protection and use of land, water and resources in an integrated and coordinated manner so as to ensure *Sustainable Development* (VGFNFA 11.1.1.6);
- promote the well being of Yukon Indian People, other residents of the planning region, the communities, and the Yukon as a whole, while having regard to the interests of other Canadians (VGFNFA 11.4.5.7);
- recommend measures to minimize actual and potential land use conflicts throughout the planning region (VGFNFA 11.4.5.4);
- recognize and promote the cultural values of Yukon Indian People (VGFNFA 11.1.1.3);
- utilize the knowledge and experience of Yukon Indian People in order to achieve effective land use planning (VGFNFA 11.1.1.4); and
- be linked to all other land and water planning and management processes established by Government and Yukon First Nations minimizing where practicable any overlap or redundancy between the land use planning process and those other processes (VGFNFA 11.2.1.2).

The NYPC General Terms of Reference (YLUPC 2003) also states that the NYPC is to consider the potential cumulative effects of proposed development and planned activities.

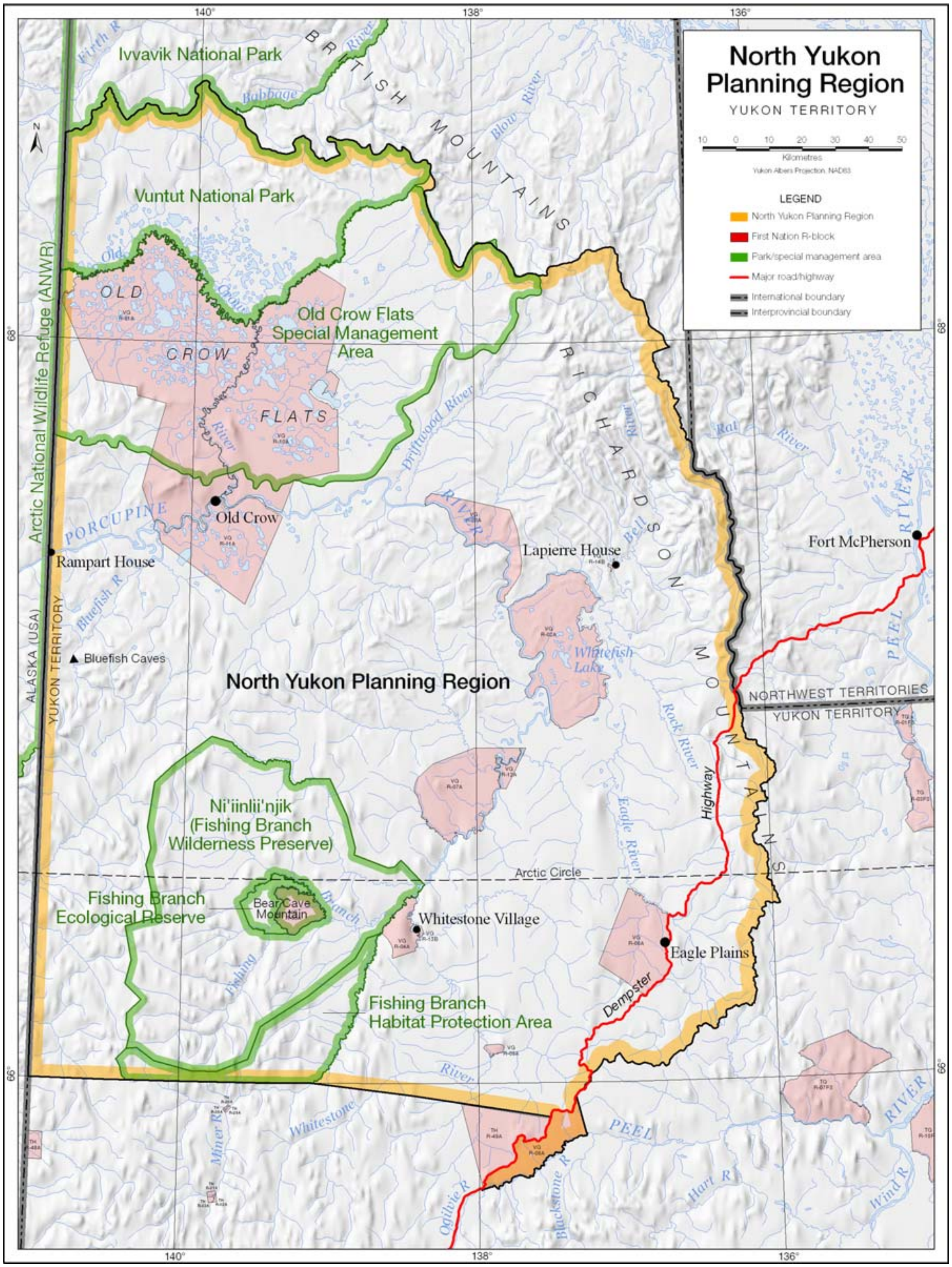

Figure 1.1. Overview of North Yukon Planning Region.

1.2 Objectives

The North Yukon Planning Region Resource Assessment Report has the following objectives:

- Describe the natural, human and economic resources of the region;
- Describe historical, current and potential future land uses and land use patterns; and
- Describe and discuss potential issues relating to current and future land use.

The North Yukon Planning Region Precise Terms of Reference (NYPC 2004) provides a description of the North Yukon regional land use planning process. This document presents the results of *Planning Phase 2: Issues Gathering*, and *Planning Phase 3: Information Gathering*. The collection, creation and analysis of resource information is the knowledge foundation for the land use planning process. Developing an adequate understanding of the natural, human and economic resources of the North Yukon Planning Region, and the issues surrounding their current and future use and management, is a critical step in the development of an integrated and informed land use plan that promotes the principles of Sustainable Development.

1.3 Report Format

This document is organized around five major sections:

- Section One – Background and Interests;
- Section Two – Regional Description (communities, First Nations, land status, economy, biophysical setting and ecological resources);
- Section Three – Human History, Heritage Resources and First Nations Land Use;
- Section Four – Regional Assessment (economic sectors, existing land impacts, conservation and Sustainable Development considerations); and
- Section Five – Conclusions and Major Planning Issues.

1.3.1 Maps

Fifty-four resource maps are included as an appendix to this report (Appendix One). These maps support the results and interpretations of the resource assessment descriptions and are referenced throughout this document.

1.3.2 Background Technical Reports

Key background technical reports developed in support of the North Yukon regional land use planning process include the following:

Anderton, I. 2004. **Porcupine River Watershed Fisheries Information Summary Report**. Unpublished report prepared by Environmental Dynamics Inc. (EDI) for North Yukon Planning Commission. EDI Project 04-YC-0026.

Bradshaw, G.D. 2005. **Mineral Potential of the North Yukon Planning Region**. Internal Report. Prepared by Yukon Geological Survey, Mineral Development Branch, Department of Energy, Mines and Resources. February 2005.

Fekete and Associates Inc. and Vector Research (Fekete). 2006. **North Yukon Conceptual Oil and Gas Development Scenario and Local Benefits Assessment**. Unpublished report prepared for North Yukon Oil and Gas Working Group. Whitehorse, YT, Canada. March 2006.

Gartner Lee Ltd. 2005. **North Yukon Regional Terrain Mapping (1:250,000 scale).** Project documentation and regional terrain map (1:250,000 scale ArcGIS coverage). Prepared for North Yukon Planning Commission. March, 2005.

Johnstone, J. 2005. **Estimating Ecosystem Transitions in the North Yukon Planning Region Associated with Climate Warming**. Unpublished report prepared for North Yukon Planning Commission. Whitehorse, Yukon. May, 2005.

North Yukon Planning Commission and Yukon Department of Environment[1]. **North Yukon Biophysical Mapping Project – Regional Ecosystems of the North Yukon Planning Region**. Internal Report. Prepared by North Yukon Planning Commission and Yukon Department of Environment. Whitehorse, YT, Canada. *In prep.*

Ryder, J.L., McNeil, P., Hamm, J., Nixon, W.A., Russell, D.E., and Francis, S.R. 2007. **An Integrated Assessment of Porcupine Caribou Seasonal Distribution, Movements, and Habitat Preferences for Regional Land Use Planning in Northern Yukon Territory, Canada**. Rangifer Special Issue No. 17: 259-270.

Yukon Department of Tourism and Culture and Vuntut Gwitchin First Nation. 2006. **North Yukon Tourism Strategy.** Prepared by TransNorthern Management Consulting. Whitehorse, YT, Canada. March, 2004. 47 pp.

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[1] Also referenced as: Francis, S.R., Meikle, J.C., Waterreus, M.B., Hamm, J., and Steffen, N.D. 2005. North Yukon Planning Region Biophysical Landscape Classification: Overview, Methods and Reference Images. Prepared for the North Yukon Regional Land Use Planning Commission. Ppt. 63 pp. Available from www.nypc.planyukon.ca.

1.3.3 Analysis and Reporting of Resource Information

For this report, Ecodistricts have been used as consistent spatial units for the purpose of reporting and interpreting resource information and potential land use interactions. Ecodistricts are sub-units of Ecoregions that represent distinctive assemblages of relief, landforms, soils and vegetation (Smith et al. 2004). Ecodistricts are readily observable, identifiable landscape areas, and are therefore logical geographic reporting units for most resource values. North Yukon Planning Region Ecodistricts are shown in Appendix One, Map 7, and are further described in Section 2.6.2.1 of this report.

1.4 Regional Issues and Interests Guiding the Resource Assessment

At the outset of the North Yukon regional land use planning process in 2004, NYPC, in consultation with its plan partners and stakeholders, identified a number of regional planning issues and interests. They were compiled from two major sources:

Vuntut Planning Commission Issues and Interests Workshops

NYPC is the second planning commission to be established under the mandate of Chapter 11 of the VGFN Final Agreement. In 2000, the Vuntut Gwitchin and Yukon Governments agreed to initiate the Vuntut Planning Commission. In June of 2001, the Vuntut Planning Commission hosted issues and interest workshops in Whitehorse and Old Crow. These workshops, entitled "*Challenges and Opportunities*", included presentations on various topics by government agencies, land claim boards and committees, researchers, industry representatives and community members. Workshops were held both in Old Crow and Whitehorse, and the general public was encouraged to attend. A list of workshop participants and topics is provided in Table 1.1(a,b).

As required by the North Yukon Planning Region General Terms of Reference (YLUPC 2003), Vuntut Planning Commission "*Challenges and Opportunities*" workshop proceedings were reviewed by the NYPC in 2004 and 2005. Materials provided by non-Vuntut Gwitchin and Yukon Government workshop participants were returned to the original presenters to verify if materials presented in June of 2001 still accurately reflected their regional planning interests.

Yukon Government and Vuntut Gwitchin Government

Consolidated issues summaries were compiled by the Yukon Government and Vuntut Gwitchin governments, and provided to NYPC in 2004. Both governments have primary approval and implementation responsibilities for the North Yukon regional land use plan.

Table 1.1(a). Vuntut Planning Commission "*Challenges and Opportunities*" workshop participants and topics, Whitehorse, June 8-9, 2001.

Agency/Association	Presenter(s)	Topic(s)
Department of Indian and Northern Affairs (DIAND)	Grant Abbott, Julia Szucs and Roger Horner	Mining, Environment Directorate and planning
Canadian Parks and Wilderness Society (CPAWS)	Mac Hislop	Protected area and conservation interests in North Yukon
Yukon Chamber of Mines	Mike Powers	Mineral interests and requirements of mineral industry
Anderson Exploration Ltd.	Heather Taylor	Eagle Plains oil and gas interests and potential future activity
Eagle Plains Resources Ltd.	Chuck Downie / Tim Termuende	Rusty Springs mineral property
Northern Cross (Yukon) Ltd.	Richard Wyman	Eagle Plains oil and gas interests (Significant Discovery Licenses) and potential future activity
Yukon Energy Corporation, Renewable Energy Caucus	Jim Bell	Renewable energy
Yukon Government, Oil and Gas Management Branch	John Masterson	Oil and gas issues in North Yukon Land Use Plan
Yukon Government, Historical Resources Branch, Archaeology	Ruth Gotthardt	Archaeological and historical resources of North Yukon
Department of Fisheries and Oceans	Al von Finster	Fisheries values and considerations in North Yukon
Gwich'in Land Use Planning Board	Charlie Snowshoe	Tetlit Gwich'in land interests and linkages to Gwich'in Land Use Plan
Wilderness Tourism Association	Blaine Walden	Wilderness tourism opportunities and requirements
Gwich'in Tribal Council	Norman Snowshoe	Gwich'in Tribal Council land interests
Yukon Conservation Society	Lewis Rifkind	Conservation interests in North Yukon

Table 1.1 (b). Vuntut Planning Commission "*Challenges and Opportunities*" workshop participants and topics, Old Crow, June 18-19, 2001.

Agency/Association	Presenter(s)	Topic(s)
Department of Indian and Northern Affairs (DIAND) and Yukon Government	Grant Abbott (DIAND) and Anna Fonseca (YG)	Geology and mineral potential of the North Yukon Planning Region
Canadian Wildlife Service (CWS)	Don Russell	Caribou issues and climate change
Vuntut Gwitchin First Nation (VGFN), Heritage Department	Megan Williams	Vuntut Gwitchin Oral History Project
Yukon Government, Fish and Wildlife Branch	Dorothy Cooley	North Yukon fish and wildlife values and planning issues
Vuntut Gwitchin First Nation (VGFN), Chief and Council	Chief Joe Linklater	VGFN general overview of issues and interests
Yukon Government, Tourism Branch and Old Crow Tourism Steering Committee	Dareille Tallarico	Tourism opportunities and development of a tourism industry in North Yukon
Vuntut Gwitchin First Nation (VGFN), Social Programs	Roger Kaye	VGFN Social Programs and relationship to VGFN traditional territory
North Yukon Renewable Resource Council	Stan Njootli Sr.	Fish and wildlife planning issues and concerns
Vuntut Development Corporation	Stephen Mills	Regional economic development considerations
Yukon Fish and Wildlife Management Board	Niki Wilson	Fish and wildlife planning considerations and potential land use impacts
Vuntut Gwitchin First Nation (VGFN), Natural Resources	Graham Baird	Fish and wildlife planning considerations and potential land use impacts
Yukon Salmon Committee	Stan Njootli Sr. and Isaac Anderton (Old Crow Habitat Steward)	Fisheries values and considerations in North Yukon
Parks Canada	Margret Njootli and David Henry	Vuntut National Park Management Plan
Gwich'in Land Use Planning Board	Charlie Snowshoe	Tetlit Gwich'in land interests and linkages to Gwich'in Land Use Plan

Based on the Vuntut Planning Commission workshops and government submissions, a general description of preliminary regional issues and interests was compiled and included in the North Yukon Precise Terms of Reference (Section 1.3.2.1. – Identified Regional Planning Issues) (NYPC 2004). Issues and interests identified in NYPC (2004) provided focus for this resource assessment.

This resource assessment provides information on, and an assessment of, the issues and interests identified in 2004. Section 5 or this report recommends major planning issues to be considered or addressed in the North Yukon regional land use plan.

1.4.1 Regional Issues and Interests

Regional issues and interests guiding the development of this resource assessment report are listed below. This section is reproduced from NYPC (2004).

Fish and Wildlife Management

Fish and wildlife are key resources of the region, and the community of Old Crow places a high value on these resources. The Vuntut Gwitchin relied on the fish and wildlife resources of the region for their existence, and fish and wildlife are woven into the culture and traditions of the First Nation. An integrated fish and wildlife management plan was prepared for the region in 2002. A large number of issues identified in the fish and wildlife management plan related to harvest, species management population monitoring and climate change. Land-based and habitat issues that have been identified in various consultations include habitat connectivity and fragmentation, the effects of access (linear developments) on fish and wildlife, the effects of oil and gas-related activity on fish and wildlife, and the desire to address the cumulative nature of human disturbances within the region. The Porcupine Caribou Herd is of special concern to the community.

Forest Resources

The community of Old Crow has a need for local forest products, specifically fuel wood and building materials. As Old Crow has grown and the requirement for forest products has increased, community members have had to travel farther away from Old Crow to obtain fuel wood and building logs. There is also the concern that some areas have been over-harvested, and that the issue of “forest ownership” surrounding cabins and camps is causing difficulties. A separate Old Crow forest management planning process is anticipated in the coming years. The North Yukon regional land use plan will provide strategic direction to the forest planning process and attempt to identify, at a broad level, areas suitable for detailed forest planning to focus, and develop criteria for project assessment related to forests.

Heritage Resources

Preserving and conserving the heritage resources of North Yukon is a priority for the community of Old Crow. The North Yukon Planning Region hosts hundreds of documented heritage resources ranging from well developed historic sites (e.g. Rampart House) to archaeological resources of global significance (e.g. Blue Fish Cave) to tool making locations. Significant heritage resources are considered to be generally well-documented in the region. The land use plan can contribute to heritage resource management by developing ways of protecting heritage sites in relation to other land uses and outlining considerations for assessing development proposals.

Mineral Exploration and Development

To date, the North Yukon Planning Region has not received a large amount of mineral exploration interest. There are currently no producing mines in the planning region and relatively few active mineral claims. One long-standing mineral exploration property, Rusty Springs, is located to the west of the Ni’iinlii’njik (Fishing Branch) Special

Management Area. Providing opportunities for access to potential mineral properties has been identified as a key requirement to develop the potential mineral interest of the region. The land use plan will establish practical management objectives that can be used by all industries and government regulators.

Oil and Gas Exploration and Development

The North Yukon Planning Region, and the adjacent Peel Watershed Planning Region, hold the most significant oil and gas potential in Yukon. This situation represents both potential economic benefits and ecological impacts for the region. Three recognized sedimentary basins are located in the North Yukon Planning Region, Eagle Plains, Old Crow and Kandik. Sporadic oil and gas exploration activities occurred in the planning region throughout the 1960s - 1980s, leaving approximately 3,500km of seismic lines, a number of abandoned well sites and related infrastructure. Most of the identified contaminated sites are a result of historical oil and gas activity. Eagle Plains hosts two active dispositions and two significant discovery licenses.

The community of Old Crow and Yukon and Vuntut Gwitchin governments have indicated that oil and gas related issues and planning deserve a large amount of consideration in the North Yukon regional land use plan. The Yukon Oil and Gas Disposition process[2] is currently used to identify which areas will be made available to energy companies for exploration and development. The Disposition process considers many things in its decision making: oil and gas potential, heritage resources, key wildlife habitat, watercourses, viewscapes, tourism values, culture, and landscape features. However, the Disposition process cannot adequately address sub-regional level management issues, specifically the cumulative nature of past and present human activities, nor can it effectively deal with overall levels of human activity. The North Yukon regional plan can provide the sub-regional perspective to oil and gas management and provide quantifiable guidelines for the pace and extent of oil and gas activities.

Protected Areas / Special Management Areas

Two protected areas have been established in the region, Vuntut National Park and Ni'iinlii'njik (Fishing Branch) Management Area, accounting for approximately 20% (10,880 km^2) of the non-overlap portion of the planning region. These protected areas represent portions of the Old Crow Flats, Old Crow Basin and North Ogilvie Mountains Ecoregions, three of the five major Ecoregions within the planning region. The Eagle Plains Ecoregion occurs entirely within the North Yukon Planning Region, and is currently unrepresented in a Yukon protected area. Both existing protected areas have approved management plans. The Old Crow Flats Special Management Area is currently under an Order in Council land withdrawal from resource development until 2012. A separate Special Management Area planning process will be created for the Old Crow Flats Special Management Area. Given the relatively large amount of the land base currently in protected areas, protected areas is not anticipated to be a major focus for the

[2] The current Oil and Gas Disposition Process is different than that utilized at the outset of the regional planning process. Similar land use planning and cumulative effects issues are still relevant with the current disposition process.

land use plan. Ecoregion representation will not be a primary focus for the identification of potential conservation values.

Tourism

Beyond the Dempster Highway corridor, the North Yukon Planning Region experiences relatively low levels of tourist activity. The Vuntut Gwitchin and Yukon governments have created a draft tourism plan for the region. Wilderness-based and cultural tourism experiences represent the greatest opportunities for the North Yukon region. The land use plan can add to this plan by identifying regional goals and potential impacts of tourism; and by identifying considerations for the tourism industry.

Traditional Activities

Activities such as hunting, fishing, and berry harvesting are important to the Vuntut Gwitchin culture and lifestyle. Traditional activities can potentially be in conflict with almost every other type of land use. The land use plan can identify what are acceptable levels of change to a traditional lifestyle and criteria for assessing other types of development.

Transportation Corridors

The main issues associated with transportation are: 1) management of the Dempster highway corridor and spur roads, 2) the existing Old Crow winter road, 3) the potential for future all-season road access to Old Crow, and 4) the requirement for potential future access corridors to develop the mineral and oil and gas resources of the region. Establishing the appropriate framework for the management of future potential access associated with oil and gas or mineral exploration and development will be an important consideration.

Contaminated Sites

Approximately eighty contaminated sites have been identified in the North Yukon Planning Region, a large number resulting from historical oil and gas activities. The Community of Old Crow has identified contaminated sites as an issue of concern in the region, and to be considered in the North Yukon regional land use plan.

Climate Change

Climate change has the potential to significantly alter the existing biophysical conditions of the North Yukon Planning Region. The majority of the planning region is underlain by permafrost, and is therefore susceptible to degradation and thaw under the predicted climate warming scenarios of 1^{o} - 4^{o}C expected to occur over the next 10-100 years. Changes in permafrost may induce large changes in habitat quality, distribution and abundance, and introduce a number of new terrain hazard and geotechnical issues to the area. New species are being reported in the region, and changes in the fire regime can be expected. The land use plan must therefore consider the potential effects of climate change through the principles of adaptive management, and consider how it will be incorporated in future plan reviews and updates.

References

Department of Indian Affairs and Northern Development. 1993. Vuntut Gwitchin First Nation Final Agreement. Department of Indian Affairs and Northern Development. Ottawa, ON, Canada. 414 pp.

Smith, C.A.S., J.C. Meikle, and C.F. Roots. (editors), 2004. Ecoregions of the Yukon Territory: Biophysical properties of Yukon landscapes. Agriculture and Agri-Food Canada, PARC Technical Bulletin No. 04-01, Summerland, British Columbia, 313 pp.

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Section 2:
Regional Setting and Ecology

2.1 Human History and First Nations

The planning region is the Traditional Territory of the Vuntut Gwitchin First Nation (Appendix One, Map 1). Vuntut Gwitchin literally means 'people among the lakes'. The region is part of the larger Gwich'in homeland of northwest Canada and Alaska. A detailed description of human history and First Nation cultures is provided in Section 3.1.

First Nations people have lived in and utilized the plant and animal resources of the region for at least 12,000 years, with some evidence of human habitation as long ago as 40,000. First Nations with interests in the North Yukon Planning Region include the Tr'ondek Hwech'in of Dawson, the Tetlit Gwich'in of Ft. McPherson (Gwich'in Secondary Use Area), and the Na-cho Nyak Dun of Mayo. Strong family ties exist between the Gwich'in communities of Old Crow, Ft. Yukon (Alaska) and Ft. McPherson (NWT). The Inuvialuit Settlement Region, on the Yukon North Slope, is located to the north of the planning region.

The Vuntut Gwitchin First Nation settled their Final Land Claim Agreement in 1993 (Department of Indian Affairs and Northern Development, 1993). As described by the North Yukon Planning Region General Terms of Reference (North Yukon Planning Commission, 2003), final plan approval and implementation responsibilities reside with the Yukon and Vuntut Gwitchin Governments.

2.2 Communities

Old Crow is the only permanent community in the North Yukon Planning Region, and the most northerly community in Yukon (Appendix One, Map 1). Established in approximately 1910, Old Crow is a predominantly First Nation village located at the confluence of the Porcupine and Old Crow rivers. Old Crow is the home of the Vuntut Gwitchin First Nation. It is the only community in Yukon without all-season road access.

The community is unincorporated and as such, the Vuntut Gwitchin Government and its departments serve as town administration with the responsibility to provide necessary community services. Vuntut Gwitchin, Yukon and Federal Governments deliver some programs jointly.

Old Crow is named after Chief Crow May I Walk, *'Deetru K'avihdik'*, a respected Chief who died in the 1870s. Until the early 1900s, Fort Yukon (Alaska) and Rampart House were the major Vuntut Gwitchin settlements in the region. Old Crow was established when three families moved from Rampart House to Old Crow around 1910, with other Vuntut Gwitchin families following. The first trader opened business in 1911. The community became firmly rooted in the 1920s when the church, school and Royal Canadian Mounted Police all shifted from Rampart House to Old Crow. By this time there were two trading posts in Old Crow, serving the needs of Gwitchin trappers trading their furs after the spring harvest in Old Crow Flats.

Today, Old Crow has a modern, newly constructed airport terminal, a Northern® store providing grocery, postal, banking and fuel services, and a new school serving the education needs of kindergarten to grade nine students. A permanently staffed nursing station, a community hall, the Alice Frost Yukon College community campus, a multi-purpose youth centre, a Royal Canadian Mounted Police detachment, an Anglican church, a cross country ski chalet with nearby ski trails, a covered skating rink, and two privately operated lodging (Bed & Breakfast) accommodations are also located in Old Crow.

While the community has lodging, there are no full service restaurants or similar visitor facilities. A modern VGFN Administrative centre, the Sarah Abel Chitze building, houses all Vuntut Gwitchin Government departments and Chief and Council. Residents live in log or wood frame housing with trucked water and sewer service. Diesel generators operated by Yukon Electrical Company Ltd. provide electricity for the community. Old Crow, similar to most Yukon communities, benefits from high speed internet and modern communications services. Air North provides scheduled air passenger and cargo service to Old Crow from Whitehorse and Inuvik.

A detailed description of Old Crow is provided in the Yukon Community Profiles (Government of Canada et al. 2004). Figure 2.2.1 shows an image of the community of Old Crow. Outside of Old Crow, the only permanent facility is the Eagle Plains visitor/transportation lodge on the Dempster Highway (Appendix One, Map 1).

References

Department of Indian Affairs and Northern Development. 1993. Vuntut Gwitchin First Nation Final Agreement. Department of Indian Affairs and Northern Development, Ottawa, ON, Canada. 414 pp.

Government of Canada, Yukon Chamber of Commerce, and Yukon Government. Yukon Community Profiles, Old Crow, 2004. Yukon Community Profiles website. Accessed November 14, 2007. URL: http://www.yukoncommunities.yk.ca/communities/oldcrow/work/

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a) Aerial view in summer with Porcupine River in foreground. Photo: J. Hawkings, CWS

b) Houses in central part of town. Photo: S. Francis, NYPC

Figure 2.2.1. The community of Old Crow: a) aerial view with Porcupine River in foreground, and b) houses in central part of town.

2.3 Population

As of December 2005, the region had a permanent population of approximately 270 residents, all residing in Old Crow (Yukon Department of Health and Social Services and Yukon Bureau of Statistics, 2005). Approximately 90% of Old Crow residents are VGFN beneficiaries. The total number of VGFN beneficiaries living within and outside the region is currently estimated to be 800 (Government of Canada et al. 2004).

For the period 1985 to present, the Old Crow population has remained relatively stable, fluctuating only moderately between 265 and 300 residents. Given the small number of residents, population trends are very sensitive to minor changes in resident numbers. Many residents travel and live outside Old Crow for periods of time to pursue work or training opportunities. Population growth trends in Old Crow are currently less than 1% with no major changes expected in the near future.

The North Yukon Planning Region (i.e. Old Crow) contains less than 1% of Yukon's total population of 31,600 (Yukon Department of Health and Social Services and Yukon Bureau of Statistics, 2005). Based on a planning region area of 55,568 km^2, the regional population density is .005 residents/km^2 (206 km^2/resident). This population density represents one of the lowest in Canada[1].

The Old Crow resident population by age group is shown in Figure 2.3.1. The demographic profile of Old Crow does not differ significantly from the Yukon average.

[1] Average population density of Canada is 3.3 people/km^2, with majority of Canada's 30 million citizens living within 200km of United States border. 41 percent of Canadian land mass contains 0.3 percent of population, including Yukon. Source: The Atlas of Canada. http://atlas.nrcan.gc.ca/site/english/maps/peopleandsociety/population/population2001/density2001. Accessed June 2006.

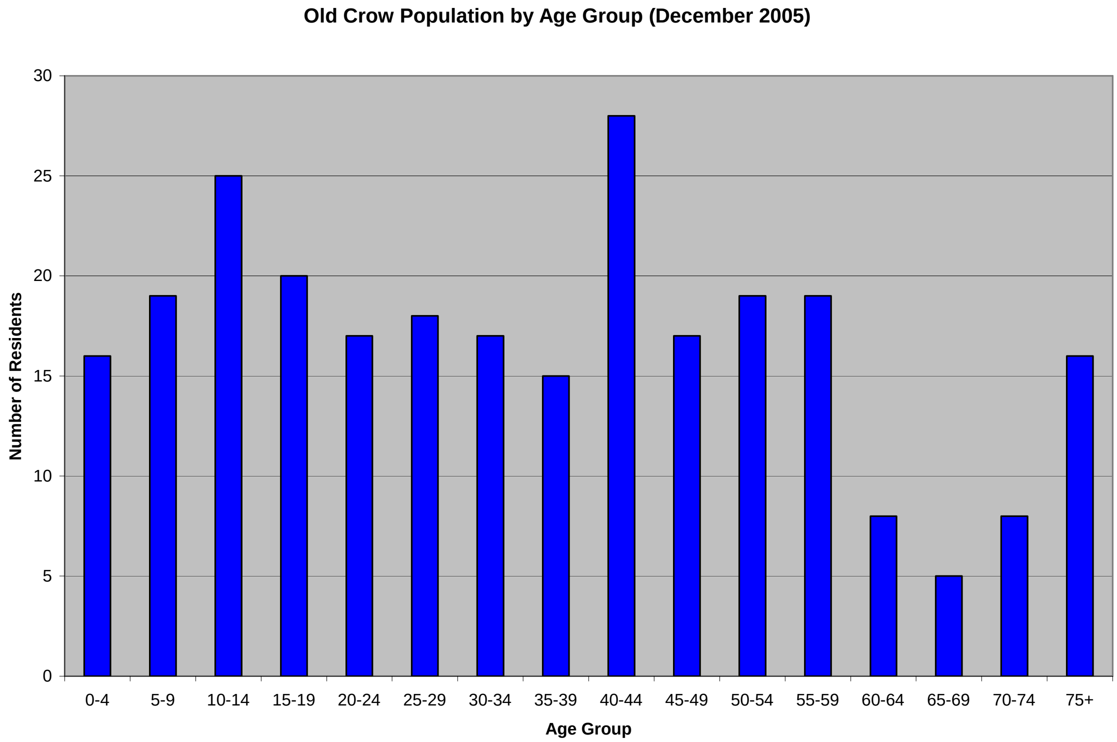

Figure 2.3.1. Old Crow population by age group (December 2005). Source: Yukon Bureau of Statistics Information Sheet #58.26.

References

Government of Canada, Yukon Chamber of Commerce, and Yukon Government. Yukon Community Profiles, Old Crow, 2004. Yukon Community Profiles website. Accessed November 14, 2007. URL: http://www.yukoncommunities.yk.ca/communities/oldcrow/work/

Yukon Department of Health and Social Services and Yukon Bureau of Statistics. 2005. Yukon Bureau of Statistics Information Sheet #58.26, December 2005. 4 pp.

2.4 Land Status

Within the region there are three major landowners and administrators: Yukon Government, VGFN and Government of Canada (Parks Canada). VGFN Settlement Lands encompass 14% (7,764 km^2) of the planning region and are almost all Category A lands (First Nation ownership of both surface and subsurface rights). Vuntut National Park of Canada, administered by the federal government, makes up 8% (4,376 km^2) of the planning region. The remaining area is Yukon public land administered by Yukon Government that accounts for 78% (43,406 km^2) of the total planning region. With the exception of VGFN Settlement Lands and land within the community of Old Crow, there is no private land ownership in the region. Appendix One, Map 2 and Table 2.4.1 provide an overview of the current land status in North Yukon Planning Region.

The North Yukon Planning Region contains a complex land management regime where land management is a shared responsibility between governments, other agencies and land claim boards. Six general types of land status occur in the region: VGFN Settlement Lands, Special Management Areas (e.g., Protected Areas and Habitat Protection Areas), Order in Council interim land withdrawals (i.e., North Yukon Interim Land Withdrawal), Yukon Public Lands (including leased land), and Village of Old Crow unincorporated lands.

2.4.1 First Nation Settlement Lands

All Vuntut Gwitchin First Nation settlement lands are contained in the North Yukon Planning Region. First Nations with portions of their traditional territories in the North Yukon Planning Region include the Tr’ondek Hwech’in, the Tetlit Gwich’in (i.e., the Tetlit Gwich’in Secondary Use Area), and the Na-cho Nyak Dun of Mayo (Section 2.3; Appendix One, Map 1). None of these First Nations have land parcels (i.e. settlement lands) within the planning region boundary.

A summary of VGFN settlement lands is provided in Appendix One, Map 2, and Table 2.4.2. Category ‘A’ lands, for which VGFN holds both surface and sub-surface rights, account for more than 99% of the total settlement lands. Approximately half of all VGFN settlement lands are included in existing Special Management Areas. More than 50% of the total VGFN land selections are represented by two parcels (R-01A - western Old Crow Flats and R-10A - eastern Old Crow Flats) within the Old Crow Flats Special Management Area.

In addition to the 14 R-blocks listed in Table 2.4.2, 53 site selections totalling 560 ha are included as part of the VGFN Final Agreement, with the majority concentrated along the Porcupine River (Appendix One, Map 2). Individual site selections are generally less than 10 ha in size. The Vuntut Gwitchin Government is currently in the process of creating land management policies and legislation for their settlement lands.

Table 2.4.1. North Yukon Planning Region land status summary table.

Land Category	**Area** (km²)	**Area** (% of total)	**Area** (% of NYPR)	**Status** [1]
Protected Areas				
Old Crow Flats Special Management Area Vuntut National Park of Canada	12,122.0	68.7	21.8	Protected as per Vuntut National Park Management Plan (2004) and OCFlats SMA Management Plan (2006)
Ni'iinlii'njik (Fishing Branch) Wilderness Preserve, Ecological Reserve and VG R-05A	5,524.2	31.3	9.9	Protected as per Ni'iinlii'njik (Fishing Branch) Management Plans (2004a and 2004b)
Order in Council Interim Land Withdrawals				
North Yukon Interim Land Withdrawal	6,555.7	100.0	11.8*	Land withdrawal established through 1978 Order in Council as part of Inuvialuit land claim negotiations
Conservation Areas (Habitat Protection Areas)				
Ni'iinlii'njik (Fishing Branch) Habitat Protection Area	978.5	100.0	1.8	Managed as per Ni'iinlii'njik (Fishing Branch) Management Plan (2004a)
First Nation Settlement Lands				
(VGFN VG Category A, Category B, S-Sites)	7,764	100.0	14.0	59% of VGFN settlement lands are within existing protected areas, with largest amount in Old Crow Flats SMA
Public Lands				
Yukon Government lands, including leased land	27,198.0	100.0	48.9	Yukon public lands, subject to general laws of application and land use regulations
Unincorporated Municipal Lands Village of Old Crow	10.0			
Total	55,567.7	--	--	

[1] Status – Current as of August 31, 2006
* refers to area directly affected by North Yukon Interim Land Withdrawal outside of existing SMAs and First Nation Settlement lands.

Table 2.4.2. Vuntut Gwitchin First Nation settlement land summary table.

Land Selection	Area (km^2)	Area (% of total)	Area (% of NYPR)	Status
Category A Lands (surface and sub-surface rights)				
R-01A (western Old Crow Flats)	2,550.6	32.8	4.6	A portion is protected as per OC Flats Management Plan (2006)
R-02A (Whitefish Lake wetlands)	868.1	11.2	1.6	
R-03A (Berry Creek – Porcupine River)	311.9	4.0	0.6	
R-04A (Whitestone River – Miner River)	115.7	1.5	0.2	
R-05A (Bear Cave Mountain)	141.7	1.8	0.2	Protected as per Ni'iinlii'njik (Fishing Branch) SMA Plan (2004b)
R-06A (Eagle Plains)	437.5	5.6	0.8	
R-07A (Johnson Creek – Schaeffer Lk.)	534.5	6.9	1.0	
R-08A (Ogilvie River)	259.4	3.3	0.5	
R-09A (Whitestone River)	15.0	0.2	0.03	
R-10A (eastern Old Crow Flats)	1,854.2	23.9	3.3	A portion is protected as per OC Flats Management Plan (2006)
R-11A (Old Crow – Porcupine River – Blue Fish wetlands)	630.1	8.1	1.1	
R-12A (Johnson Creek – east bank Porcupine River)	36.3	0.5	0.1	
Subtotal	7,754.8	99.8	14.0	
Category B Lands (surface rights)				
R-13B (Whitestone River)	3.5	0.05	<0.01	Site of Whitestone Village (with S-55).
R-14B (Bell River - LaPierre House)	3.4	0.05	<0.01	Contains LaPierre House (with S-16) – Yukon Historic Site
Subtotal	6.9	0.09	0.01	
Total	7,768.8	100.0	14.0	14% of planning region is VGFN Settlement Land. 59% (4,547 km^2) of total VGFN land selections are protected by existing designations / management plans

2.4.2 Protected Areas

Three areas in the region have long term or permanent protected area status; these are Vuntut National Park of Canada, Old Crow Flats Special Management Area[2], and the Ni'iinlii'njik (Fishing Branch) Wilderness Preserve and Ecological Reserve (Parks Canada et al. 2004; Yukon Department of Environment and Vuntut Gwitchin Government, 2006; Yukon Government and Vuntut Gwitchin First Nation, 2004a,b). Together they represent 32% of the planning region.

A strong conservation focus in the region was achieved as a result of the Vuntut Gwitchin's desire to protect the land, wildlife and fish resources, and their traditional way of life from potential development activities, as directly expressed through the outcome of the Berger Inquiry of the 1970s (Berger 1977). In 1993, the same sentiments were reflected in the Vuntut Gwitchin First Nation Final Agreement (Department of Indian Affairs and Northern Development, 1993). Each protected area is discussed below.

2.4.2.1 Old Crow Flats Special Management Area

Situated to the north of Old Crow, Van Tat K'atr'anahtii (Old Crow Flats Special Management Area; Appendix One, Maps 1 and 2) contains some of the highest heritage, cultural and ecological values in the North Yukon Planning Region; '*Van Tat'* (Old Crow Flats) is the subsistence harvesting and cultural homeland of the Vuntut Gwitchin First Nation. The area is recognized as an important wetland under the Ramsar Convention, an international designation of the United Nations (Gillespie et al. 1991).

A reflection of the importance of Old Crow Flats to the Vuntut Gwitchin people is the two largest VGFN settlement lands, R-01A (western Old Crow Flats) and R-10A (eastern Old Crow Flats), representing over 50% of the total VGFN settlement lands. These form the core of the Old Crow Flats Special Management Area. These two settlement land parcels will receive permanent protected area status, as per the recently completed Old Crow Flats Special Management Area Management Plan (Yukon Department of Environment and Vuntut Gwitchin Government, 2006).

Old Crow Flats Special Management Area covers 12,122 km^2, or 22% of the North Yukon Planning Region. Table 2.4.3 provides a summary of land status in Old Crow Flats SMA. Old Crow Flats SMA was created through the Vuntut Gwitchin First Nation Final Agreement and is comprised of three separate land designations; a National Park (Vuntut National Park of Canada), Vuntut Gwitchin First Nation Settlement Land, and interim protected lands (public land administered by Yukon Government).

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[2] The term 'Special Management Area' is based on the Chapter 10 definition as described in the Vuntut Gwitchin First Nation Final Agreement and Yukon Umbrella Final Agreement. Special Management Areas may include a wide range of conservation designations and levels of protection, upheld by a variety of federal and territorial legislation (e.g. National Parks – National Parks Act; Habitat Protection Area – Yukon Parks and Land Certainty Act; National Wildlife Area – National Wildlife Act)

Table 2.4.3. Old Crow Flats SMA land status summary table.

Land Category	Area (km^2)	Area (% of SMA)	Area (% of NYPR)	Status [1]
VGFN Settlement Lands				
R-01A (western Old Crow Flats)	2,216.7	18.4	4.0	Protected (OCFlats SMA Management Plan 2006)
R-10A (eastern Old Crow Flats)	1,731.5	14.3	3.1	Protected (OCFlats SMA Management Plan 2006)
Subtotal	3,948.2	32.7	7.1	
National Park Lands				
Vuntut National Park	4,376.1	36.1	7.9	Protected (Vuntut N.P. Management Plan 2004)
Yukon Government Lands				
Old Crow Flats - East	3,011.6	24.9	5.4	Interim Protected until 2026 (OCFlats SMA Management Plan 2006)
Old Crow Flats - West	763.0	6.3	1.4	Interim Protected until 2026 (OCFlats SMA Management Plan 2006)
Subtotal	3,774.6	31.2	6.8	
Total	12,098.9*	100.0	21.8	70% of total Old Crow Flats SMA is permanently protected including the entire 'core wetland' area. Remaining 30% is interim protected until 2026.

[1] Status – Current as of August 31, 2006
* Total SMA area as reported is slightly less than entire boundary (12,122.0 km^2) due to removal of Old Crow River.

While different land designations exist within the Old Crow Flats Special Management Area, Chapter 10 of the Vuntut Gwitchin First Nation Final Agreement requires that the entire area be managed as a single ecological unit[3].

[3] In the resource assessment maps of Appendix One, Vuntut National Park and Old Crow Flats have been shown as being "distinct" areas to avoid potential confusion between the two management regimes and management plans. However, it should be recognized that the entire area, including the national park lands, is the Old Crow Flats Special Management Area.

Vuntut National Park of Canada

Vuntut National Park, created in 1993 through the Vuntut Gwitchin First Nation Final Agreement, includes the northern portion of the Old Crow Flats Special Management Area and a portion of the British Richardson Mountains (Appendix One, Map 2). VGFN settlement lands are not contained within the national park boundary.

Vuntut National Park is 4,376 km^2 in size (8% of the region). Together with Ivaavik National Park, located to the north of Vuntut in the Inuvialuit Settlement Region, this area creates a contiguous 14,546 km^2 block of national park lands. Combined with the adjacent Arctic National Wildlife Refuge lands in Alaska, to the west, this area forms one of the largest protected area networks in North America.

Vuntut National Park is co-managed with the Vuntut Gwitchin First Nation and the North Yukon Renewable Resources Council. A park management plan was approved in 2004 (Parks Canada et al. 2004). The management plan for Vuntut National Park identifies ecological integrity as the primary park management objective.

First Nation Settlement Lands and Yukon Government Public Lands

The Old Crow Flats SMA Plan permanently protects the “core wetlands” of the Special Management Area (Vuntut Gwitchin Government and Yukon Environment 2006). This protection includes all Vuntut Gwitchin Settlement Lands (VGFN R-01A, R-10A and S-25A) plus Yukon public lands within the core wetlands area (i.e. ‘Little Flats’).

The two non-wetlands portions of the Old Crow Flats Special Management Area, referred to as “Area East” and “Area West”, have protected area status for a period of 20 years (expires in 2026). The areas are Yukon public lands administered by Yukon Government. Combined with Vuntut National Park, the entire *‘Van Tat’* wetlands are permanently protected.

The non-national park lands portion of Old Crow Flats SMA is co-managed by the Vuntut Gwitchin First Nation and Yukon Government, with the participation of numerous other agencies including Parks Canada, Canadian Wildlife Service and the North Yukon Renewable Resources Council.

2.4.2.2 Ni'iinlii'njik (Fishing Branch) Special Management Area

Centred on the Fishing Branch River and Bear Cave Mountain, the Ni'iinlii'njik (Fishing Branch) Special Management Area covers 6,500 km^2, or 12% of the North Yukon Planning Region. The SMA encompasses a portion of the Ogilvie Mountains in the southwestern portion of the region (Appendix One, Maps 1 and 2). This SMA was created jointly through the VGFN Final Agreement and the former Yukon Protected Areas Strategy.

Built around a unique karst – salmon – grizzly bear ecosystem, the SMA contains some of the highest concentrated values in the region. Bear Cave Mountain plays a critical role in Vuntut Gwitchin culture and legend. The Fishing Branch River-Bear Cave Mountain complex has been identified in several previous notations as an area of very high conservation value (see Section 4.3 for a detailed discussion of past conservation areas of interest).

Similar to the Old Crow Flats Special Management Area, Ni'iinlii'njik (Fishing Branch) is comprised of different land designations including VGFN Settlement Land, an Ecological Reserve, a Wilderness Preserve, and a Habitat Protection Area. Table 2.4.4 provides a summary of the different land categories and their relationship to the North Yukon Planning Region.

Two different management plans are in effect for this area: 1) the Wilderness Preserve and Habitat Protection Area (Yukon Government and Vuntut Gwitchin First Nation, 2004a), and 2) the Ecological Reserve and First Nation Settlement Lands (Yukon Government and Vuntut Gwitchin First Nation, 2004b). While separate management plans exist, as described in the Vuntut Gwitchin First Nation Final Agreement the entire area is to be managed as an integrated ecological unit.

Table 2.4.4. Ni'iinlii'njik (Fishing Branch) SMA land status summary table.

Land Category	Area (km^2)	Area (% of SMA)	Area (% of NYPR)	Status
VGFN Settlement Land				
R-05A and S-3A1 (Bear Cave Mountain)	141.7	2.2	0.3	Protected as per Management Plan (2004b)
Natural Environment Park				
Ni'iinlii'njik (Fishing Branch) Wilderness Preserve	5,213.4	80.2	9.4	Protected as per Management Plan (2004a)
Ecological Reserve				
Fishing Branch Ecological Reserve	169.1	2.6	0.3	Protected as per Management Plan (2004b)
Habitat Protection Area				
Ni'iinlii'njik (Fishing Branch) Habitat Protection Area	978.5	15.0	1.7	Various uses and activities as established in management plan – HPA is not withdrawn from disposition but has high conservation focus (2004a).
Total	6,502.7	100.0	11.7	85% of total SMA is permanently protected with conservation focus in remaining 15% (HPA).

2.4.3 North Yukon Interim Land Withdrawal

The North Yukon Interim Land Withdrawal applies to all lands north of the Porcupine and Bell rivers, including the Inuvialuit Settlement Region on the Yukon North Slope (Appendix One, Map 2). The withdrawal area does not apply to VGFN settlement lands, and is of secondary importance in areas with existing National Park or Special Management Area status. There is no specified time for expiry of the withdrawal (Yukon Department of Energy, Mines and Resources, 2003, 2005: Orders in Council 2003/143 and 2005/53). Section 17 of the Yukon *Oil and Gas Act* also withdraws the area from oil and gas disposition.

The withdrawal was established in 1978. The origins of the withdrawal began with the Berger inquiry (Berger 1977) and negotiations leading to the settlement of the Inuvialuit Final Agreement. It was originally established under federal jurisdiction, and renewed during devolution. The intent of the withdrawal was to allow for conservation planning, specifically for the purpose of setting aside lands required for creation of National Parks and other conservation areas. Porcupine Caribou Herd conservation figured prominently in the establishment of the withdrawal area.

The Inuvialuit Final Agreement was settled in 1984, and the Vuntut Gwitchin First Nation Final Agreement in 1993. Two national parks, Ivvavik and Vuntut, were created in the 1990s through co-management processes as part of the land claim agreements. As a result of the completion and approval of the Old Crow Flats Special Management Area Plan in August of 2006 (Yukon Department of Environment and Vuntut Gwitchin Government, 2006), the current withdrawal order is being amended. The interim land withdrawal remains in effect in the Inuvialuit Settlement Region and within the planning region outside of the Old Crow Flats Special Management Area.

Land management issues within the withdrawal area outside of Old Crow Flats SMA were considered during the North Yukon planning exercise. Two general areas comprise the remaining undesignated Yukon Government public land within the withdrawal area; these include the eastern portion of the withdrawal area (Driftwood and Bell rivers) and the western portion (Rampart House – Caribou Bar River). The two areas represent approximately 13% (7,334 km^2) of the planning region.

Together with the protected areas, approximately 45% (24,980 km^2) of the region is currently withdrawn from land disposition. The withdrawals remove these areas from mineral and oil and gas disposition, and prevent exploration activities.

2.4.4 Old Crow Community Lands

Old Crow community lands encompass approximately 210 ha. The community lands are positioned between VG R-01A and the Porcupine River. VGFN community lands, as per the VGFN Final Agreement, allow for the enactment of local laws and regulations by the First Nation. Old Crow is an unincorporated community and does not have a separate municipal government; Vuntut Gwitchin Government provides community governance in partnership with the Yukon and Federal governments, most municipal services. Chapter 11 regional planning commissions do not make direct land management recommendations within municipal lands, but do consider municipal concerns and connections with the broader landscape during the planning exercise, including economic and social objectives.

2.4.5 Existing Land Dispositions

Fourteen land parcels within the Eagle Plains oil and gas basin are currently under oil and gas permits (see Appendix One, Map 43). Northern Cross (Yukon) Limited is the majority owner of all permit areas. Permit #0001 has an expiry date of November 30, 2008. Permit #s 0005-0017 have an expiry date of August 31, 2013. Two significant discovery licences were issued in the region in 1988, and have no expiry date. Future exploration activities in the Eagle Plains basin are uncertain. As per the Yukon oil and gas disposition process, it is anticipated that the region will continue to receive regular calls for bids.

Approximately 475 active mineral claims are present in the region (see Appendix One, Map 44). These include the Rusty Springs and Alto properties to the west of Ni’iinlii’njik (Fishing Branch) Wilderness Preserve, and the recent Fox and Rich claims in the southeastern portion of the region. As of September 2007, an application to explore the Sun mineral claims, also in the southeastern portion of the region, is pending.

There are 28 gravel pits in the region; twenty-seven are located along the Dempster highway. The remaining gravel pit quarry is located on Crow Mountain near Old Crow. This quarry was developed in 2004 to service the needs of the community. One telecommunication tower is present along the Dempster highway. Site specific dispositions showing gravel pits and the communication tower are shown in Appendix One, Map 49.

A detailed description of land dispositions for each sector is provided in Section 4.1.

2.4.6 Dempster Highway Corridor

The Dempster Highway is the only major all-season gravel road within the region. The road traverses approximately 200 km of the southeast portion of the planning region, through Eagle Plains and skirting the foothills of the Richardson Mountains. The highway was completed in 1979. The Dempster Highway is further discussed in Section 4.1.8, transportation.

The highway provides the all-season road link between southern Canada, Yukon and the Mackenzie Delta communities of the Northwest Territories. The only permanent facility along the highway in Yukon is the Eagle Plains lodge, which provides a full range of services for travellers.

2.4.7 Adjacent Land Status

In general, most areas adjacent to the planning region are managed with a strong conservation focus or have protected area status. The Arctic National Wildlife Refuge (ANWR) in Alaska borders approximately two-thirds of the western boundary of the region (Appendix One, Maps 1 and 2). Ivvavik National Park borders Vuntut National Park in the northern portion of the planning region.

The Inuvialuit Settlement Region, located northeast of the region on the Yukon North Slope, is under the North Yukon interim land withdrawal (see Section 2.4.3 above or discussion). The Gwich'in Settlement Region in the Northwest Territories is located to the east of the region; the NWT portion of the Dempster Highway corridor and two Gwich'in Conservation Zones (Rat River and James Creek-Vittrekwa River) are found here (Appendix One, Map 1). The Gwich'in regional land use plan was approved in 2003 (Gwich'in Land Use Planning Board, 2003).

Along the Richardson Mountains and Eagle Plains, the region shares a common boundary with the Peel Watershed Planning Region. The southern boundary is the VGFN - Tr'ondek Hwech'in First Nation traditional territory overlap area, which will be part of the future Dawson Planning Region.

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2.5 Economy

The regional economy can be considered a “mixed economy”, where both traditional subsistence harvesting (traditional economic activities) and wage-based activities co-exist. Similar to other First Nations communities in the North American Arctic, residents of Old Crow actively seek participation in a cash economy as a means of supporting subsistence activities.

2.5.1 Traditional Economy

A large proportion of the economic activity in Old Crow is still focused on subsistence harvesting activities including hunting, fishing, and trapping. The Old Crow traditional economy is described in Section 4.1.7. Locations of and participation rates in subsistence harvesting activities are reported in Sections 3.3 (current First Nations Land Use) and 4.1.7

2.5.2 Market and Wage-Based Economy

The region currently has one of the lowest levels of wage-based economic activity in the Yukon. The planning and delivery of government services (health and social services, housing, education, administration and transportation) and government transfer payments are the primary economic inputs.

According to a 1993 assessment, Old Crow’s cash economy provided about 90 total jobs, most of which are part time or seasonal. The positions equal approximately 53 full-time equivalent jobs (Kofinas, 1998). These employment figures have not changed significantly over the past ten years. Most of the jobs in Old Crow depend directly or indirectly on funds allocated through the VGFN Final Agreement.

Between the 1950s-80s, some Old Crow residents participated in oil and gas and mineral exploration activities throughout the region. For the past twenty years, low levels of resource-based exploration in the region have not provided significant wage-based employment opportunities to residents.

2.5.2.1 Participation Rates in Wage-Based Economy

The proportion of adults involved in the Old Crow market economy and labour market is smaller than for Yukon as a whole. The 2001 census indicated that 73% of Old Crow residents over 15 years of age were involved in the formal labour market, while the average for Yukon was 80% (Yukon Bureau of Statistics, 2001).

Sixty percent of 15-24 year olds reported being involved in the labour market; the Yukon-wide level of involvement for this age group is closer to 70% (Yukon Bureau of Statistics, 2001). This may be indicative of limited employment opportunities for young adults in Old Crow, or people choosing not to participate in wage-based employment. Accounting for the lower participation rate, unemployment is still generally higher in Old Crow than for Yukon as a whole (Government of Canada et al. 2004). However, while participation rates in wage-based economic activity may be lower, Old Crow residents have higher participation rates in traditional economic activities than many other Yukon communities.

Wage-based work in Old Crow is less likely to be full-time, full-year than the Yukon average. The 2001 Census reported that 32% of all Old Crow workers were working full time, full year compared with 46% for the Yukon as a whole (Yukon Bureau of Statistics, 2001). At the same time, approximately 7% of Old Crow residents working in the market economy reported they were primarily self-employed.

Some Old Crow residents participate in wage-based employment outside of the community, in a variety of geographic locations within and outside of the Yukon. These employment opportunities represent various sectors including government services, oil and gas exploration, mineral exploration and transportation. Approximately 65% (550) of the total 800 Vuntut Gwitchin First Nation beneficiaries reside outside of Old Crow and the planning region.

2.5.2.2 Sources of Wage-Based Employment

Vuntut Gwitchin government services provide approximately 80% of the total wage-based employment in Old Crow. The Vuntut Gwitchin Government receives approximately $9.8 million in federal transfer payments annually through their final agreement (approximately $35,000 per Old Crow resident). Since the Vuntut Gwitchin Government is also responsible for providing many municipal services in the unincorporated community, First Nation Government employment includes such activities as construction, building maintenance, water and fuel delivery, and similar municipal responsibilities. Vuntut Gwitchin Government also provides social services, justice, health, education and Elder support programs, some of which are offered in partnership with other governments and agencies.

Yukon and Federal Government-financed capital infrastructure projects such as the Old Crow airport terminal and runway upgrade, the riverbank stabilization program and construction of the Old Crow winter road offer important short-term or seasonal wage employment opportunities. Other service employers such as power utilities, education, communications and health care provide additional full and part-time employment for Old Crow residents. Parks Canada, through Vuntut National Park operations, also provide seasonal or project specific employment opportunities. Air North, providing scheduled air passenger and cargo transportation service to Old Crow, is the largest private sector employer in the community.

Old Crow also hosts many academic researchers and film crews. Some Old Crow residents act as guides and provide logistics for these visitors, both in summer and winter months. These visitors also require in-town lodging and therefore service the local beds and breakfasts. Both groups may also seek direct assistance where field assistants, camp cooks, and similar positions are required. The direct economic impact of these visitors is not currently known, but is discussed further under Section 4.1.1, Tourism and Recreation.

2.5.2.3 Income Characteristics

The most recent available economic data is the 2001 Census. Income statistics for Old Crow residents compared to Yukon and Canada are reported in Table 2.5.1.

Table 2.5.1. Income statistics for Old Crow residents compared to Yukon and Canada. Source: Yukon Bureau of Statistics (2001).

Group	Annual Median Income ($)		
	Old Crow	Yukon	Canada
Males (15 years and older)	$15,232 (105 males)	$29,753 (10,865 males)	$29,276 (11,189,035 males)
Females (15 years and older)	$14,667 (105 females)	$24,579 (10,810 females)	$17,122 (11,534,015 females)
Families	$44,672 (75 families)	$63,490 (7,815 families)	$55,016 (8,371,020 families)
Households	$28,224 (120 households)	$51,930 (11,360 households)	$46,752 (11,562,975 households)

2.5.3 Transportation and Related Infrastructure

Road, air and water are all important modes of transportation in the planning region. Transportation networks and infrastructure play a major role in land use and economic development in remote northern jurisdictions. In northern Yukon, transportation infrastructure is currently limited. Much of the region is remote and inaccessible for portions of the year. Section 4.1.8 provides a detailed discussion of surface and air transportation infrastructure and considerations.

2.5.3.1 Roads and Trails

The Dempster Highway is the only major all-season, maintained highway in the planning region (Appendix One, Maps 1 and 2). Completed in 1979, the highway links Yukon and southern Canada to the Mackenzie delta communities of Fort McPherson, Tsiigehtchic and Inuvik in NWT. Most current and future transportation interests within the region relate to the transport of materials and goods along the Dempster Highway corridor.

Old Crow is the only community in the Yukon without all-season road access. On an as needed basis, a winter road between Old Crow and the Dempster Highway is constructed (Appendix One, Maps 1 and 2). The winter road is used to transport large quantities of building materials, construction equipment, vehicles or other large items. The winter road follows the same routing each time it is constructed and generally follows a series of historic tote roads, survey and seismic lines constructed during the 1950s-1980s period of oil and gas exploration. The winter road was last open during the winter of 2004.
An extensive network of winter trails exists in the vicinity of Old Crow. The Old Crow – Fort McPherson winter trail is used for occasional snowmobile and dogsled travel between the two communities (Appendix One, Map 41).

2.5.3.2 Air Transportation

Regular scheduled air service meets the daily needs of Old Crow, with chartered air service used to accommodate major freight volumes, including fuel. Air transport facilitates the movement of people between Old Crow, Dawson, Inuvik, Whitehorse and seasonally, Fairbanks (Alaska).

2.5.3.3 Water Transportation

Some of the major rivers of the region, most importantly the Porcupine, Eagle, and Bell, facilitate summer and winter travel for residents, and river-based wilderness tourism and recreation (Appendix One, Map 41). Many of the tourism and recreation pursuits are associated with river travel along the Eagle, Bell, and Porcupine rivers.

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2.6 Biophysical Setting

This section provides a description of the biological and physical setting of the North Yukon Planning Region. Physiography, geology, climate, glacial history, landscape types (vegetation and soils), natural disturbance regimes and climate change are discussed. *Ecoregions of the Yukon Territory – Biophysical Properties of Yukon Landscapes* (Smith et al. 2004) should be referenced for detailed Ecoregion descriptions and additional background information.

2.6.1 Physical Environment

2.6.1.1 Physiography and Bedrock Geology

Appendix One, Map 3 provides an overview of the region's bedrock geology. Bedrock in the region is composed of a variety of rock types of different ages. Sedimentary rocks (sandstones, shales, carbonates, mudstones and clastics) are the predominant type, with some older igneous intrusive and volcanic rocks present. The most extensive bedrock type is the Mesozoic sedimentary rocks in the Eagle Plain area. Bedrock geology is described by Roots and Hart (2004).

The region contains three distinct physiographic landscapes – mountains, plateaus and basins. Major mountain ranges are the British Mountains, Barn Mountains, Old Crow Range, Keele Range, David Lord Range, Richardson Mountains and Northern Ogilvie Mountains. The Eagle Plains is a broad plateau bounded by the Richardson Mountains, Northern Ogilvie Mountains and David Lord Range. Old Crow Flats and its surrounding pediment slopes is the major structural basin. Elevation ranges from a low of approximately 300 m in Old Crow Basin to a high of 1,600 m in the Northern Ogilvie Mountains. Extensive areas of bedrock are exposed in the major mountain ranges. In Old Crow Basin, hundreds of metres of sediments overlie the bedrock.

The region is part of the Mackenzie Platform. Prior to 190 million years ago, a broad shallow marine continental shelf characterized North America's western continental margin. The shelf accumulated carbonate and clastic sediments for over a billion years. These rocks now define the Mackenzie Platform. The total thickness of sedimentary layers is as much as 14 km. The oldest strata (from 1850 to 500 Ma) are exposed in uplifted blocks in the Ogilvie Mountains.

Beginning during the Ordovician period (at about 450 Ma), a submarine rift valley developed within the continental shelf. This region of deeper water accumulated sediments in what is now known as the Selwyn Basin. Its oldest rocks are sandstone and grit, overlain by dark shale and chert, with volcanic flows that erupted from undersea rifts. In the Devonian period (about 380 Ma), black siltstone and pebble conglomerate were deposited over both the Selwyn Basin and adjacent Mackenzie Platform. These were subsequently covered by extensive sandstone, limestone, and shale until about 170 Ma, when they were uplifted above sea level.

Younger sedimentary rocks (less than 150 Ma) underlie Eagle Plains and are scattered in outcrops surrounding the Old Crow basin and the coastal plain. Shale, mudstone and fine brown sandstone are the predominant rock types in the northern Yukon. They formed in a shallow marine and non-marine basin that received sediments from the rising mountains to the southwest. These are the source rocks for potential oil and gas resources in the region.

The British and Barn mountains, an eastern continuation of the Alaskan Brooks Range, are part of the Arctic–Alaska Terrane, consisting of continental margin sediments (Yukon Ecoregions Working Group, 2004a). The south-trending Richardson Mountains resulted from the uplifting of Paleozoic deep-water clastic sediments.

Bedrock chemistry plays a large role in determining the acidity of soils, with soils derived from weathered shale and sandstone generally being very acidic. Soil chemistry affects water chemistry and quality, with resultant effects on fish and fish habitats (see Section 2.8)

2.6.1.2 Surficial Geology and Glacial History

Appendix One, Map 4 provides an overview of the region’s surficial geology. Surficial geology is described by Bond et al. (2004). Major surfical geology materials are bedrock and colluvium. Glaciolacustrine sediments were deposited in the three major basins environments, Old Crow Flats, Bluefish-Cadzow and Whitefish, in pro-glacial lakes. Modern stream valleys such as the Porcupine and Eagle rivers contain alluvial gravels and sediments. Mountain peaks and slopes are covered with frost-shattered rock; rock tors and pinnacles are common.

Glacial history of the region has influenced the landforms, hydrology, surficial geology, ecology and human history. The region is part of Beringia, the ancient landscape of northwestern North America and eastern Siberia that remained unglaciated during the last ice ages. Portions of the region have remained free of ice for at least two million years. In this ancient landscape, most upland areas outside of major river valleys are comprised of colluvial or bedrock surficial materials; there are no recent glacial tills.

Extensive gently inclined pediment slopes, formed over hundreds of thousands of years of weathering and slope processes, are a conspicuous part of the northern Yukon landscape. The Old Crow basin (e.g., Driftwood River and Blackfox Creek) contains the best examples of these pediments surfaces. Glacial lake sediments are present in Old Crow Flats, Bluefish and Whitefish wetlands, and some other low-lying areas. All major wetland complexes are contained within the extent of the glacial lake sediments, and are maintained through thermokarst processes.

The course of the Porcupine River has undergone a significant diversion in the past 15,000 years. Prior to the most recent glacial advance, the McConnell phase, the Porcupine River watershed drained to the northeast through the Bell River and Summit

Lake-Rat Pass, into the Mackenzie River and Arctic Ocean. As the Laurentide ice sheet approached the Richardson Mountains from the east, it created an ice dam across Rat Pass blocking the flow of the Porcupine River. Water from the Porcupine River began to collect in Old Crow Flats, Bluefish and Whitefish basins. Eventually, approximately 10,000 years ago, the Porcupine River cut a new channel to the west, along its present course through the Ramparts, draining into the Yukon River system. The draining of the glacial lakes was likely a catastrophic event.

Evidence of the glacial lakes includes elevated beach ridges and many metres of fine-grained lake sediments. Also at the end of the last ice age, large volumes of water from melting ice sheets in the Peel River watershed flowed into the region through the major rivers (Eagle, Whitestone and Miner). The extensive terraces and incised valleys of these rivers were formed by the glacial meltwaters, with the best example being the Eagle River.

A variety of periglacial landforms are present, including solifluction lobes, sorted circles and patterned ground on peat plateaus. Cryosols, or soils affected by permafrost, are the dominant soil types.

2.6.1.3 Climate

A description of the region's climate is provided by Wahl (2004). The region has the coldest average winter and annual temperatures in Yukon (–8 to –12^{o}C). Average January temperatures hover around –35^{o}C with Old Crow Flats experiencing the coldest average winter temperatures (-40^{o}C). July temperatures occasionally reach 30^{o}C. The region receives 300-400 mm of precipitation annually, with most falling as rain during the summer period.

Northern Yukon and surrounding areas have undergone detectable warming over the past three to four decades. Estimates for the period 1966-1995 are approximately 0.5°C warming per decade (Serreze et al. 2000).

2.6.1.4 Hydrology

Appendix One, Map 5 provides an overview of the region's watersheds. A description of watersheds and hydrologic regions is provided by Janowicz (2004).

2.6.1.4.1 Watersheds

Within the region, the Porcupine River watershed drains about 12% or 58,000 km^2 of the Yukon, including the southern portion of the British Mountains, the western portion of the Richardson mountains and the northeastern portion of the Ogilvie Mountains. Though the Porcupine River drains into the Yukon River at Fort Yukon, Alaska, and is actually a part of the Yukon watershed to the south, the two portions are treated as separate watersheds. The Porcupine and Yukon drain into the Bering Sea in Alaska. While the Porcupine watershed contains numerous small-to moderate-sized lakes, they are mainly concentrated in the Bluefish, Bell-Whitestone and Old Crow basins. Outside of these major basins and off-channel lake habitats, lakes are rare.

The region is within the North Hydrologic Region. This hydrologic region encompasses the Mackenzie Mountains Ecoregion in the south and the British–Richardson Mountains Ecoregion in the north. Streamflow characteristics are largely controlled by the continuous underlying permafrost. Peak flows, which normally occur in June, are greater relative to areas with less permafrost, due to shorter pathways through the watershed as a result of limited infiltration rates. As in other regions, summer rain events will produce secondary peaks, and sometimes an annual peak on smaller streams, especially in mountainous areas. Minimum flows generally occur in March and tend to be lower than the Interior and Western hydrologic regions to the south, because of the effect of lower winter temperatures on groundwater flow. Small streams within this region frequently experience zero flow, while some intermediate-sized streams may occasionally experience zero winter flow.

2.6.1.4.2 Major Rivers

The Porcupine River watershed contains a number of major sub-basins. In addition to the Porcupine River mainstem, the most significant rivers in the region are the Eagle, Bell, Whitestone, Miner, Fishing Branch, and Old Crow rivers. Other important tributaries are the Rock, Bluefish, Driftwood and Johnson-Pine Creek drainages. Within the region, the Old Crow River watershed is the largest sub-basin to the Porcupine.

The Porcupine, Eagle and Bell rivers are important transportation corridors for residents and visitors to the region. The Major Rivers and their immediate environments also represent some of the most sensitive and important ecological environments within the region. River valleys are key areas for many species including moose, furbearers, and birds. River aquatic environments are fish and waterfowl habitat, and facilitate fish migration between critical seasonal habitats.

2.6.1.5 Permafrost

The entire region is underlain by continuous permafrost. Permafrost has a large effect on the hydrology, terrain and distribution of landscape types. Permafrost depths range from about 60 m at Old Crow to greater than 100 m in Eagle Plains. Active layer depths range from 30 cm in wet, poorly drained areas to greater than 100 cm on well-drained, south-facing slopes.

Permafrost largely controls streamflow characteristics (Yukon Ecoregions Working Group, 2004b). Permafrost reduces the capacity of the soil to store groundwater, resulting in rapid spring and summer run-off and limited storage over the winter period. The region’s major wetland complexes (Old Crow Flats, Bluefish-Cadzow Lake, and

Whitefish), and the thermokarst lakes within them are very sensitive permafrost environments (Appendix One, Map 4).

Major factors that can contribute to the degradation or loss of permafrost in the region include wildfire, climate change, and human surface disturbance. Human disturbances, including roads and seismic lines, may have impacts on hydrology in regions with permafrost, but the extent of these impacts is not yet fully understood. Small-scale debris flows and slumps are common occurrences when permafrost has been degraded.

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2.6.2 Ecosystems

The planning region contains a diversity of ecosystems. Climate, latitude, landforms, geology, elevation, surficial materials and natural disturbance regimes all play a role in affecting their distribution and composition. Ecosystems can be described at a range of spatial scales. Regional ecosystems describe general ecological conditions across broad geographic areas. They are influenced by regional climate and landforms. Local ecosystems refer to specific Landscape Types, or vegetation-soil associations.

2.6.2.1 Ecoregions and Ecodistricts

The National Ecological Framework of Canada provides a hierarchical classification to describe large land units based on their ecological similarity. The planning region is entirely within the Taiga Cordillera Ecozone, a large climatic and physiographic region region spanning much of northwestern Canada. Ecoregions are smaller, more defined land units nested within Ecozones, generally represented at a mapping scale of 1:1 million. Portions of six Ecoregions occur within the region; Old Crow Flats, Old Crow Basin, Eagle Plains, North Ogilvie Mountains, British Richardson Mountains and Davidson Mountains[1] (Appendix One, Map 6; Table 2.6.1). Detailed Ecoregion descriptions are provided in Smith et al. (2004).

Ecodistricts are sub-units of Ecoregions that are commonly mapped at 1:250,000 scale. Ecodistricts represent landscapes of intermediate size with ecologically similar and repeating patterns of landforms and vegetation. There are portions of 24 Ecodistricts within the planning region (Appendix One, Map 6; Table 2.6.1). Owing to their scale of delineation, and their observable characteristics, Ecodistricts should be considered logical and ecologically-meaningful land management units for regional planning. Detailed Ecodistrict descriptions are provided in North Yukon Planning Commission (2007).

[1] The Davidson Mountains Ecoregion is not described in Ecoregions of Yukon (Smith et al. 2004). This Ecoregion resulted from the correlation of ecological boundaries with Alaska following publication of Smith et al. (2004). The Davidson Mountains is the ‘mountainous’ portion of the western Old Crow Basin Ecoregion.

Table 2.6.1. Summary of North Yukon Ecoregions, Ecodistricts and Bioclimate zones.

Ecoregion	Area (% NYPR)	Major Bioclimate Zones	Ecodistrict	Area (% NYPR)
Eagle Plains	33.6	Taiga Wooded	Chance Creek	11.5
			Richardson Foothills West	7.3
			David Lord Range	4.5
			Johnson Creek	4.0
			Whitefish Wetlands	3.6
			Whitestone River	2.6
			Upper Peel River	0.1
North Ogilvie Mountains	22.9	Taiga Wooded; Taiga Shrub; Alpine	Keele Range	7.1
			Kandik River	6.7
			Fishing Branch River	6.2
			Nahoni Range	2.8
			Tatonduk Mountains	0.1
Old Crow Basin	14.6	Taiga Wooded; Taiga Shrub	Driftwood River	9.9
			Lord Creek	4.7
Old Crow Flats	11.9	Taiga Wooded	Old Crow Flats Wetlands	9.2
			Bluefish Wetlands	2.7
British Richardson Mountains	8.8	Taiga Shrub; Alpine;	Bell River	5.7
			Richardson Mountains North	1.3
			Canyon Creek	1.2
			Barn Range	0.3
			Richardson Mountains South	0.2
			British Mountains	0.1
Davidson Mountains	8.2	Taiga Wooded; Taiga Shrub; Alpine	Timber Creek	4.4
			Old Crow Range	3.8

2.6.2.2 Bioclimate Zones

Bioclimate zones are broad ecological zones that represent relatively stable, observable vegetation types or environments. They provide a means to describe broad ecological patterns that result from climatic, elevation or latitudinal influences. Bioclimate zones are a level of ecological classification in the developing Yukon Biophysical Mapping Framework. Three major bioclimate zones are recognized in the planning region: Alpine, Taiga Shrub and Taiga Wooded, with a small inclusion of the Tundra zone in the northern portion of the region (Appendix One, Map 7). Each zone is described below.

Taiga Wooded bioclimate zone

The Taiga Wooded bioclimate zone is characterized by low-middle elevation spruce forests with an open or sparse forest canopy. Deciduous trees (aspen, poplar and birch) may be significant forest components in some areas; they may be dominant tree species following forest disturbances such as fire or debris flows. This zone covers about 75% of the North Yukon Planning Region. It characterizes the broad plateaus of the region (e.g., Eagle Plains) and the valley bottoms and lower mountain slopes. The distribution and depth of permafrost is a major factor affecting vegetation distribution and dynamics, with relative soil moisture being very important during summer periods. Hill crests, middle-lower slopes and flat, poorly drained areas have characteristic vegetation communities. In steep terrain, active slope processes (rock slides, slumps, talus cones) play in important role in the actual distribution of forested areas.

Taiga Shrub bioclimate zone

The Taiga Shrub bioclimate zone is characterized by tall or low shrub vegetation with sparse or sporadic krummholtz coniferous tree cover. Herb vegetation (tussock tundra) may also be important. This zone covers about 17% of the region, and contains important barren ground caribou habitats. Taiga Shrub generally occurs at mid-high elevations in the mountainous areas of the region, with the best representations being in the Richardson and Northern Ogilvie Mountains. However, the geographic distribution of the Taiga Shrub bioclimate zone is also influenced by Arctic weather systems (eg. along the west slopes of the Richardson Mountain foothills) and topography, resulting in potentially complex ecological patterns. In the northern portion of the planning region, the low-middle elevation Taiga Shrub areas grade into Tundra. In the future, consideration may be given to developing a ‘low’ and ‘high’ elevation variant of this bioclimate zone.

Alpine bioclimate zone

The Alpine bioclimate zone represents the highest elevations of mountain areas. Sparsely vegetated dwarf shrub, herb/cryptogram and low stature, scattered krummholtz coniferous trees are the dominant vegetation types. In very high elevation or rugged areas, large expanses may include bare rock, colluvium or scattered relatively permanent snow/ice patches. The extent of unvegetated Alpine areas in northern Yukon is generally more extensive than in the Boreal Cordillera of southern Yukon. The Alpine bioclimate zone represents about 7% of the planning region, with the most extensive areas occurring in the Nahoni Range, Bell River and Canyon Creek Ecodistricts.

Tundra bioclimate zone

The Tundra bioclimate zone represents low and mid-elevation, non-forested conditions dominated by dwarf shrub and herb/cryptogram vegetation. Latitude is the primary control on its’ geographic distribution. The Tundra zone is north of latitudinal tree-line. In Yukon, the Tundra bioclimate zone is under the influence of the extremely cold Southern Arctic weather system, with proximity to the Beaufort Sea. While only the most northerly portion of the planning region is shown as the Tundra bioclimate zone (Appendix One, Map 7), the mapped boundary between Tundra and Taiga Shrub is not precise. As described above for Taiga Shrub, bioclimate mapping in the northern portion of the planning region may require future re-interpretation.

2.6.2.3 Landscape Types

Landscape types are general vegetation – soil associations within regional ecosystems. Landscape types represent the 'building blocks' of ecosystems and form the basis for the description of landscapes and regional wildlife habitats. Twenty-eight distinct Landscape Types are recognized within the North Yukon Planning Region (Appendix One, Map 8; Table 2.6.2). Table 2.6.3 provides a description and reference image for each.

The landscape types are broadly organized into Upland and Lowland classes, with Lowland ecosystems being influenced by surface water. Upland Ecosystems are stratified by elevation into High Elevation and Low to Mid-Elevation Ecosystems. Lowland ecosystems are separated into Riparian, Wetland and Aquatic types. Low-mid elevation upland types are further organized around the concept of landscape position and relative soil moisture. Some of the landscape types are considered to be successional stages of a forested type. The representation of each landscape type within the region is shown in Table 2.6.2.

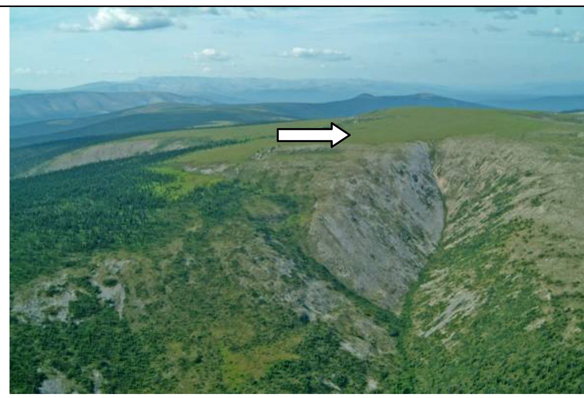
Landscape types were classified and mapped through the North Yukon Biophysical Mapping Project. A predictive modeling approach was utilized. A number of different people and agencies collaborated on the development of the North Yukon biophysical map. Detailed methods and additional landscape type reference photos are contained in Francis et al. (2005), available from the NYPC website (www.nypc.planyukon.ca).

Table 2.6.2. Summary of North Yukon Planning Region Landscape Types (updated Feb. 2006).

Landscape Type	Area (km^2)	Area (% NYPR)
HIGH ELEVATION, UPLAND ECOSYSTEMS		
High Elevation Rock/Exposed	2,756	5.0
High Elevation Sparsely Vegetated	2,628	4.7
High Elevation Herb	1,785	3.2
High Elevation Shrub	835	1.5
High Elevation Coniferous Forest	331	0.6
LOW-MIDDLE ELEVATION, UPLAND ECOSYSTEMS		
Low Elevation Exposed/Sparsely Vegetated	343	0.6
Wet Sites *		
Wet Herb	4,674	8.4
Wet Shrub	7,028	12.6
Wet Mixedwood Forest	137	0.3
Wet Coniferous Forest	2,515	4.5
Moist Sites		
Moist Herb	3,769	6.8
Moist Shrub	5,823	10.5
Moist Mixedwood Forest	297	0.5
Moist Coniferous Forest	3,057	5.5
Mesic Sites		
Mesic Herb	3,787	6.8
Mesic Shrub	4,212	7.6
Mesic Mixedwood Forest	324	0.6
Mesic Coniferous Forest	3,672	6.6
RIPARIAN ECOSYSTEMS		
Riparian - Exposed	131	0.2
Riparian - Herb	1,073	1.9
Riparian - Shrub	2,256	4.1
Riparian - Mixedwood	119	0.2
Riparian - Conifer	763	1.4
Riparian – Wetland *	436	0.8
WETLAND ECOSYSTEMS *		
Wetland - Herb	48	0.1
Wetland - Shrub	353	0.6
Wetland - Forest	823	1.5
AQUATIC ECOSYSTEMS *		
Open Water (standing and flowing)	1588	2.9

* Note: see Section 2.5.4.3 regarding Wetlands

Table 2.6.3. North Yukon Planning Region Landscape Types (LT).

Landscape Type and Description	Reference Image [2]
UPLAND, HIGH ELEVATION ECOSYSTEMS (Alpine and High Taiga-Shrub Bioclimate Zones)	
High Elevation Rock/Exposed Exposed bedrock, colluvium and talus in mountainous areas. May contain sporadic lichen and dwarf shrub-herb vegetation types. Occurs in the highest elevation and most rugged mountain areas of the region. This LT is characterized by steep slopes. Meta-stable LT	
High Elevation Sparsely Vegetated High elevation sparse lichen, herb and dwarf-low shrub, typically occurring on moderate to gentle slopes. Meta-stable LT	
High Elevation Herb High elevation moist/mesic herb and low shrub, typically occurring on moderate to gentle slopes. Meta-stable LT with high susceptibility to climate change-induced change	

[2] All photos: J. Hawkings, CWS, J. Meikle, YG, and I. Anderton, EDI.

Table 2.6.3 (cont'd). North Yukon Planning Region Landscape Types (LT).

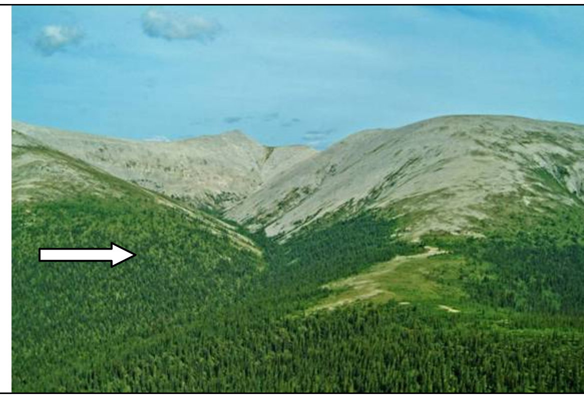
High Elevation Shrub Mesic to moist, moderate-tall stature shrub communities occurring in mountain environments. Typically occurs with sporadic, low stature trees. Over long time periods High Elevation Shrub may be successional to High Elevation Coniferous Forest (1 - 150 years post-disturbance).	
High Elevation Coniferous Forest High elevation, moist to mesic sites with open canopy coniferous forests. This LT typically occurs on moderate-steep slopes. High Elevation Coniferous Forest is a relatively stable forest type that experiences very long fire cycles. Successional Forest LT	
LOW-MIDDLE ELEVATION, UPLAND ECOSYSTEMS Taiga Wooded and Low-Taiga Shrub Bioclimate Zones	
Low Elevation Exposed/Sparsely Vegetated Active slumps, debris flows and permafrost degradation. Rate and trajectory of vegetation recovery may be highly variable, and difficult to predict. Considered a meta-stable LT	

Table 2.6.3 (cont'd). North Yukon Planning Region Landscape Types (LT).

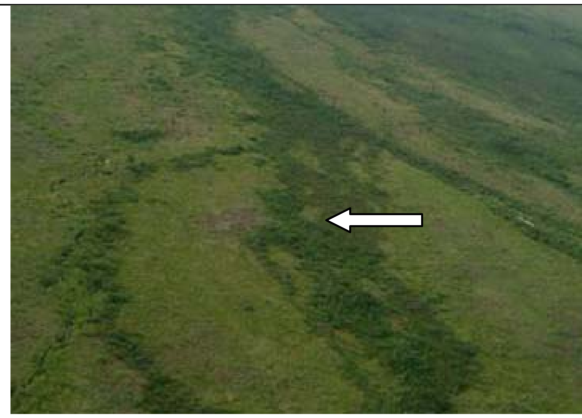
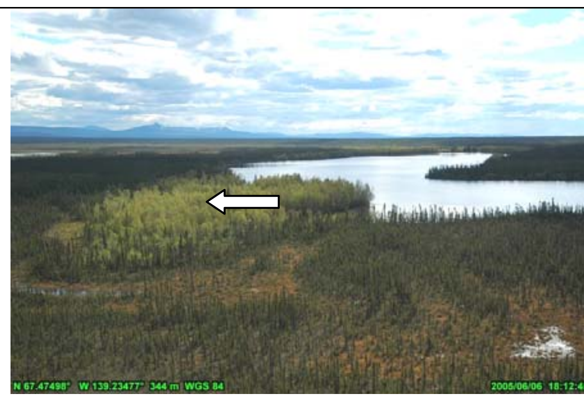
Wet Sites	
Wet Herb Poorly drained herbaceous tussock vegetation communities occurring on flat to gentle-slopes. This LT is common on pediment slopes and is most extensive in the northern portion of the region. Meta-stable LT with high susceptibility to climate change-induced change	
Wet Shrub Poorly drained shrub vegetation communities occurring on flat to gentle slopes. Common on pediment slopes throughout region; Wet Shrub is the most extensive LT in the region. On pediment slopes, Wet Shrub is commonly found in runnel channels, as pictured. Meta-stable LT	
Wet Mixedwood Forest Early-mid successional, poorly drained mixedwood forest communities occurring on flat to gently-sloping terrain. Birch and poplar are most common deciduous tree species. Successional to Wet Coniferous Forest (100 year transition)	

Table 2.6.3 (cont'd). North Yukon Planning Region Landscape Types (LT).

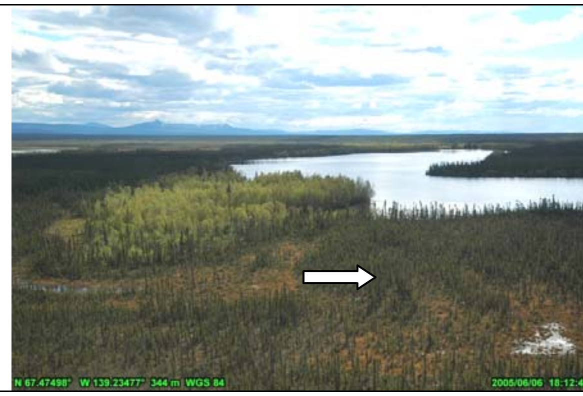
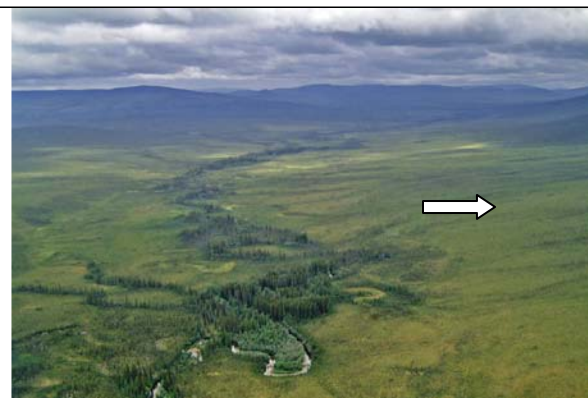
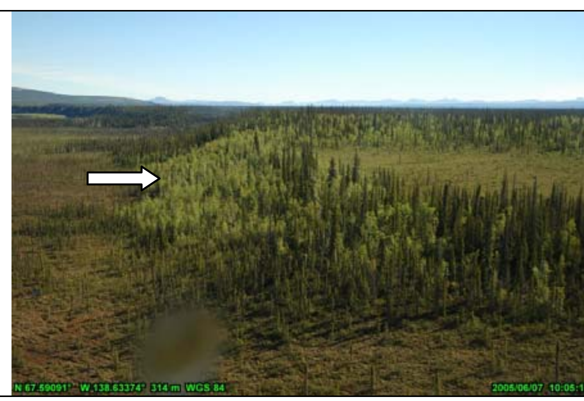
Wet Coniferous Forest Poorly drained black spruce-dominated coniferous forest communities occurring on flat to gentle slopes. Thick organic materials are common. Successional Forest LT	
Moist Sites	
Moist Herb Early-successional, post-disturbance herbaceous vegetation communities occurring on receiving sites (gullies and lower slope positions). Successional to Moist Shrub (1 – 5 years post-disturbance)	
Moist Shrub Early-mid successional, post-disturbance shrub vegetation communities occurring on receiving sites (gullies and lower-slope positions). Successional to Moist Mixedwood (6 – 40 years post-disturbance)	
Moist Mixedwood Forest Mid-successional, post-disturbance mixedwood forest communities occurring on receiving sites (gullies and lower-slope positions). Successional to Moist Coniferous Forest (41 – 80 years post-disturbance)	

Table 2.6.3 (cont'd). North Yukon Planning Region Landscape Types (LT).

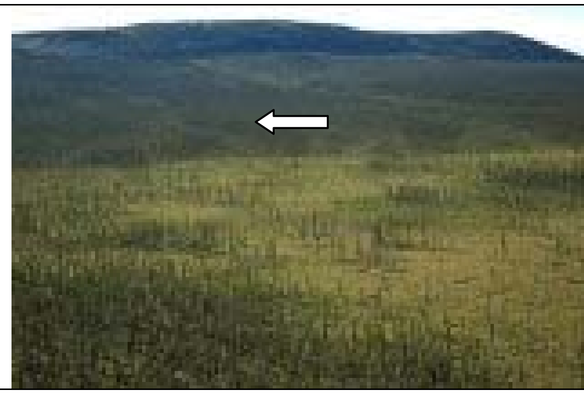
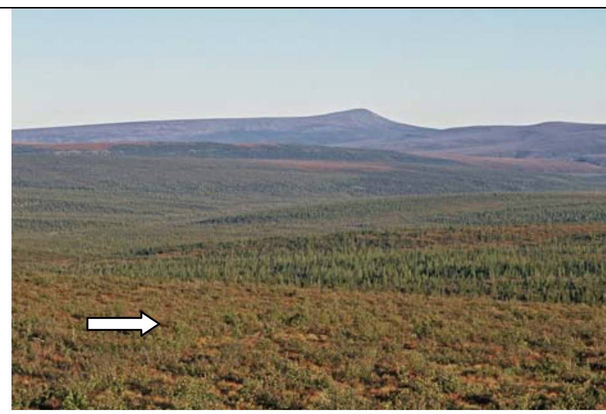
Moist Coniferous Forest Late-successional coniferous forest communities occurring on receiving sites (gullies and lower slope positions). Successional Forest LT	
Mesic Sites	
Mesic Herb Very early-successional, post-disturbance herbaceous vegetation communities occurring on mesic sites (upper slopes and slope-crests). Successional to Mesic Shrub (1 – 5 years post-disturbance)	
Mesic Shrub Early-successional, post-disturbance shrub vegetation communities occurring on mesic sites (upper slopes and slope-crests). Successional to Mesic Mixedwood Forest (6 – 25 years)	

Table 2.6.3 (cont'd). North Yukon Planning Region Landscape Types (LT).

Mesic Mixedwood Forest Mid-successional, post-disturbance mixedwood forest communities occurring on mesic sites (upper slopes and slope-crests). Birch, poplar and aspen deciduous species may all be present. Successional to Mesic Coniferous Forest (26 – 60 years post disturbance)	
Mesic Coniferous Forest Late-successional coniferous forest communities occurring on mesic sites (upper slopes and slope-crests). Mesic coniferous forests may contain high lichen abundance. Successional Forest LT.	
RIPARIAN ECOSYSTEMS	
Riparian – Exposed Exposed alluvial gravels and sediments along rivers. The amount of exposed areas in riparian environments is dynamic and dependent on time of year and precipitation levels. Meta-stable LT	

Table 2.6.3 (cont'd). North Yukon Planning Region Landscape Types (LT).

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Riparian Herb

Off-channel, wet herbaceous vegetation communities in river valleys. Similar ecological properties as Wet Herb.

Meta-stable LT

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Riparian Shrub

Early-mid successional shrub vegetation communities in river valleys. Riparian shrub is influenced by active fluvial processes.

Successional to Riparian Mixedwood Forest (1 – 40 years post disturbance or colonization of exposed river sediments)

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Riparian Mixedwood Forest

Mid-successional mixed-wood forest communities in riparian zones.

Successional to Riparian Coniferous Forest (41 – 80 years post disturbance or colonization of exposed river sediments)

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Table 2.6.3 (cont'd). North Yukon Planning Region Landscape Types (LT).

Riparian Coniferous Forest Late-successional coniferous forest communities in riparian zones. Successional Forest LT	
Riparian – Wetland Off-channel wetlands with variable vegetation composition but typically composed of herbaceous vegetation and open water. Ecologically similar to Riparian Herb and Wetland Herb. Meta-stable LT.	
WETLAND ECOSYSTEMS	
Wetland – Herb Wetlands dominated by herbaceous vegetation; may include emergent aquatics. Typically occurs in complexes with shrub and forested wetlands. Meta-stable LT	

Table 2.6.3 (cont'd). North Yukon Planning Region Landscape Types (LT).

Wetland – Shrub Shrub-dominated wetlands. Typically occurs in complex with herb and forested wetlands. Meta-stable LT	
Wetland – Forested Wetlands with high proportion of tree cover, typically spruce or larch. Forest wetlands may include bogs, fens and other types. Wetland – Forest occurs in a mosaic nature with shrub and herb wetlands. May be ecologically similar to Wet Coniferous Forest. Meta-stable LT	
AQUATIC ECOSYSTEMS	
Open Water Surface water features, both moving (lotic) and still-water (lentic) environments.	

2.6.2.3.1 Plant Species List and Status

Approximately 600 species of plants occupy the planning region; 93 are recorded as rare in the region (Bruce Bennett, Yukon Department of Environment, unpublished data, 2005) according to criteria developed by NatureServe International (2007). There are no plant species of national concern in according to the Status of Endangered Wildlife in Canada (COSEWIC) and the Species at Risk Act (SARA) (Environment Canada, 2007).

Information on plant occupancy was obtained from a summary of various field surveys and reports (Bruce Bennett, Yukon Department of Environment, unpublished data, 2005). The information includes records of plants known or expected to occur within the North Yukon Planning Region. It should be noted that the database of plant species was not obtained from a comprehensive survey of the region, but rather from a compilation of information from various locations. An assessment of plant species' population trends and distribution across the region is not available; however some information is available on population status for some species within the region.

Methods

A rare plant species list for the region was prepared from information provided by Yukon Department of Environment botanist Bruce Bennett (Bruce Bennett, Yukon Department of Environment, unpublished data, 2005). Most of the species are confirmed to occupy the region, although some are expected to be present but have not yet been found. The information was summarized from field surveys and notes spanning the period from 1894 to 1996 (Bruce Bennett, Yukon Department of Environment, 2005; Cody, 1996).

Plant status codes for species of concern are preceded by an "S" and a score that represents sub national ranks applied to the Yukon. The sub national ranks are based on an internationally recognized measure of plant rarity, developed by NatureServe International (2007). The plant status codes are:

S1 – (1-5 populations in Yukon)
S2 – (6-20 populations in Yukon)
S3 – (21-100 populations in Yukon)

Some plant species have uncertain status that fall somewhere between these criteria (i.e. S2/S3) and are noted as such in Table 2.6.4.

Results

Listed below are 93 plant species recorded as rare in the North Yukon Planning Region (Table 2.6.4). Of these, 65 have been documented within the region and 28 are expected to occur. Notes on the general habitats where these plants might be found are included. A full list of 607 plant species known or expected to occur in the region is beyond the scope of this report, but is available from the North Yukon Planning Commission of NatureServe Yukon upon request.

Of note, it is suspected that at least seven, and possibly nine plant species, are non-native to the region and do not occur here naturally. Non-native plant species have been introduced from several sources; re-seeding of areas along the Dempster Highway to promote re-growth of vegetation in areas impacted by construction and other activities has been one of the main sources. Although the seed used for re-seeding the areas comes from species native to the region, often the sources contain a few seeds from species that are not native to the region. Current practices for restoring disturbed areas along the highway rely on natural re-vegetation to avoid this situation. Other introduced non-native species come from seeds deposited in the feces of horses and birds. A few non-native plant species may have spread into the region from introductions that occurred along the Mackenzie River.

It should be noted that many areas within the region have not been surveyed, and there are substantial knowledge gaps in the information. Some species listed here as rare may be common in other parts of the region. Some species expected in the region may be completely absent. Also, a few species that are suspected as non-native may actually be native to the region. Despite the limitations of the available information, this list currently provides the best source of information for determining plant presence and general status in the North Yukon Planning Region.

Table 2.6.4 Occurrence and status of rare plant species in the North Yukon region.

Number	Species[1]	Status[2]	Habitat notes
1	Ground-pine	S1	Woods and clearings
2	Maritime Quillwort	S1	Shallow water in silty lakesides or pond margins
3	Northwestern or Boreal Moonwort	S2/S3	Grassy and rocky slopes and meadows, mostly alpine
4	Rusty Cliff Fern	S1	Rocky cliffs and scree slopes
5	Flat-stem Pondweed	S3	Aquatic in lakes to 2m depth
6	Alaskan Wild Rye	S2	Sandy or gravelly riverbanks, riverbars and open hillsides
7	Arctic Wild Rye	S2/S3	Sandy and gravelly riverbanks and bar and on sandy slopes
8	Northern Festuca (e)	S2/S3	Calcareous alpine tundra and rocky slopes
9	Slender Rock-brake	S2	Calcareous shaded crevices and cliffs
10	Oriental Koeler's Grass	S2	Dry to moist tundra, shale screes, and ground squirrel burrows
11	Ice Grass (e)	S2/S3	Alpine snowfields and gravelly snowmelt sites
12	Northern Bluegrass (e)	S1/S2	Shattered bedrock and limestone tundra
13	Polar Bluegrass (e)	S1	Open, well-drained, alpine slopes
14	Siberian Trisetum	S1	Willow-alder thickets and stream banks
15	Two-coloured Sedge	S2	Wet sand and silt by streams
16	Yukon Sedge	S2/S3	Riverbanks and alluvial river flats
17	Arctic Marsh Sedge (e)	S1	Pond edges in tundra
18	Krause's Sedge (e)	S2/S3	Dry calcareous or alkaline soils
19	Lapland Sedge	S2	Wet woodland meadows and bogs
20	Pale Sedge (e)	S3	Wet calcareous lakeside meadows
21	Swollen-beaked Sedge	S2/S3	Wet floating mats or edges of pools in fens
22	William's Sedge	S2/S3	Calcareous sandy soil, often on hummocks pond edges
23	One-glume Spike-rush	S2	Calcareous or saline seepages along riverbanks or lakeshores
24	Rufous Wood-rush	S3	Borders of bogs, marshes and on moist sand and riverbanks
25	Wahlenberg's Wood-rush	S2/S3	Hummocky meadows and alpine slopes
26	Small Yellow Lady's-slipper	S2	Moist calcareous woodlands
27	Spotted Lady's-slipper	S2	Open mossy woods in calcareous soils
28	Northern Willow	S2/S3	Wet to dry mossy tundra
29	Chamisso's Willow	S3	Wet alpine meadows and banks along streams
30	Balsam willow (e)	S2	Moist woodland clearings, fens and bogs
31	Round-leaved Willow (e)	S2/S3	Alpine tundra

[1] Notes about species occurrence in the region: (r)=rare, (o)=occasional, or (u)=uncommon, and (e)=expected to be found north of 66°N, but not currently documented in region
[2] Plant status codes are as follows: S1 (1-5 populations in Yukon), S2 (6-20 populations in Yukon), or S3 (21-100 populations in Yukon – watch list)

Table 2.6.4 (cont'd). Occurrence and status of rare plant species in the North Yukon region.

Number	Species[1]	Status[2]	Habitat notes
32	Alaska Knotweed	S2/S3	Gravel and sandy riverbanks, muddy flats, borders of ponds and disturbed situations
33	Green Sorrel (e)	S1	Moist alpine or subalpine meadows
34	Scamman's Springbeauty (e)	S3	Alpine tundra
35	Slender Mountain Sandwort	S3	Dry gravelly terraces, hillsides and grassy slopes.
36	Low Sandwort	S2	Gravel wash and moist mossy areas on slopes
37	Carnation	S2	Gravelly calcareous riverbanks, terraces and slopes of unglaciated areas
38	Yukon Stichwort	S3	Dry gravelly terraces, hillsides and grassy slopes.
39	Snow Pearlwort	S3	Moist sandy or gravelly lakeshores
40	Large-seeded Nodding Campion	S1	Tundra, gravel slopes, talus, cliffs
41	Northern Bog Starwort	S2	Alpine slopes, meadows, shores of lakes and streams
42	Matted Starwort	S1	Calcareous scree slopes at high altitudes
43	Umbellate Starwort (e)	S1	Moist alpine slopes
44	Common Coontail	S2	Shallow lakes and ponds
45	Porcupine River Thimbleweed	S2	Arctic-alpine tundra often in scree
46	Floating Marsh-marigold	S2	Ponds, ditches, and marshy meadows
47	Northern Larkspur	S1	Alpine meadows and valleys
48	Arctic Buttercup	S2	Alpine talus and gravelly slopes
49	Turner's Buttercup	S2/S3	Subalpine meadows and moist streams
50	Walpole's Poppy	S2	Dry calcareous alpine tundra and rocky outcrops
51	Elegant Rockcress	S1	Open grassy slopes
52	Smooth Northern Rockcress	S2/S3	Calcareous gravels, scree slopes, and sea shores
53	Purple Braya	S2/S3	Calcareous gravels, scree slopes, and sea shores
54	Baffin Whitlow-grass	S3	Alpine rocky and turfy slopes
55	Macoun's Whitlow-grass	S3	Moist alpine screes and turf
56	Arctic Pennycress (e)	S1/S2	Arctic and alpine turfy tundra
57	Spotted Saxifrage (e)	S2	Alpine tundra, meadows and rocky slopes

[1] Notes about species occurrence in the region: (r)=rare, (o)=occasional, or (u)=uncommon, and (e)=expected to be
found north of 66°N, but not currently documented in region
[2] Plant status codes are as follows: S1 (1-5 populations in Yukon), S2 (6-20 populations in Yukon), or S3 (21-100 populations in Yukon – watch list)

Table 2.6.4 (cont'd). Occurrence and status of rare plant species in the North Yukon region.

Number	Species[1]	Status[2]	Habitat notes
58	Cushion Saxifrage (e)	S2	Rock outcrops, shale and calcareous gravel slopes
59	Leafy-stem Saxifrage	S3	Streamsides and lakeshores
60	Bipinnate Cinquefoil	S2	Open meadows and slopes
61	Elegant Cinquefoil	S3	High alpine areas on rocky and gravelly exposed slopes and ridges
62	Arctic Locoweed (e)	S1	Rocky ridges and sand dunes
63	Northern Locoweed	S3	Alpine tundra and rocky ridges
64	Merten's Locoweed (e)	S1	Moist alpine slopes and gravel bars
65	Blackish Locoweed	S3	Stoney alpine slopes
66	Arctic Willowherb (e)	S2	Alpine herbmats
67	Northern Swamp Willowherb (e)	S2/S3	Wet places in river flats
	Willowherb (e)		
68	Mackenzie's Water-hemlock	S3	Marshes and borders of lakes and ponds
69	Macoun's Woodroot	S2	Dry alpine heath and stony slopes
70	Pincushion Plant (e)	S3	Acidic rocks and gravels
71	Few-flowered Shooting Star	S2	Wet meadows
72	Arctic-montane Dwarf-primrose	S3	Dry rocky alpine slopes and tundra
73	Arctic Primrose	S2/S3	Wet meadows and stream banks
74	Richardson's Phlox	S3	Sandy or gravelly hilltops or barrens
75	Showy Forget-me-not	S2	Rocky alpine slopes and barrens
76	Alaskan Tall Bluebells	S2/S3	Riverbanks, open woods, and clearings, occasionally above timberline
77	Elegant Paintbrush	S3	Moist calcareous tundra and rocky or sandy lakeshores
78	Raup's Paintbrush	S3	Riverbanks and lakeshores to slopes near timberline
79	Awlwort (e)	S2/S3	Muddy or sandy pond margins, sometimes immersed
80	Lap[land Lousewort (e)	S2/S3	Dry to moist tundra and heath
81	Kitten-tails	S3	Alpine herbmats
82	Lesser Bladderwort (e)	S3	Shallow water or sometimes emergent on the margins of pools

[1] Notes about species occurrence in the region: (r)=rare, (o)=occasional, or (u)=uncommon, and (e)=expected to be
found north of 66°N, but not currently documented in region
[2] Plant status codes are as follows: S1 (1-5 populations in Yukon), S2 (6-20 populations in Yukon), or S3 (21-100 populations in Yukon – watch list)

Table 2.6.4 (cont'd). Occurrence and status of rare plant species in the North Yukon region.

Number	Species[1]	Status[2]	Habitat notes
83	Three-petal Bedstraw	S1	Sphagnum bogs
84	Boreal Wormwood (e)	S2	Dry rocky rubble on steep alpine slopes
85	Pacific Alpine Wormwood (e)	S2	Alpine and arctic tundra
86	Richardson's Wormwood (e)	S2	Gravel and cobble of riverbeds
87	Large-flowered Daisy	S2/S3	Calcareous slopes and dry tundra in alpine and subalpine areas
88	Tundra Fleabane	S2	Alpine heathy areas and gravelly slopes
89	Purple Fleabane (e)	S3	Sandy and gravelly riverbanks and bar and on sandy slopes
90	One-flower Fleabane	S3	Alpine tundra, stoney and gravelly situations mainly on calcareous soil
91	Yukon Fleabane	S2	Calcareous stoney slopes
92	Linear-leaved Daisy	S1	Grassy south-facing slopes
93	Boreal Groundsel	S3	Calcareous alpine tundra, rocky slopes and floodplains

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2.6.2.4 Wetlands

Wetlands are a specific Landscape Type that require special consideration. Wetlands represent some of the most biologically and culturally important areas in the planning region. In this report, wetlands are defined as:

> *"all open water aquatic environments, both lentic (still water) and lotic (moving water) features and their adjacent environments"*.

Open water (lakes, rivers and streams) accounts for approximately 3% (1,667 km^2) of the planning area (Appendix One, Map 32). Off-channel lakes are common wetlands in the major river valleys. Many smaller wetlands are likely important for a variety of wetland species, but are at present poorly mapped and described.

[1] Notes about species occurrence in the region: (r)=rare, (o)=occasional, or (u)=uncommon, and (e)=expected to be
found north of 66°N, but not currently documented in region
[2] Plant status codes are as follows: S1 (1-5 populations in Yukon), S2 (6-20 populations in Yukon), or S3 (21-100 populations in Yukon – watch list)

A variety of wetland habitat types are known to occur, including peatlands (bogs and fens), swamps, marshes, and shallow open water (ponds). Peatlands are the dominant wetland habitat type in the region (A. Leach, Ducks Unlimited Canada, pers. comm.). Many of the peatlands, swamps, and marshes are considered to be wet soils. A comprehensive and accurate map showing these wetland habitats in the region is not currently available. However, based on available information, between 8 and 16% of the region may be considered a wetland environment, if wet soils and open water are both included as "wetland" habitat[3].

Many of the wetlands in the region form large wetland complexes (Appendix One, Map 9). Wetland complexes are concentrated geographic groupings of individual wetlands, and may include both wetland and non-wetland Landscape Types. Wetland complexes function as an integrated hydrologic system.

The region contains three major wetland complexes of territorial significance: Old Crow Flats, Bluefish-Cadzow Lake, and Whitefish (Yukon Department of Environment, 2005). Together these represent approximately 14% of the region; all are associated with old glacial lake basins, and underlain by fine-grained, ice-rich glacial lake sediments (Appendix One, Map 4). Old Crow Flats accounts for a large proportion of the wetland area in the region, with Bluefish-Cadzow and Whitefish accounting for most of the remainder.

The complexes are very sensitive environments that are susceptible to permafrost degradation and altered hydrology as a result of surface disturbance.
Wetlands and wetland complexes are discussed in more detail in the section on waterbirds (Section 2.7.5.4).

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[3] The National Wetlands Working Group (1988) define wetlands as "land that has the water table at, near, or above the land's surface or which is saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophytic vegetation, and various kinds of biological activity that are adapted to the wet environment". Permafrost conditions can create poor soil drainage conditions across broad geographic areas, resulting in hydric soil conditions for much of the growing season with possible seasonal standing water. Such areas would typically not be considered 'wetlands'.

2.6.2.5 Natural Disturbance Regimes

Natural disturbances include agents such as wildfire, forest insects, extreme weather events and terrain disturbances. Natural disturbances play a large role in shaping and controlling the distribution of Landscape Types, and therefore affect wildlife habitat quality and abundance.

2.6.2.5.1 Wildfire

Wildfire is the most active natural disturbance agent in the region. Appendix One, Map 10 shows the fire history of the region for the period 1950-2005 as recorded by Yukon fire mapping (Yukon Wildland Fire Management 2006). Fire rates vary by Ecoregion and Landscape Type (Table 2.6.5 and 2.6.6). Although on average less than 1% of each Ecoregion burns in a given year, over the past 50-years a detectable trend in increasing fire activity has been recorded (Figure 2.6.1), consistent with climate change impact projections (McVoy and Burn 2005; Kochtubajda et al. 2006). The estimated burn rates and fire cycles reflect the Landscape Type composition of each Ecoregion, and the susceptibility of each Landscape Type to fire. High elevation, wet upland sites, wetlands and riparian Landscape Types typically have lower burn rates in all Ecoregions.

Within the planning area, the Eagle Plains Ecoregion experiences the highest level of wildfire activity, with fire rates that are similar to more southern areas of Yukon. Eagle Plains is in the Taiga Wooded Bioclimate Zone; coniferous forest cover is the dominant vegetation type. Upland forests (mesic and moist conifer) display fire cycles on the order of 200-250 years. During the extreme 2004 fire season, almost 500,000 ha was burned, with the majority in Eagle Plains. The Old Crow Basin and Davidson Mountains Ecoregions also experience relatively high fire rates.

Fire size class distributions are reported Table 2.6.7. Fire size classes are characteristic for northern boreal and taiga forested landscapes. Fire is an episodic event with a few, very large fires occurring in extreme fire years, similar to 2004, accounting for the majority of the total area burned. In forested areas like Eagle Plains, these extremely large fire years have significant effects on wildlife habitat conditions through their influence on seral stage (age and composition of forest community).

Table 2.6.5. Estimated fire rates (annual % of area burned) and fire cycles (length of time required to burn area equal to the Ecoregion) for North Yukon Planning Region Ecoregions, based on 1950-2005 Yukon fire records.

Ecoregion	Annual Area Burned (%)	Fire Cycle (Years)
Eagle Plains	0.65	153
Old Crow Basin	0.30	329
Davidson Mountains	0.22	453
Old Crow Flats	0.08	1270
British Richardson Mountains	0.07	1472
North Ogilvie Mountains	0.04	2285

Table 2.6.6. Estimated fire rates (annual % of LT burned) and fire cycles (length of time required to burn area equal to area of LT) for North Yukon Planning Region Landscape Types, based on 1950-2005 Yukon fire records.

Landscape Type	Annual Area Burned (%)	Fire Cycle (Years)
High Elevation, Upland Ecosystems		
High Elev. Rock / Exposed	0.04	2,777
High Elev. Sparsely Vegetated	0.12	803
High Elev. Herb	0.07	1,491
High Elev. Coniferous Forest	0.10	971
Low-Middle Elevation, Upland Ecosystems		
Exposed/Sparely Vegetated	0.20	503
Wet Herb	0.22	455
Wet Shrub	0.22	451
Wet Coniferous Forest	0.11	928
Moist Coniferous Forest	0.38	264
Mesic Coniferous Forest	0.48	210
Riparian Ecosystems		
Riparian - Exposed	0.16	616
Riparian - Herb	0.25	400
Riparian - Coniferous Forest	0.16	628
Riparian - Wetland	0.13	796
Wetland Ecosystems		
Wetland - Herb	0.09	1,163
Wetland - Shrub	0.26	386
Wetland - Forest	0.16	640
Aquatic Ecosystems		
Water	N/A	N/A

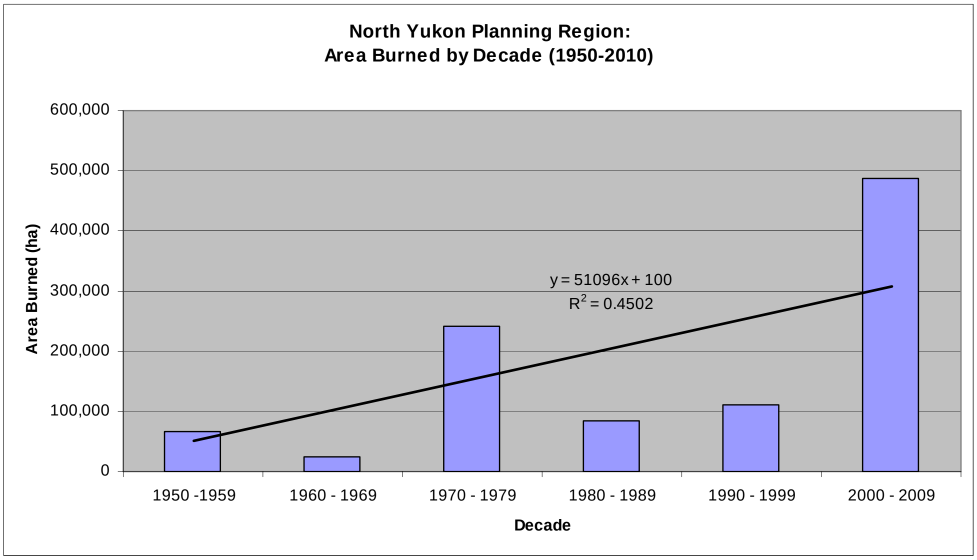

Figure 2.6.1. Area burned by decade in North Yukon Planning Region (1950 – 2010), based on 1950-2005 Yukon fire records.

Table 2.6.7. North Yukon Planning Region fire size class distribution (1950 – 2005), based on 1950-2005 Yukon fire records.

Fire Size Class	Fire Size Class (ha)	Number of Fires	Frequency (%)	Area Burned by Size Class (ha)
A	0.1 - 100	5	5.1	350
B	100.1 – 1,000	38	38.8	18,588
C	1,000.1 – 10,000	40	40.8	143,705
D	10,000.1 – 100,000	12	12.2	354,538
E	>100,000	3	3.1	495,370
TOTALS		**98**	**100**	**1,012,551**

2.6.2.5.2 Other Natural Disturbances

The role of forest insects and extreme climatic events (e.g. wind storms) in the planning region is not well understood, but these are not currently considered to be major forest disturbances. Climate limits the geographic distribution and growth rates of insects. The current cold climate of northern Yukon limits insect damage through killing frosts and slow insect growth and larval development (Volney and Fleming 2000). Generally climate change is expected to increase the rate, frequency and intensity of forest insect outbreaks (Juday et al. 2005).

Many rock slides and debris flows have been observed throughout the North Ogilvie and Richardson Mountains (Figure 2.6.2), but it is not currently possible to quantify the extent or frequency of these events. Small-scale debris flows and slumps are common throughout the region; many appear to be associated with wildfire activity and resultant permafrost degradation along steep slopes. The occurrence of debris flows along watercourses and waterbodies may affect water quality and fish habitat (Figure 2.6.3). The frequency and extent of terrain disturbances is expected to increase with climate change.

Figure 2.6.2. Rock slide in Ogilvie Mountains. Photo: J. Hawkings, CWS.


(a)


(b)

Figure 2.6.3. Debris flows along Porcupine and Old Crow rivers. Such features are frequently observed following forest fire. Photos: a) J. Hawkings, CWS and b) I. Anderton, Environmental Dynamics.

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2.6.3 Climate Change

Climate in the North Yukon and surrounding areas has undergone detectable warming over the past 3-4 decades. Estimates for the period of 1966-1995 are for an annual average of ~0.5 °C annual warming per decade (Serreze et al. 2000). Although current and predicted rates of warming are believed to be highest in winter, analyses of temperature trends at individual climate stations in northern Yukon indicate a significant summer warming trend of about 0.3-0.5 °C per decade (Arctic Borderlands Ecological Knowledge Co-op).

An annual warming rate of 0.5 °C per decade corresponds to a warming of 5 °C in annual temperatures between 1970 and 2070. This scenario lies within the temperature envelopes predicted for northern regions with a doubling of atmospheric CO_2. An average warming rate of 0.5 ^oC per decade is considered to be a reasonable climate change scenario for the planning region. Different climate change models for Canada are available and can be explored at the Canadian Climate Impacts and Scenarios (CCIS) Project (www.cics.uvic.ca/scenarios).

2.6.3.1 Ecosystem Responses to Climate Change

A variety of climatic-induced changes to ecosystems are predicted to occur; some have been discussed in previous sections. The 0.5 °C warming per decade scenario is used as the basis for estimating ecosystem responses in this report.

2.6.3.1.1 Vegetation Change (Landscape Types)

Some vegetation communities (landscape types) are predicted to change in response to a warming climate. There is the strong evidence for expansion of shrubs into surrounding tundra and increasing shrub size in association with recent warming (Silapaswan et al. 2001, Sturm et al. 2001, Sturm et al. 2005). There is also accumulating evidence for a slower rate of tree expansion into surrounding shrub tundra, with treeline forests increasing in density and a spread of low-density forests into the tundra (Szeicz and Macdonald 1995, Lloyd and Fastie 2002, Lloyd and Fastie 2003).

Appendix One, Map 11 shows landscape types with predicted rates of rapid change in the coming five decades. Table 2.6.8 lists the specific landscape types and describes the nature of the predicted vegetation transition. While not identified directly on Map 11, the water and wetland landscape types should also be recognized as landscape type expected to undergo change, with the nature of wetland change being uncertain.

Climate change is expected to be the single most important factor that has affected, or is likely to affect, wetland resources in the region. Several recent studies have documented long-term declines in surface water in Arctic environments, and associated changes from wetland to terrestrial habitat (Hinzman et al. 2005; Riordan 2005; Smith et al. 2005). A 5% decline in lake extent from 1972 to 2001 was recently reported for Old Crow Flats (Labreque 2005). However, while wetlands are expected to have high rates of change, the overall amount may be maintained in a dynamic but shifting steady state status. Wetlands are further described in Section 2.7.5.4.1.

Table 2.6.8. North Yukon Planning Region biophysical landscape types with high susceptibility to climate change in next five decades. Data from Johnstone (2005).

Landscape Type *	% NYPR	Expected Transition and Rate
High Elevation Herb	3.2	Transition to High Elevation Shrub in 3-5 decades. Mechanism for transition is invasion/expansion of shrubs into High Elevation Herb.
Wet Herb	8.4	Transition to Wet Shrub in 1-5 decades. Mechanism for transition is invasion/expansion of shrubs into Wet Herb.
Total	11.6	

* Other biophysical transitions are expected but are anticipated to occur over longer-time scales. The largest effect on forested landscape types may be fire and forest insect-related disturbances.

2.6.3.1.2 Stream flow

As a result of increasing rates and seasonal duration of snow and ice ablation, glacier-fed streams in Yukon and British Columbia are experiencing increasing rates of summer flow and discharge (Fleming and Clark 2002). In contrast, basins such as the Porcupine River that are not glacier fed, are experiencing decreasing rates of summer flow and discharge, even when overall levels of precipitation are increasing. This situation appears to be explained by increasing evapotranspiration rates. Under a warmer climate, summer evapotranspiration rates are increasing faster than precipitation inputs, resulting in overall 'droughtier' summer conditions and decreased streamflow. As a result of continuous permafrost and the northern hydrologic regime, increasing levels of winter precipitation have only a marginal effect on mid- and late-summer water availability.

2.6.3.1.2 Natural Disturbances

Potential climate change effects on fire, forest insects and terrain disturbances have been discussed in Section 2.6.2.5, above. In general, under a 0.5 ^{o}C climate warming scenario, the rate, extent and intensity of natural disturbances is expected to increase, resulting in an overall more dynamic landscape. Increasing rates of disturbance may play a large role in accelerating the rate of vegetation community transition in some landscape types, particularly forest and shrub communities. Over the past 50-years, a detectable trend in increasing fire activity has been recorded (Figure 2.6.1), consistent with predicted climate change effects on northern fire regimes. Increasing fire rates, through permafrost disruption, may also increase the frequency and size of debris flows and other terrain disturbances (see Section 2.6.2.5.2, above)

2.6.3.2 Potential Climate Change Impacts

2.6.3.2.1 Land Use Impacts

Effects on Traditional Economic Activities

Decreasing summer precipitation may result in lower water levels in the Porcupine River. River-based travel during the summer months may become more difficult, preventing Old Crow residents from accessing subsistence harvesting opportunities (e.g., Figure 2.6.4). Such water level decreases may also impact future river-based wilderness tourism opportunities.

During the first few months of winter when the snowpack is light, hunters rely on frozen rivers for long-distance travel. While a hard freeze enabling safe travel has historically come by the beginning of November, warmer temperatures in recent years have occasionally left areas of thin ice or open water well into December. If significant climate warming occurs, these late freeze-up events could become more common (Berman and Kofinas 2004).

Figure 2.6.4. Confluence of Old Crow River and Porcupine Rivers. July 2004. Photo: J. Meikle, YG.

Effects on Industry and Transportation

Hinzman et al. (2005) provide a summary of possible climate change effects on industrial land uses. On the Alaskan North Slope, the time period when travel by off-road vehicle is permissible (i.e., when the active layer is completely frozen and vegetation is adequately protected by snow) has been gradually decreasing, resulting in dramatically shorter times available for industrial or private transit. The duration of permissible tundra travel has decreased from over 200 days in the early 1970s to just over 100 days in 2000s. Similar situations have been noted for use of ice roads in both Alaska and Northwest Territories. This has resulted in greater difficulty and environmental risk for mineral and oil exploration. A secondary result of the shortened winter work season is limited human resource and equipment availability.

Although changes in the closing date are substantial (changing by three weeks from late May in the early 1970s to early May in recent years, Alaska Department of Natural Resources, unpublished data), the date of opening has changed much more dramatically. In the early 1970s, the start of the off-road winter travel period was early November; under the current climatic regime this has changed to early January. The marked change in winter opening may be due to delayed active layer freezing resulting from relatively milder winters and warmer summers.

2.6.3.2.2 Ecological Impacts

Stream flow and Fish

Decreasing stream flow may impact fish populations. As described in Section 2.8, the amount and quality of water is a key factor affecting fish over-wintering success. Winter water availability is already limited, and further decreases in winter stream flow may negatively impact regional fish populations.

Terrestrial Habitat Change

Landscape Type transitions will affect habitat conditions within the region. Increasing shrub stature and density in Wet Herb and High Elevation Herb landscape types will affect snow resistance. Higher stature shrubs have greater ability to ‘hold’ snow, likely resulting in a deeper overall snow pack. Snow is an important factor influencing Porcupine Caribou distribution and range utilization. The high and low elevation tundra/herb landscape types expected to undergo the highest rates of vegetation transition (i.e., Wet Herb and High Elevation Herb). These landscape types are also within Porcupine Caribou concentrated use areas (see Section 2.7 and Appendix One, Map 20 and 52).

Increasing natural disturbance rates may also result in a variety of habitat-related impacts ranging from overall younger forest ages to increased rates of defoliation and plant pathogens. For species dependent on forest age-class characteristics, such as caribou and moose, increasing fire rates may have large effects. Forest communities maintained in an overall younger condition would generally result in increased habitat quality for moose and decreased quality for caribou.

Snow Conditions

As mentioned above, snow condition (depth and hardness) is an important factor influencing Porcupine Caribou Herd distribution and range utilization. Russel et al. (1993) describe different snow regions, and their relative effect on Porcupine Caribou Herd distribution. In low snow years, Eagle Plains is used more extensively than in deep snow years. While Eagle Plains holds the most abundant lichen resources in the region, deep snow conditions create difficulties for winter travel, movement and feeding, ultimately resulting in an energetically unfavourable situation (i.e. body condition).

In contrast, the Richardson Mountains generally receives lower amounts of snow and is a more wind-swept environment. While lichen resources are not as abundant, low snow depths create favourable conditions for travel and movement. If the level of winter precipitation generally increases, as suggested by most climate change models, or the frequency of high depth snow years increases, the Richardson Mountains and other wind-swept Alpine and Taiga Shrub environments may receive even higher levels of caribou use than at present.

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2.7 Wildlife Resources

This section summarizes the distribution and status of wildlife (mammals and birds) in the region. Approximately 40 species of mammals and 150 species of birds occupy the region, on a seasonal or annual basis. Various sources of traditional, local, and scientific knowledge on wildlife distribution, status, and trends in the region are summarized. Additional information is provided for priority species of interest to Old Crow community residents: barren-ground caribou (Porcupine herd), moose, and marten.

Suitable habitats that support wildlife species are described, identified, and mapped (where possible). Many significant and potentially sensitive areas for wildlife are highlighted. Major findings, areas of conservation interest, and potential threats to the health of wildlife and their habitats are discussed.

2.7.1 Wildlife Species List and Status

2.7.1.1 Mammals

Key Findings

- The region is occupied seasonally or annually by approximately 40 species of mammals (see Table 2.7.1.1 below)
- Approximately 29 mammal species are present within the entire region
- Records of mammal species are based on observed or expected presence of animals; there are knowledge gaps in the information
- Two listed species of national conservation concern, the Grizzly bear and Wolverine, are present in the region
- Grizzly bear population status and trend are unknown; Wolverine surveys conducted by Parks Canada at Old Crow Flats suggest a stable and abundant population
- Musk-ox appear to be infrequent visitors to the region; population status and trend in the region are unknown

Background

Approximately 40 species of mammals including shrews, hares, pikas, rodents, carnivores, and ungulates (sheep, moose, and caribou) occupy the region, on a seasonal or annual basis. The information on mammal occupancy of the region comes from the Ecoregions of the Yukon database (Smith et al. 2004). The information includes records of mammals known or expected to occur within the following ecoregions present in the North Yukon region: British-Richardson Mountains, Old Crow Basin, Old Crow Flats, North Ogilvie Mountains, and Eagle Plains. It should be noted that the database is not a comprehensive survey of the mammals of the region, but rather a compilation of incidental sightings and expected occurrences. Information on each species' population distribution, status, and trends across the region is not available, with the exception of caribou, and to a lesser extent, moose (see Sections 2.7.5.1.1 and 2.7.5.2.1).

The Grizzly bear and Wolverine are two species of national conservation concern in the region. The Grizzly bear was listed as special concern under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2002, and has the same status under the Species at Risk Act (SARA) (Environment Canada, 2006). The Wolverine was listed as special concern by COSEWIC in 2003, and has the same status under SARA (Environment Canada, 2006). Wolverine populations at the Old Crow Flats during the winter appear to be stable, and abundances are much higher compared to similar undisturbed areas in Alaska (Henry, 2004). There are no specific SARA guidelines or required management prescriptions for species with special concern status.

Methods

A mammal species list was prepared from information provided in the wildlife section of Ecoregions of the Yukon Territory: Biophysical Properties of Yukon Landscapes (O'Donoghue and Staniforth, 2004). Each species was noted as present in one or more of the following ecoregions found in the North Yukon region: British-Richardson Mountains, Old Crow Basin, Old Crow Flats, North Ogilvie Mountains, and Eagle Plains.

Discussion

Listed below are 40 species of mammals which occupy or are expected to occupy the North Yukon region (Table 2.7.1.1). Of these, 29 are present within the entire region. All of the species can be found within the region at any time of year. Some of the species reported (i.e. Woodland caribou) are likely infrequent residents of the region.

The migratory barren-ground Porcupine caribou herd occupies the region mostly during winter, spring migration, fall migration, and late fall seasons (see Section 2.7.5.1). Moose are also known to migrate into Old Crow Flats during the summer season and back into Alaska during the winter season (see Section 2.7.5.2). Based on recent evidence, Stone sheep are not present in the region (J. Carey, Yukon Department of Environment, pers. comm.). A small population of Fannin sheep inhabits the North Ogilvie Mountains and may be occasional visitors to the region, but new genetic evidence indicates that Fannin are actually Dall sheep rather than Stone sheep/Dall sheep hybrids.

Of note, Musk Ox are seen infrequently in the region and are occasional visitors (Vuntut Gwitchin First Nation et. al., 2002; Dennis Frost, VGFN, pers. comm.). At the Old Crow local knowledge workshop held in November, 2004, residents also identified the Arctic Fox as being historically present in the region (sighted in 1927).

The ecoregions from which this list was prepared do not perfectly match the boundary of the North Yukon Planning Region, and extend north and south of the region. Some of the species listed here may be rare or absent from the region; alternatively, the fact that a species is not recorded does not mean it is absent. Despite the limitations of the available information, this list provides the best source of knowledge for determining mammal presence in the region.

Table 2.7.1.1. Occurrence and distribution of mammal species in the North Yukon region.

Number	Species	Ecoregion (x=present)				
		British-Richardson Mountains	Old Crow Basin°	Old Crow Flats	North Ogilvie Mountains	Eagle Plains
	Shrews					
1	Common Shrew	x	x	x	x	x
2	Pygmy Shrew	x	x	x	x	x
3	Dusky Shrew	x	x	x	x	x
4	Tundra Shrew	x	x	x	x	x
5	Barren-ground Shrew	x	x			
	Hares and Pikas					
6	Snowshoe Hare	x	x	x	x	x
7	Collared Pika	x			x	x
	Rodents					
8	Northern red-backed vole	x	x	x	x	x
9	Brown lemming	x	x	x	x	x
10	Long-tailed vole	x	x	x	x	x
11	Singing vole	x			x	
12	Tundra vole	x	x	x	x	x
13	Meadow vole	x	x	x	x	x
14	Chestnut-cheeked vole	x	x	x	x	x
15	Muskrat	x	x	x	x	x
16	Northern bog lemming	x	x	x	x	x
17	Ogilvie Mountains lemming•				x	
18	Collared lemming	x	x	x		
19	Beaver	x	x	x	x	x
20	Porcupine	x	x	x	x	x
21	Hoary marmot				x	
22	Arctic ground squirrel	x	x	x	x	x
23	Red squirrel	x	x	x	x	x

° Ecoregion includes Davidson Mountains
• Recent genetic analyses suggests this species may be a disjunct population of collared lemmings rather than a separate species (Slough et al. 2006 *In press*).

Table 2.7.1.1.(cont'd). Occurrence and distribution of mammal species in the North Yukon region.

Number	Species	Ecoregion (x=present)				
		British-Richardson Mountains	Old Crow Basin°	Old Crow Flats	North Ogilvie Mountains	Eagle Plains
	Carnivores					
24	Wolf	x	x	x	x	x
25	Red fox	x	x	x	x	x
26	Lynx		x	x	x	x
27	Wolverine+	x	x	x	x	x
28	River otter	x	x	x	x	x
29	Marten	x	x	x	x	x
30	Ermine (short-tailed weasel)	x	x	x	x	x
31	Least weasel	x	x	x	x	x
32	Mink	x	x	x	x	x
33	Black bear	x	x	x	x	x
34	Grizzly bear+	x	x	x	x	x
35	Polar bear	x				
	Ungulates					
36	Dall sheep	x			x	
37	Stone sheep♦				x	
38	Moose	x	x	x	x	x
39	Woodland caribou				x	
40	Barren-ground caribou	x	x	x	x	x

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° Ecoregion includes Davidson Mountains
+ Wolverine and Grizzly Bear listed as special concern (COSEWIC 2002&2003)
♦ recent genetic analysis has shown that Stone sheep likely originated from hybridisation of thinhorn and bighorn sheep

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2.7.1.2 Birds

Key Findings

- The region is occupied seasonally or annually by approximately 150 species of birds (see Table 2.7.1.2 below)
- Approximately 120 species are regularly-occurring breeders, occupying the region from May to September
- Records of species and season(s) of occupancy are based mostly on incidental sightings of birds from the 1860s to 1998
- Two listed species of national conservation concern, the Short-eared owl and the Peregrine falcon, are present in the region

Background

Approximately 150 species of birds including seabirds, loons, ducks, geese, swans, shorebirds, raptors, owls, cranes, rails, nightjars, kingfishers, woodpeckers, flickers, upland birds (grouse and ptarmigan), and songbirds (i.e. thrushes, swallows, sparrows, etc.) occupy the region, on a seasonal or annual basis. The majority of these species are migratory, and are present only during the breeding season which extends from approximately May to September.

The information on bird occupancy of the region comes from the Birds of the Yukon database (Sinclair et al. 2003). These data include records of bird sightings from the 1860s to 1998. It should be noted that the Birds of the Yukon database is not a comprehensive survey of the birds of the region, but rather a compilation of incidental sightings and survey information for the entire Yukon. An assessment of each species' population distribution, status, and trends across the region is generally not available. Some limited information on waterfowl population status and trends is reported in the waterbird section (section 2.7.5.4.1).

The Short-eared owl and Peregrine falcon are two species of national conservation concern in the region. The short-eared owl was listed as special concern under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1994, and has the same status under the Species at Risk Act (SARA) (Environment Canada, 2006). North American populations of the species have been in decline since 1976, but Yukon populations appear to be stable (Christensen, 2004). There are no specific SARA guidelines or required management prescriptions for species with special concern status.

There are two subspecies of Peregrine falcon in the region; the *tundrius* subspecies was listed as special concern in 1992, and the *anatum* subspecies was listed as threatened in 2000 (Environment Canada, 2006). A national recovery plan for the *anatum* subspecies was prepared in 1988 (Erickson et al. 1988). The *anatum* subspecies is most common in the region. In general, Yukon populations of *anatum* Peregrines are doing very well (Tom Jung, Yukon Department of Environment, pers. comm.). A map of known Peregrine falcon distribution in the region is provided in Appendix 1, Map 18.

Methods

A bird species list, seasons of occupation, and observed habitat use for the region was prepared by bird biologists with expert knowledge of the species' Yukon distribution (Canadian Wildlife Service and Yukon Department of Environment, unpublished data, 2006). Most of the information used in the assessment came from the Birds of the Yukon database (Sinclair et al. 2003). Some additional information was provided from Birds of North America species accounts (Cornell Lab of Ornithology and American Ornithologists' Union, 2006). Each species was noted as a regularly occurring breeder, a non-breeding visitor to the region during migration, or a rare visitor (breeder or non-breeder). Observed habitat use of each species was summarized for the habitats described in the North Yukon biophysical map (see Section 2.6.2.3).

The seasons of occupancy were defined as follows: spring (March to May), summer (June to July), fall (August to November), and winter (December to February). A detailed species list and some general observations on habitat use are reported below (Canadian Wildlife Service, unpublished data, 2006).

Discussion

Listed below are 149 species of birds which have occupied the North Yukon region from the 1860s to 1998 (Table 2.7.1.2). Of the species recorded, 120 are regularly-occurring breeding species. A further 9 species are regular visitors to the area during migration, but do not breed here. Also included in the list are 20 rare species which have been recorded in the area, but which are not expected every year.

This following provides general information on occupancy and observed habitat use for groups of species in the region, based on descriptions provided by Pam Sinclair at the Canadian Wildlife Service (Canadian Wildlife Service, unpublished data, 2006).

Loons and Grebes

Three species of loons and 2 species of grebes occupy the region, and all are recorded breeding here. These species typically use open water, wetlands near river valleys, and wetland herb habitats during migration and breeding.

Swans and Geese

Two species of swans and 4 species of geese occupy or migrate through the region. These species typically use open water, herb/shrub communities near river valleys and wetlands, and wetlands near river valleys during migration and breeding.

Waterfowl

Twenty-one species of waterfowl occupy the region, and most breed here. These species typically use open water, herb/shrub communities near river valleys and wetlands, and wetlands near river valleys during migration and breeding. Four waterfowl species nest in tree-holes close to open water sources during the breeding season (Goldeneye species, Bufflehead, and Common Merganser).

Raptors

Thirteen species of raptors occupy the region. These species use a variety of high elevation, forest, river valley, herb, shrub, and wetland habitats during migration and breeding. As indicated above, Peregrine falcons are a species of national conservation concern.

Ptarmigan and Grouse

Three species of ptarmigan and 3 species of grouse occupy the region. These species use a variety of high elevation, forest, river valley, wet herb/shrub, and habitats near wetlands during migration and breeding. These upland birds are annual residents.

Cranes and Rails

Two species of cranes and rails occupy the region, but neither are recorded breeders. These species use wet herb habitats during migration.

Shorebirds

Twenty-three species of shorebirds occupy or migrate through the region. These species use high elevation, river valley, wet herb/shrub, and wetland habitats during migration and breeding.

Seabirds

Eight species of seabirds occupy or migrate through the region. These species include jaegers, gulls, and arctic terns. These species use a variety of habitats, but are mostly associated with river valley and wetland habitats during migration and breeding.

Owls

Six species of owls occupy the region, and 3 are recorded breeders. These species use a variety of high elevation, forest, river valley, wet herb/shrub, and habitats near wetlands during migration and breeding. Many owls are annual residents. The Short-eared owl is a species of national conservation concern.

Nightjars/Kingfishers/Woodpeckers/Flickers

Five species of nightjars, kingfishers, woodpeckers, and flickers occupy the region. The only recorded breeding species here is the American Three-toed Woodpecker. These species use a variety of forest habitats, often near river/stream valleys and wetlands, during migration and breeding.

Songbirds

Fifty-four species of passerines and songbirds occupy the region. Most of these species are migratory, but a few are annual residents (i.e. Pine Grosbeak, Ravens, Chickadees, etc.). These are a diverse group of species that occupy the full range of habitats present in the region.

Summary

The bird species list for the region provides a general overview of species recorded in the region; some of the observations date back to the 1860s. It is important to note that the knowledge presented here is based on the species' observed habitat use throughout the Yukon, rather than specific information from the North Yukon region. Observed habitat use of each species varies depending on the region considered. Also, the use of the region by each species is based on spotty and incomplete records of bird sightings. Most records tend to come from specific areas where studies have been conducted or close to where people live. The fact that a species is not recorded does not mean it is absent. There are many gaps in the knowledge base, particularly for the winter season.

Despite these limitations, the species list, observed habitat use, and seasons of occupancy provide the best available information for identifying bird occupancy and seasonal use of the region.

Table 2.7.1.2. Occurrence and status of bird species in the North Yukon region.

Number	Species[1]	Breeding status (x=confirmed[2])	Season (x=present[3])			
			Spring	Summer	Fall	Winter
	Loons and Grebes					
1	Red-throated Loon	x	x	x	x	
2	Pacific Loon	x	x	x	x	
3	Common Loon	x	x	x	x	
4	Horned Grebe	x	x	x	x	
5	Red-necked Grebe	x	x	x	x	
	Swans and Geese					
6	Tundra Swan	x	x	x	x	
7	Trumpeter Swan (r)	x		x		
8	Greater White-fronted Goose	x	x	x	x	
9	Snow Goose (m)		x			
10	Brant (m)		x	x	x	
11	Canada Goose	x	x	x	x	
	Waterfowl					
12	Eurasian Wigeon (r)			x		
13	American Wigeon	x	x	x	x	
14	Mallard	x	x	x	x	
15	Blue-winged Teal	x	x	x	x	
16	Northern Shoveler	x	x	x	x	
17	Northern Pintail	x	x	x	x	
18	Green-winged Teal	x	x	x	x	
19	Canvasback	x	x	x	x	
20	Redhead (r)				x	
21	Ring-necked Duck	x		x	x	
22	Greater Scaup	x	x	x	x	
23	Lesser Scaup	x	x	x	x	
24	Harlequin Duck	x	x	x	x	
25	Surf Scoter	x	x	x	x	
26	White-winged Scoter	x	x	x	x	
27	Long-tailed Duck	x	x	x	x	
28	Bufflehead			x	x	
29	Common Goldeneye	x	x	x	x	
30	Barrow's Goldeneye	x	x	x	x	

[1] Each species is a regularly occurring breeder in the region, unless followed by an (r) = rare visitor (breeder or non-breeder), or an (m) = non-breeding visitor to the region during migration
[2] Breeding status was confirmed by the presence of a nest or where flightless young were observed
[3] Seasons in which birds were observed in the North Yukon region, from Birds of the Yukon database

Table 2.7.1.2 (cont'd). Occurrence and status of bird species in the North Yukon region.

Number	Species[1]	Breeding status (x=confirmed[2])	Season (x=present[3])			
			Spring	Summer	Fall	Winter
	Waterfowl cont'd…					
31	Red-breasted Merganser	x	x	x	x	
32	Common Merganser		x	x	x	
	Raptors					
33	Osprey	x	x	x	x	
34	Bald Eagle	x	x	x	x	
35	Northern Harrier		x	x	x	
36	Sharp-shinned Hawk			x	x	
37	Northern Goshawk		x	x	x	
38	Swainson's Hawk			x	x	
39	Red-tailed Hawk	x	x	x	x	
40	Rough-legged Hawk	x	x	x	x	
41	Golden Eagle	x	x	x	x	
42	American Kestrel	x	x	x	x	
43	Merlin	x	x	x	x	
44	Peregrine Falcon♦	x	x	x	x	
45	Gyrfalcon	x	x	x	x	
	Ptarmigan and Grouse					
46	Ruffed Grouse (r)					
47	Spruce Grouse		x	x	x	
48	Sharp-tailed Grouse				x	
49	Willow Ptarmigan	x	x	x	x	
50	Rock Ptarmigan	x	x	x		x
51	White-tailed Ptarmigan			x	x	
	Cranes and Rails					
52	Sora (r)			x		
53	Sandhill Crane		x	x	x	

[1] Each species is a regularly occurring breeder in the region, unless followed by an (r) = rare visitor (breeder or non-breeder), or an (m) = non-breeding visitor to the region during migration
[2] Breeding status was confirmed by the presence of a nest or where flightless young were observed
[3] Seasons in which birds were observed in the North Yukon region, from Birds of the Yukon database
♦The *Anatum* subspecies would be most common in the region (currently listed as threatened, COSEWIC 2000). The status is due to be re-assessed in the next couple of years.

Table 2.7.1.2 (cont'd). Occurrence and status of bird species in the North Yukon region.

Number	Species[1]	Breeding status (x=confirmed[2])	Season (x=present[3])			
			Spring	Summer	Fall	Winter
	Shorebirds					
54	Black-bellied Plover (m)		x			
55	American Golden-Plover	x	x	x	x	
56	Semipalmated Plover	x	x	x		
57	Killdeer (r)		x	x		
58	Lesser Yellowlegs	x	x	x	x	
59	Solitary Sandpiper		x	x	x	
60	Wandering Tattler	x		x	x	
61	Spotted Sandpiper	x	x	x	x	
62	Upland Sandpiper	x	x	x	x	
63	Whimbrel	x	x	x	x	
64	Hudsonian Godwit (r)		x	x		
65	Surfbird†	x		x		
66	Semipalmated Sandpiper (m)		x	x	x	
67	Least Sandpiper	x	x	x	x	
68	White-rumped Sandpiper (r)			x		
69	Baird's Sandpiper		x	x	x	
70	Pectoral Sandpiper (m)		x	x	x	
71	Stilt Sandpiper (m)			x		
72	Buff-breasted Sandpiper (r)		x	x		
73	Long-billed Dowitcher (m)		x	x	x	
74	Wilson's Snipe	x	x	x	x	
75	Red-necked Phalarope	x	x	x	x	
76	Red Phalarope (r)			x		
	Seabirds					
77	Pomarine Jaeger (r)			x		
78	Parasitic Jaeger (m)		x	x	x	
79	Long-tailed Jaeger	x	x	x	x	
80	Bonaparte's Gull	x	x	x	x	
81	Mew Gull	x	x	x	x	
82	Herring Gull	x	x	x	x	
83	Glaucous Gull (m)		x	x	x	
84	Arctic Tern	x	x	x	x	

[1] Each species is a regularly occurring breeder in the region, unless followed by an (r) = rare visitor (breeder or non-breeder), or an (m) = non-breeding visitor to the region during migration
[2] Breeding status was confirmed by the presence of a nest or where flightless young were observed
[3] Seasons in which birds were observed in the North Yukon region, from Birds of the Yukon database
† Notable as a species with a limited global distribution

Table 2.7.1.2 (Cont'd). Occurrence and status of bird species in the North Yukon region.

Number	Species[1]	Breeding status (x=confirmed[2])	Season (x=present[3])			
			Spring	Summer	Fall	Winter
	Owls					
85	Great Horned Owl		x	x	x	
86	Snowy Owl (r)		x	x		x
87	Northern Hawk-Owl	x	x	x	x	x
88	Great Gray Owl	x	x			
89	Short-eared Owl•	x	x	x	x	
90	Boreal Owl		x			x
	Nightjars, Kingfishers, Woodpeckers, Flickers					
91	Common Nighthawk (r)					
92	Belted Kingfisher		x	x	x	
93	Hairy Woodpecker (r)			x		
94	Three-toed Woodpecker	x	x	x	x	
95	Northern Flicker		x	x	x	
	Songbirds					
96	Olive-sided Flycatcher		x	x		
97	Alder Flycatcher		x	x		
98	Say's Phoebe	x	x	x	x	
99	Northern Shrike		x	x	x	
100	Gray Jay	x	x	x	x	
101	Common Raven	x	x	x	x	x
102	Horned Lark		x	x	x	
103	Tree Swallow	x	x	x	x	
104	Violet-green Swallow	x	x	x		
105	Bank Swallow	x	x	x	x	
106	Cliff Swallow	x	x	x	x	
107	Barn Swallow (r)			x		
108	Boreal Chickadee		x	x	x	
109	Siberian Tit			x	x	
110	American Dipper		x	x	x	
111	Ruby-crowned Kinglet	x	x	x	x	
112	Northern Wheatear	x	x	x	x	

[1] Each species is a regularly occurring breeder in the region, unless followed by an (r) = rare visitor (breeder or non-breeder), or an (m) = non-breeding visitor to the region during migration
[2] Breeding status was confirmed by the presence of a nest or where flightless young were observed
[3] Seasons in which birds were observed in the North Yukon region, from Birds of the Yukon database
• Nationally listed as species of special concern (COSEWIC 1994)

Table 2.7.1.2 (Cont'd). Occurrence and status of bird species in the North Yukon region.

Number	Species[1]	Breeding status (x=confirmed[2])	Season (x=present[3])			
			Spring	Summer	Fall	Winter
	Songbirds cont'd…					
113	Townsend's Solitaire			x		
114	Gray-cheeked Thrush	x	x	x	x	
115	Swainson's Thrush	x	x	x		
116	Hermit Thrush			x		
117	American Robin	x	x	x	x	
118	Varied Thrush	x	x	x	x	
119	Yellow Wagtail (r)				x	
120	American Pipit	x	x	x	x	
121	Bohemian Waxwing		x	x	x	
122	Tennessee Warbler (r)			x		
123	Orange-crowned Warbler		x	x	x	
124	Yellow Warbler	x	x	x	x	
125	Yellow-rumped Warbler	x	x	x	x	
126	Blackpoll Warbler	x	x	x	x	
127	Northern Waterthrush	x	x	x	x	
128	Wilson's Warbler	x	x	x	x	
129	American Tree Sparrow	x	x	x	x	
130	Chipping Sparrow			x	x	
131	Savannah Sparrow	x	x	x	x	
132	Fox Sparrow	x	x	x	x	
133	Lincoln's Sparrow		x	x	x	
134	White-crowned Sparrow	x	x	x	x	
135	Golden-crowned Sparrow			x		
136	Dark-eyed Junco	x	x	x	x	
137	Lapland Longspur		x	x	x	
138	Smith's Longspur		x	x		
139	Snow Bunting		x	x	x	
140	Rusty Blackbird	x	x	x	x	
141	Brewer's Blackbird (r)			x		
142	Brown-headed Cowbird (r)				x	
143	Gray-crowned Rosy Finch		x	x	x	
144	Pine Grosbeak		x	x	x	x
145	Red Crossbill (r)			x		
146	White-winged Crossbill		x	x	x	
147	Common Redpoll	x	x	x	x	

[1] Each species is a regularly occurring breeder in the region, unless followed by an (r) = rare visitor (breeder or non-breeder), or an (m) = non-breeding visitor to the region during migration
[2] Breeding status was confirmed by the presence of a nest or where flightless young were observed
[3] Seasons in which birds were observed in the North Yukon region, from Birds of the Yukon database

Table 2.7.1.2 (cont'd). Occurrence and status of bird species in the North Yukon region.

Number	Species[1]	Breeding status (x=confirmed[2])	Season (x=present[3])			
			Spring	Summer	Fall	Winter
	Songbirds cont'd…					
148	Hoary Redpoll		x	x	x	
149	Pine Siskin		x	x	x	

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[1] Each species is a regularly occurring breeder in the region, unless followed by an (r) = rare visitor (breeder or non-breeder), or an (m) = non-breeding visitor to the region during migration
[2] Breeding status was confirmed by the presence of a nest or where flightless young were observed
[3] Seasons in which birds were observed in the North Yukon region, from Birds of the Yukon database

2.7.1 Traditional and Local Knowledge Summary

2.7.2.1 Vuntut Gwitchin First Nation

2.7.2.1.1 Old Crow Community Wildlife Workshop

Background

From October 27th to November 4th, 2004, the North Yukon Planning Commission (NYPC) and plan partners hosted a series of interactive local knowledge workshops to discuss regional cultural, heritage, fisheries, and wildlife values with community residents in Old Crow, Yukon. The workshops were held to gather community input on important cultural areas, and significant current and historical areas for fish and wildlife populations within the region. All information that was generously shared by residents was documented and mapped.

The wildlife workshops were held between November 3-4th, with participation of staff from the NYPC, Vuntut Gwitchin First Nation, Yukon Department of Environment, North Yukon Renewable Resource Council, Canadian Wildlife Service, Ducks Unlimited Canada, and other plan partners. Similar workshops to identify important areas for caribou hunting activities have been previously conducted in the community (Berman and Kofinas, 2004).

Various species groups including caribou, moose, sheep, bears, furbearers, raptors, and waterbirds were discussed at the wildlife workshops. A few records for sandhill cranes and owls were also recorded. Maps of significant areas for these species were prepared from the findings of the workshop, using geographic information system (GIS) tools to define the boundaries of the identified locations. Important land uses (i.e. hunting, trapping, etc.) associated with each species group were recorded, along with notes about seasonal or annual occupation by animals and why the area was significant.

2.7.2.1.2 Identified Wildlife Areas

Key Findings

- The findings from the Old Crow wildlife workshop provided a rich and valuable information source on significant areas for mammals and birds in the region
- Significant wildlife areas generally included river/stream valleys, wetlands, various mountains and mountain ranges, and areas near Old Crow (see Appendix 1, Maps 12-18)
- The community workshop highlighted many potentially sensitive areas for wildlife within the region, particularly for areas lacking scientific information

Background

The Old Crow community wildlife workshop session was used to identify significant wildlife areas for various species and seasons in North Yukon. The records reflect current and historical knowledge of wildlife distribution within the region. The species included large and small mammals, and a variety of birds.

Methods

A local knowledge wildlife workshop was held in Old Crow, Yukon from November 3-4th, 2004, to identify significant current and historical areas for wildlife in the region. Significant areas were identified based on their relative importance to wildlife for various seasons and life functions (i.e. general range, breeding, staging, mineral lick, etc.). A total of 18 elders and community residents, and 9 support staff (planners and biologists) participated either fully or partially in the workshop sessions. A list of participants and support staff is provided in Table 2.7.2.1.2.

Significant areas for various species and species groups were discussed and drawn on 1:250,000 scale paper maps of the region. The paper maps showed existing key areas for wildlife (current to 2004) produced by Yukon Department of Environment (Yukon Department of Environment, 2004). The main species discussed included caribou (Porcupine herd), moose, bears (black, grizzly, and polar), furbearers (marten, mink, lynx, beaver, muskrat, otter, wolverine, wolf, and fox), sheep (dall's), and raptors (Northern Harrier, Bald Eagle, Golden Eagle, Osprey, unidentified Falcon, and Peregrine Falcon).

A few areas for waterbirds (duck species) were also identified, but many of the waterbird areas were previously identified at the wetlands workshop in Old Crow, hosted by Ducks Unlimited in May 2004. A few significant areas for sandhill cranes and owls (great-horned, short-eared, snowy, and unidentified owls) were also identified and drawn. All information was later compiled using geographic information system (GIS) software, and maps showing the distribution and seasonal occupancy of each species group within the region were produced.

Discussion

Appendix 1, Maps 12-18 show the significant wildlife areas identified by Old Crow residents at the local knowledge workshops. The community knowledge of significant areas generally spanned the period from the 1930s to present, although many of the stories told at the workshop reflected a historical knowledge base much older than this time period.

The maps show identified areas for each species group and species above, with the exception of the few records for sandhill cranes and owl species. Sandhill crane and owl observations were located near Old Crow. The following provides general information on the locations and functions of significant areas for wildlife, based on the information provided at the community workshops.

Barren-ground caribou (Porcupine herd)

The map of significant areas for caribou confirmed that most of the region is, and has been, occupied by Porcupine caribou. Local knowledge was provided for the months of August to May, corresponding to the fall migration, rut, winter and spring migration seasons of the herd. The community knowledge of caribou distribution dates back to at least the 1930s.

Several north-south migration routes were identified (i.e. Richardson Mountains and Aitch Hill to Old Crow Flats) as well as numerous locally significant areas, particularly around the perimeter of the Old Crow Flats, Whitestone Village, several mountain ranges south of Old Crow (i.e. Sharp, Heart, Ahvee, Lone, and White Snow mountains), and Mason Hill. Specific areas of caribou occupation obtained from other information sources are reported below in the key areas and focal wildlife species sections on caribou (see Sections 2.7.3.2 and 2.7.5.1).

Moose

The map of significant areas for moose confirmed that most of the region is, and has been, occupied by moose. Local knowledge was provided for all seasons. Two migration routes were identified (Little Flats to Driftwood hills, and Lone mountain to Old Crow Flats). Significant areas included Old Crow Flats, Old Crow Range, Bluefish Basin wetlands, Whitefish wetlands, Driftwood River, Johnson Creek, Porcupine River, Whitestone Village (including Whitestone and Miner Rivers), Bear Cave Mountain, Eagle Plains basin, Choho Hill, Mason Hill, and the north Richardson Mountains. Specific areas of moose occupation obtained from other information sources are reported below in the key areas and focal wildlife species sections on moose (see Sections 2.7.3.2 and 2.7.5.2).

Bears

The map of significant areas for bears identified many areas in the region, particularly along the Porcupine River. Local knowledge was provided for all seasons. The majority of the identified areas were for Grizzly bears (see Grizzly bear status in Section 2.7.1.1 above). Two Grizzly bear denning areas were identified; one area was North of Pattullo Lake along Black Fox Creek, and another area was located at Bluefish Basin midway between Lone Mountain and Old Crow. Significant Grizzly bear areas included the Porcupine River, Old Crow Flats, Old Crow community vicinity, Lone Mountain, Berry Creek mouth, Whitefish wetlands, Whitestone Village (including Whitestone and Miner Rivers), Bear Cave Mountain, and the south Richardson Mountains. An important area of use for Grizzly bears at Fishing Branch is reported below from the key areas database (see Section 2.7.3.2 and Appendix 1, Map 14).

One significant area for Black bears was noted as the upland forest directly west of Schaeffer Creek. Two Polar bears were reported shot at Schaeffer Creek in 1948. Polar bears were also shot at Cody Creek (one in 1947) and north of Whitestone Village (one, unspecified year) in the southern portion of the region.

Furbearers

The map of significant areas for furbearers confirmed that most of the region is, and has been, used by furbearers. Local knowledge was provided for the fall, winter, and spring seasons which coincide with the trapping season. River valleys and wetlands were identified as the best areas. Many of the areas for furbearers are also important for hunting and trapping activities. Significant areas included Old Crow Flats, Whitefish wetlands, Bluefish Basin wetlands, Cadzow lake wetlands, Porcupine River, Whitestone Village (including Whitestone and Miner Rivers), Driftwood River, Johnson Creek, Moose Creek, Keele Mountain range, Eagle Plains basin, and the Richardson Mountains (Bell River valley). Specific areas of use for some species of furbearers obtained from other information sources are reported below in the key areas (muskrat) and focal wildlife species section on marten (see Section 2.7.3.2 and Appendix 1, Map 15 and Section 2.7.5.3).

Identified significant areas for Wolverine (see Wolverine status in Section 2.7.1.1 above) were the Old Crow Flats and Driftwood River areas in the northern portion of the region. Old Crow Flats has been documented as an area with high Wolverine densities and abundance compared to similar undisturbed areas in Alaska (Henry, 2004).

Sheep

The map of significant areas for sheep identified several mountain ranges in the region. Local knowledge was provided for all seasons. Significant areas included the Barn Mountains in Vuntut National Park, Ahvee Mountain (1930s-40s), Mahoney Lake, Cody Hill, Fishing Branch, Rat Pass, Bear Cave Mountain, Mount Rover (south), Mount Dewdney, and the north Richardson Mountains. Community residents noted that many of these ranges do not support populations of sheep at present; current sheep use areas were the Barn Mountains, Mount Miller, and Mount Rover (south). Specific areas of use for sheep obtained from other information sources are reported below in the key areas section (see Section 2.7.3.2 and Appendix 1, Map 16).

Raptors

The map of significant areas for raptors identified many river/stream valleys and wetlands in the region, particularly along the Porcupine River. Local knowledge was provided for the spring, summer, and fall seasons. Twenty-two raptor nesting sites were identified near Bear Cave Mountain, Fishing Branch River, Miner River, Whitestone River, Porcupine River, and Old Crow River. Significant areas included the Porcupine River, Old Crow Flats, Old Crow community vicinity, and the Miner River. Specific areas of use for raptors obtained from other information sources are reported below in the key areas section (see Section 2.7.3.2 and Appendix 1, Map 18).

Identified significant areas for Peregrine Falcons (*anatum* subspecies, see Peregrine falcon status in Section 2.7.1.2 above) were the Miner River (south portion) and the mouth of Driftwood River.

Waterbirds

The map of significant areas for waterbirds (duck species) identified many river/stream valleys and wetlands in the region, particularly along the Porcupine River. Local knowledge was provided for the spring, summer, and fall seasons. Locations for breeding, staging, and nesting were identified. Significant wetland areas included the Old Crow Flats, Whitefish Lake, Bluefish Basin, and Cadzow Lake. Significant river/stream valleys included the Porcupine, Whitestone, Bell, and Miner. A detailed assessment of areas of use obtained from Ducks Unlimited and other information sources are reported below in the key areas and focal wildlife species sections on waterbirds (see Section 2.7.3.2 and Appendix 1, Map 17 and Section 2.7.5.4.1).

Summary

The local knowledge workshops in Old Crow highlighted significant areas for wildlife in the region, particularly within river/stream valleys, wetlands, various mountains and mountain ranges, and areas near Old Crow. It is important to acknowledge that while the workshop information identified general areas of significance to wildlife, most of the identified areas are important cultural areas as well. The information is a valuable complement to the detailed assessment of focal species and key areas within the region, and provided the only information for many areas that are lacking scientific data.

There are knowledge gaps in the database for areas that are no longer visited, have not been visited in recent times, or are only visited on a seasonal basis. For example, Porcupine caribou can be found in the region at all times of year, but the community knowledge of distribution is best for the winter season when animals are harvested near Old Crow. For some records there was difficulty in determining significant areas where hunting/trapping activities were noted. It was assumed that if these activities were recorded that the species were present and that the areas were significant.

The records are as accurate as the recollections of community member's current and historical knowledge of animal distributions within the region. Many of the observations are associated with stories that are not adequately captured in this type of summary. Some observations could not be linked to a particular location within the region; these are not included in the maps here but all workshop materials, observations, and products are available from the NYPC and VGFN government. Additional information on significant areas for focal species and habitats are summarized in Sections 2.7.4 and 2.7.5.

References

Berman, M., and G. Kofinas. 2004. Hunting for models: grounded and rational choice approaches to analyzing climate effects on subsistence hunting in an Arctic community. Ecological Economics 49(2004): 31-46.

Henry, D. 2004. Track transects for monitoring changes in wolverine and other mustelid populations in the Old Crow Flats Third Annual Report (Winter of 2003-04). Parks Canada, Yukon Field Unit, Unpublished Report. 36 pp.

Yukon Department of Environment. 2004. Yukon Wildlife Key Area Inventory. Digital database and software produced by NatureServe Yukon, Fish and Wildlife Branch, Department of Environment, Government of Yukon, Whitehorse. Yukon Government website. Accessed August 9, 2006. URL: http://environmentyukon.gov.yk.ca/geomatics/data/wildlife-key-area.html

Table 2.7.2.1.2 List of VGFN community participants and support staff who contributed to or recorded knowledge of significant wildlife areas during the Old Crow community wildlife workshops in November 2004.

VGFN participants:	
Ellen Bruce	Danny Kassi
Fanny Charlie	John Joe Kaye
Alfred Charlie	Mary Jane Moses
Donald Frost	Stan Njootli Sr.
Marvin Frost	Stan Njootli Jr.
Edith Josie	Hannah Netro
Peter Josie	Dick Nukon
William Josie	Joel Peter
Harvey Kassi	Peter Tizya
Support staff:	
Shawn Francis, NYPC	Jim Hawkings, CWS
Megan Williams, VGFN	Bob Hayes, DU
Melissa Valja, VGFN	Amy Leach, DU
Bev Brown, NYRRC	Val Loewen, Yukon Dept of Environment
Dorothy Cooley, Yukon Dept of Environment	

2.7.3 Wildlife Key Areas

2.7.3.1 Key Area Database Overview

Background

The Yukon Department of Environment has maintained a key areas database for wildlife species of interest since 1988 (Yukon Department of Environment, 2005; Val Loewen, Yukon Department of Environment, pers.comm.). The database spans the entire Yukon Territory, although there are many areas of the Yukon that have never been surveyed. Recent versions of the database (v.2005) can be queried in a GIS environment. The mapped observations show locations of wildlife at key times of year. Most of the records are for large and conspicuous species. The database is not an assessment of suitable or potential habitat for species; key areas are locations used by wildlife for critical, seasonal life functions. The key areas are obtained from scientific sources of information of wildlife, generally from surveys of animals. The Key Areas do not include traditional or local knowledge sources of information.

For each wildlife species, there are unique areas that serve a distinct purpose. For example, thinhorn sheep winter range is characterized as relatively snow-free, wind-swept, south-facing slopes, that are important as foraging areas during this limiting time of year. Many species, such as sheep, use key areas traditionally around the same time each year. Others, such as moose, will use them only occasionally when they are forced to by factors such as severe weather. Often animals aggregate in key areas in relatively large numbers, making populations vulnerable to direct habitat loss or disturbance (Yukon Department of Environment, 2005).

Disclaimer

Wildlife Key Areas (WKA) were compiled by the Yukon Department of Environment WKA Inventory Program (2005) against 1:250,000 NTDB from various data sources. Key Areas are based on observed locations of wildlife at key times of year, not on habitat assessment. With new information, boundaries and designations of Key Areas can change and additional Key Areas can be identified. Furthermore, Key Areas are not the only sites important for wildlife. Other information sources can identify other sites important for wildlife for reasons outside the scope of the WKA Inventory Program. Updates to Key Areas occur only periodically. For the most current information, please consult with the Regional Biologist for your area of interest. If you have questions or would like to contribute to the WKA database, please contact the WKA Inventory Program (wka@gov.yk.ca).

2.7.3.2 Identified Key Wildlife Areas

Key Findings

- The Key Areas database identified many areas in the region that are significant for large and small mammals, and a variety of birds (see Appendix 1, Maps 12-18)
- The Richardson Mountain range has been a key area for caribou, moose, and sheep
- Major river/stream valleys and wetland areas (Old Crow Flats, Whitefish, Bluefish Basin, and Cadzow Lake) are key areas for moose, furbearers, and birds
- Fishing Branch Ecological Reserve has been a key area for bears and furbearers
- The key areas information highlighted significant and potentially sensitive areas for wildlife, and is a useful dataset to complement other sources of wildlife information

Background

The Key Areas database was used to identify significant wildlife areas for various species and seasons in North Yukon. The species included large and small mammals, and a variety of birds.

Methods

The following species groups were queried from the key areas database (v.2005) to identify areas with significant wildlife values in the region: caribou, moose, bears, furbearers, sheep, raptors, and waterbirds. Maps showing the distribution and seasonal occupancy of wildlife within the region were produced.

Discussion

Appendix 1, Maps 12-18 show the key areas identified by Yukon Department of Environment, current to 2005. These show identified areas for each species group and season (where available). The following provides general information on seasonal distribution and occupancy for groups of species in the region, based on the information obtained from the database (Yukon Department of Environment, 2005).

Barren-ground caribou (Porcupine herd)

The Porcupine caribou key area shows significant summer insect relief areas for the herd. Summer insect relief areas are present across the northern portion of the region, within Old Crow Flats SMA and the North Richardson Mountains. Specific areas of observed habitat use by the herd for other seasons are reported in the focal wildlife species section on caribou (see Section 2.7.5.1).

Moose

The moose key areas show the western portion of Old Crow Flats, a large area east of Old Crow in the Driftwood/Porcupine River drainages, and the Bell River and associated tributaries within the North Richardson Mountains as significant areas for moose. All seasons are included in the summary, although most areas have been surveyed only once at a particular time of year. Several key areas here are also identified and discussed below in the focal wildlife species section on moose (see Section 2.7.5.2).

Bears

The bear key areas shows Bear Cave Mountain, located with Fishing Branch Ecological Reserve, as a significant spring, summer, and fall area for grizzly bears. Information on additional grizzly bear areas and black bear areas is not provided, owing to a lack of survey information for bear populations within the region. Information on bear distribution is also summarized in the local knowledge section on identified wildlife areas (see Section 2.7.2.1.2 and Appendix 1, Map 14).

Furbearers

The furbearer key areas show Old Crow Flats and Whitefish wetlands areas as a significant all season area for muskrats. Information on additional furbearer areas is not provided, owing to a lack of survey information for furbearer populations within the region. Information on furbearer distribution is also summarized in the local knowledge section on identified wildlife areas (see Section 2.7.2.1.2 and Appendix 1, Map 15). Specific information on marten distribution is summarized in the focal wildlife species section on marten (see Section 2.7.5.3).

Sheep

The sheep key areas show both the northern and southern portions of the Richardson Mountains as a significant sheep area for a variety of seasons and functions. The highlighted areas are significant mineral licks, migration routes, winter range, early winter rutting range, and spring lambing range. An additional key area in the Fishing Branch Habitat Protection Area (south-central portion of the region) is also shown. Information on sheep distribution is also summarized in the local knowledge section on identified wildlife areas (see Section 2.7.2.1.2 and Appendix 1, Map 16).

Raptors

The raptor key areas show many of the major river/stream valleys, and portions of the valleys, as significant summer nesting areas. The areas include the Porcupine, Bell, Eagle, Whitestone, and Bluefish Rivers, and Whitefish wetlands area, Old Crow Flats, and Fishing Branch. Most of the key areas show nesting locations along cliff edges. The raptor species include Golden and Bald eagles, Gyrfalcons, Osprey, Merlin, Rough-legged hawks, and raptors (unspecified species). Peregrine Falcon key areas are highlighted separately, owing to the species threatened status (see Peregrine falcon status in Section 2.7.1.2 above).

Waterbirds

The waterbird key areas show four major wetland areas identified by the Yukon wetlands technical committee (2005) as significant summer nesting and moulting habitat. These areas include Old Crow Flats, Whitefish Lake, Bluefish Basin, and Cadzow Lake. The waterbird species groups include ducks, geese, and swans. Additional information on waterbird distribution is summarized in the focal wildlife species section on waterbirds (see Section 2.7.5.4).

Summary

The key areas information highlighted many significant and potentially sensitive areas for wildlife populations. The data are also a useful complement to the detailed assessment of focal species within the region. It is important to acknowledge that the key areas database is compiled from many sources of scientific information on the seasonal or annual distribution of species, for specific seasons and areas of interest. There are knowledge gaps in the database, and many areas within the region that may be significant have not been surveyed or otherwise identified. Additional information on areas of significance for focal species and habitats are summarized in Sections 2.7.4 and 2.7.5.

References

Yukon Department of Environment. 2005. Yukon Wildlife Key Area Inventory. Digital database and software produced by NatureServe Yukon, Fish and Wildlife Branch, Department of Environment, Government of Yukon, Whitehorse. Yukon Government website. Accessed August 9, 2006. URL: http://environmentyukon.gov.yk.ca/geomatics/data/wildlife-key-area.html

2.7.4 Focal Wildlife Species

2.7.4.1 Identification of Focal Species

At the local knowledge workshops conducted in Old Crow, Yukon, in November 2004, the North Yukon Planning Commission, Vuntut Gwitchin First Nation, Yukon Department of Environment, and other plan partners identified three focal species as being of interest for further study: Porcupine caribou, moose, and marten. Waterbirds (ducks, swans, geese, loons) were also of interest. Many significant areas for waterbirds were identified by Old Crow residents during a Ducks Unlimited local knowledge workshop in May, 2004. These species are of importance for community subsistence harvest, and they also have special cultural and ecological significance to first nations and other residents.

A summary of current knowledge of the focal species' distribution, population status, and observed habitat use within the region is reported below. Maps of suitable habitat for each are described and shown. This information was obtained through community workshops held in Old Crow, and workshops held in Whitehorse with Yukon Government biologists. During these sessions, observed habitat use for each focal species was discussed, rated, and mapped for each species and season. The ratings were based on observed habitat use by each species. These ratings were then applied to the biophysical map of the region (see biophysical map Section 2.6.2.3 and Appendix 1, Map 8) to produce an overall map of habitats rated for each focal species.

Given the specific habitat requirements of waterbirds, a map of potential waterbird habitat was produced in consultation with Ducks Unlimited Canada and the Canadian Wildlife Service. The findings are reported below.

2.7.4.2 Habitat Suitability Workshops

Key Findings

- A summary of habitat ratings obtained from the habitat suitability workshops, for each focal species and season, is shown in Table 2.7.4.2(c)

Background

At the November 2004 community wildlife workshop in Old Crow, residents expressed interest in describing and mapping observed habitat use of caribou, moose, and marten within the region. These species are important for community subsistence harvest, and they have special cultural and ecological significance to first nations and other residents.

Two subsequent workshops were held with Old Crow community residents and Yukon government biologists in 2005 to rate observed habitat use for each species, by season. The objectives of the workshops were to: 1) describe and discuss the habitats identified and mapped as part of the biophysical mapping exercise for the region (see Section 2.6.2.3), 2) to rate each habitat type for its relative value to these wildlife species, for each season considered, and 3) to apply the habitat ratings to the biophysical map to identify areas of suitable habitat for these species.

In early January, 2005, the Yukon Department of Environment hosted a habitat suitability mapping workshop in Whitehorse, Yukon. Biologists were asked to rate the seasonal value of various habitat types occupied by caribou (Porcupine herd) and moose within the region. Each biologist had expert knowledge of the habitat use for each species. Colour reference photos of the various habitat types identified on the North Yukon biophysical map were shown to participants, and the photos were rated for their relative value to these species, by season.

A subsequent habitat suitability mapping workshop was held with Vuntut Gwitchin First Nation (VGFN) community residents in Old Crow, Yukon, from January 27-28, 2005. The workshop was hosted by the North Yukon Planning Commission, in partnership with the Yukon Department of Environment and the North Yukon Renewable Resource Council. Community residents who attended the workshop were shown the same habitat reference photos as provided at the biologist workshop. The participants were asked to rate the habitats for their relative value to caribou and moose, by season. Marten observed habitat use was also rated by community residents.

The ratings from the biologist and community workshops were combined to produce one rating for each habitat type, for each species and season. The intent of the exercise was to develop habitat ratings for each species and apply the ratings to the North Yukon biophysical map to identify the location and relative value of various wildlife habitats within the region.

Methods

For both workshops, colour reference photos of various habitats identified on the North Yukon biophysical map were shown to participants. The reference photos were taken at a variety of locations within the region, and corresponded to the 28 unique habitat classes shown on the biophysical map. Participants were asked as a group to rate each habitat type for its value to Porcupine caribou, moose, and marten, for each season of interest. Porcupine caribou and moose observed habitat use was rated by biologists and community residents at both workshops; marten observed habitat use was rated by community residents at the Old Crow workshop.

A four class habitat rating system was used for this exercise:

0 – lowest habitat value
1 – low habitat value
2 – moderate habitat value
3 – highest habitat value

Prior to the exercise, participants agreed on a common definition of the seasons and range of months for each season being considered. The dates for each season were discussed and decided upon by the Old Crow residents, based on their knowledge of the timing of important life history events for each species (i.e. rutting season).

With respect to rating observed habitat use, residents in Old Crow were generally familiar with and comfortable in rating winter habitat use of Porcupine caribou and marten, and all season habitat use for moose. Based on this feedback, the range of dates and seasons considered for the habitat ratings were as follows:

Table 2.7.4.2(a). Species, seasons, and range of dates considered for the wildlife habitat suitability mapping workshops in January 2005. The species and seasons were determined by residents of Old Crow.

Species	Season
Caribou	1 season • Winter (November 1 – March 31)
Moose	4 seasons • Spring-Summer (June 1 – July 31) • Early Fall (pre-rut, August 15-September 15) • Late Fall (rut to late fall/freeze up, September 16 – October 31) • Winter (November 1 – March 31)
Marten	1 season • Winter (November 1 – March 31)

An example of a habitat reference photo (high elevation shrub) shown to workshop participants is provided in Figure 2.7.4.2. The rating assigned to this habitat type varied from 0 to 3, depending on the species and season in question. A total of 16 Old Crow residents, 4 biologists, and 5 support staff participated either fully or partially in the wildlife habitat suitability workshops. A list of participants and support staff is provided in Table 2.7.4.2(b).

Support staff collected notes on the relative value of each habitat type, special conditions tied to the ratings that would influence the rating (i.e. snow cover), and other additional notes. All information was recorded on hardcopy data forms and is archived at the Yukon Land Use Planning Council office in Whitehorse. Yukon Department of Environment staff collected additional information on lynx and snowshoe hare observed habitat use during the workshops, for their own interpretation. These results are not reported here.

Following the workshop, habitat ratings and additional notes were entered into spreadsheets and checked for potential inconsistencies by support staff. Habitat ratings for each species and season were compiled in a database and the results were applied to the North Yukon biophysical map.

Preliminary maps of suitable habitat for each species and season were shown to the workshop participants in April 2005 for review and discussion. Revised tables were generated from the feedback received and the habitat ratings were re-applied to the North Yukon biophysical map. The final ratings for each species and season reflect an overall rating obtained by combining the knowledge shared by participants from both workshops, for each habitat type. The maps of suitable habitat are current to May 2006.

Discussion

A summary of the habitat ratings for each species and season is provided in Table 2.7.4.2(c). The maps of suitable habitat for each species and season, interpretations of the results and other key findings are reported below in the focal wildlife species assessment section (see Section 2.7.5).

It is important to acknowledge that the habitat ratings reported here are based on expert opinion and subjective interpretations of observed habitat use for the species considered. Workshop participants noted that the species' occupation of suitable habitats is dependent upon many factors including, but not limited to: snow depth/resistance, predation risk, competition for resources, weather, wind, insect harassment, timing of seasonal cycles (i.e. spring green-up), presence of mineral licks, fire history, recent burn intensity, individual/group behaviours, and human disturbance.

The ability to accurately identify and interpret habitat use for each species is neither implied nor guaranteed. There may be habitats used by each species, over longer time scales, that have not been prioritized or identified correctly in this assessment. In particular, an accurate assessment of winter habitat use is limited by an inability to incorporate snow depth information into the maps of suitable habitat.

Despite some limitations, the results of the habitat suitability workshops can be used to identify significant and potentially sensitive habitats within the region for Porcupine caribou, moose, and marten populations. The assessment highlights patterns in the arrangement (i.e. clusters) of habitat within the region. The results also identify areas that may not have significant habitat value for these species.

The maps are particularly useful to provide data for areas of the region that were previously lacking information on wildlife populations and habitats. In combination with the key wildlife areas maps compiled by Yukon Department of Environment (see Section 2.7.3.2 and Appendix 1, Maps 12-18), other telemetry or survey information, and local knowledge of wildlife distribution (see Section 2.7.2.1), the maps of suitable habitat are a useful product to identify wildlife values that may otherwise have been missed.

Figure 2.7.4.2 Example of a habitat reference photo (high elevation shrub) shown to workshop participants and rated for its value to caribou, moose, and marten, during the wildlife habitat suitability workshops in January 2005.

Table 2.7.4.2(b). List of VGFN community participants, expert biologists, and support staff who contributed to or recorded knowledge of observed habitat use for focal wildlife species at the habitat suitability workshops in January 2005.

VGFN participants:	
John Joe Kaye	Edith Josie
Joel Peter	Shawn Bruce
Stephen Frost Sr.	Essau Schaeffer
Irwin Linklater	Hannah Netro
Fanny Charlie	Peter Josie
Harvey Kassi	Freddie Frost
Stan Njootli Sr.	Robert Bruce
Donald Frost	Dick Nukon
Biologist participants:	
Rick Farnell, caribou biologist	Rick Ward, moose biologist
Don Russell, caribou biologist	Dorothy Cooley, Dawson Regional biologist
Support staff:	
Shawn Francis, NYPC	Bruce McLean, Yukon Dept of Environment
Dorothy Cooley, Dawson Regional biologist	Bev Brown, North Yukon RRC
John Meikle, Yukon Dept of Environment	

Table 2.7.4.2(c). Summary of North Yukon region habitat ratings assigned to each habitat type by workshop participants, for each species and season (0=lowest value, 3=highest value).

Habitat description	**Habitat Rating (scale of 0-3)**					
	Caribou	*Moose*				*Marten*
	Winter	Fall	Late Fall	Winter	Spring/ Summer	Winter
UPLAND ECOSYSTEMS						
High Elevation						
High Elevation Rock/Exposed	2	1	0	0	0	0
High Elevation Sparsely Vegetated	2	1	2	0	1	0
High Elevation Herb (Mountain)	2	1	2	0	0	0
High Elevation Shrub (Mountain)	0	1	3	2	0	1
High Elevation Coniferous Forest (Mountain)	2	1	2	0	0	2
Low-Middle Elevations						
Low Elevation Exposed/Sparsely Vegetated	0	0	0	0	1	0
Wet Sites						
Wet Herb (Plateau, Valley)	1	1	1	1	0	1
Wet Shrub (Plateau, Valley)	0	3	1	2	3	1
Wet Mixedwood Forest (Plateau, Valley)	1	3	3	2	0	2
Wet Coniferous Forest (Plateau, Valley)	0	2	2	0	1	2
Moist Sites						
Moist Herb (Plateau, Valley)	1	1	1	1	0	0
Moist Shrub (Plateau, Valley)	1	1	3	2	0	1
Moist Mixedwood Forest (Plateau, Valley)	1	3	3	2	0	2
Moist Coniferous Forest (Plateau, Valley)	3	2	3	0	0	2
Mesic Sites						
Mesic Herb (Plateau, Valley)	2	1	0	0	0	0
Mesic Shrub (Plateau, Valley)	2	1	2	1	0	1
Mesic Mixedwood Forest (Plateau, Valley)	1	3	3	2	0	2
Mesic Coniferous Forest (Plateau, Valley)	3	2	3	0	0	2
RIPARIAN ECOSYSTEMS						
Riparian - Exposed	0	1	1	1	0	0
Riparian - Herb	2	3	3	1	1	1
Riparian - Shrub	1	3	3	3	0	1
Riparian - Mixedwood	1	2	3	3	1	3
Riparian - Conifer	2	0[1]	0	1	0	2
Riparian - Wetland	2	2	1	3	3	1
WETLAND ECOSYSTEMS						
Wetland - Herb	2	2	1	3	3	1
Wetland - Shrub	0	3	1	2	3	1
Wetland - Forest	0	2	2	0	1	1
AQUATIC ECOSYSTEMS						
Open Water (Standing and running)	2	2	3	1	3	1

[1] A rating for this habitat type was not obtained, and it was arbitrarily assigned a rating of 0

2.7.5 Focal Wildlife Species Assessment

2.7.5.1 Barren-ground caribou (Porcupine herd)

2.7.5.1.1 Populations

Key Findings

- Most of the region is occupied by the Porcupine caribou herd (see Appendix 1, Maps 19-23)
- Caribou occupy the region primarily during winter, spring migration, fall migration, and late fall seasons; occupation is limited during the calving, post-calving and early summer
- The herd occupies the Richardson Mountain range during most seasons; the northern portion of the Richardson range is occupied during the summer as well
- The herd occupies the Eagle Plains basin less often, consistent with findings dating back to the 1970s
- Most of the seasonally important areas (calving and summer range), when caribou are least tolerant of disturbance, are within Ivvavik and Vuntut National Parks, and Old Crow Flats Special Management Area

Background

The Porcupine caribou are a barren-ground herd that range from Northeastern Alaska to the Yukon/Northwest Territories border (see Appendix 1, Map 19a). The herd is of special cultural significance to northern communities, and it plays an important role in northern ecosystems. Within the region, the community of Old Crow is one of the primary users of the herd, and subsistence harvest remains strong (Berman et al. 2004). Approximately 600 caribou are harvested each year near Old Crow. Other communities harvest caribou during the winter season along the Dempster highway corridor.

General migration patterns of the herd show that animals converge on the north slope of the Yukon and Alaska during the spring migration season, en route to the calving grounds. During the fall migration to late fall (rut) season, the herd displays large variability in movements between habitat patches. In general, fall migration occurs as a southward movement of caribou into the Richardson and Ogilvie mountain ranges. Between the late fall to winter season, caribou move more locally between habitat patches, within these same mountain ranges. A detailed description and characteristics of the caribou range are reported in Russell et al. (1993).

Within the region, the factors most likely to impact the herd in the near future are oil and gas exploration and development, and effects of climate change. The cumulative effects on the herd from these and other factors may be greater than each factor in isolation. Potential oil and gas development project areas and timelines are discussed in Section

4.1.2. In Alaska, barren-ground caribou have shown a particular sensitivity to disturbances associated with oil and gas development (Nellemann and Cameron, 1998; Cameron et al. 2005). Negative impacts to boreal caribou populations in the Northwest Territories are anticipated if development proceeds along the MacKenzie Valley pipeline corridor (J. Nagy, University of Alberta, pers. comm.). Additional harvest pressures on caribou are a concern when new areas are opened up for exploration and potential development. The potential positive and negative effects of climate change on the Porcupine herd have also been reported (Kruse et al. 2004, McNeil et al. 2005).

The most recent population survey, conducted in 2001, estimated a herd size of 123,000 animals, down from a 30 year high of 178,000 animals in 1989 (McNeil et al. 2005). Considerable research effort has been devoted to understanding the herd's distribution, life history, energetics, and potential effects of development on caribou health, dating back to the 1950s (i.e. Fancy et al. 1989, 1994; Russell et al. 1992, 1993, 2005; Griffith et al. 2002; McNeil et al. 2005). The herd is generally considered to be the most studied in the world (Russell et al. 2000).

A long-term study of relevance to land-use planning has involved tracking seasonal movements of cows fitted with radio-collars. Each year since 1983, several cows have been collared, and tracked for a few years afterward, to understand habitat use and movement patterns of the herd. An examination of these data is useful for identifying broad, landscape level patterns in distribution and movements of the herd. A detailed description of the telemetry project and results can be found at the Arctic Borderlands Ecological Knowledge Societies (ABEKS, 2005).

To improve our understanding of concentrated and general use areas of importance to caribou across the herd's range, the Canadian Wildlife Service and the Yukon Land Use Planning Council analyzed the telemetry dataset of cow locations (years 1985-2004). The goal was to identify seasonally significant areas for caribou. Calving season distributions are included from analyses reported in Griffith et al. (2002). The assessment confirmed that the entire North Yukon region is occupied by caribou at all times of year, but particularly during winter, spring migration, fall migration, and the late fall (rut) seasons. The results are reported below.

Methods

The general methods for identifying concentrated and general use areas of animals from home range analyses are described in Seaman et al. (1998). The method to determine a concentrated use area follows that described in other studies (Schindler, 2005; Schindler pers. comm.). Concentrated use areas represent habitats occupied at a higher density of animals than other areas within the herd's range. General use areas represent habitats where most of the animals were found.

Additional detail on the telemetry project and the range of dates for seasons when caribou are found within the region are reported in McNeil et al. (2005) and Griffith et al. (2002). These seasons are as follows:

(1) Winter (December 1 to March 31)
(2) Spring Migration (April 1 to May 31)
(3) Calving (3 week period following first recorded birth)
(4) Post-calving (June 11 to June 30)
(5) Early summer (July 1 to July 15)
(6) Mid to late summer (July 16 to August 7)
(7) Fall migration (August 8 to October 7)
(8) Rut/late fall (October 8 to November 30)

Concentrated and general use areas for all seasons were identified to permit a range-wide assessment of seasonally significant areas. All analyses were based on individual locations of animals, as determined by satellite re-location. Concentrated and general use areas for the calving season have been previously reported (Griffith et al. 2002), and these results are also shown. General migration pathways were also derived for the winter, spring migration, fall migration, and late fall (rut) seasons when caribou primarily occur within the region. Migration pathways represent the movements of one or more satellite collared animals between seasons and habitat patches.

Discussion

Appendix 1, Maps 19b and 20 show the concentrated and general use areas of the herd for the seasons described above. For the calving season, concentrated and general use areas are shown from results reported in Griffith et al. (2002). Appendix 1, Maps 21-23 show the general migration pathways of caribou between areas and seasons when they occupy the region most.

Within the region, the concentrated use areas represent a total area of 1,962,620 hectares. This represents approximately 35% of the planning region's total area. Across the entire range of the herd, including Alaska, the concentrated use areas for all seasons is estimated at 8,480,980 hectares. The concentrated use area within the region represents 23% of the total concentrated use areas across the entire range.

Appendix 1, Map 20 shows the concentrated and general use areas of the herd within the region, separated by seasons. As indicated above, caribou primarily occupy the region during the winter, spring migration, fall migration, and late fall (rut) seasons. The relative importance of annual life-cycle periods and associated habitats for these seasons were previously evaluated and ranked by the Porcupine Caribou Technical Committee (1993). The Committee reported that for these seasons, the Porcupine herd caribou: a) are more tolerant to disturbance, b) have a lower intensity of habitat use in a given area, and c) have the option of accessing alternative habitats. In contrast, the calving, post-calving, and early summer seasons were identified as the most important and sensitive seasons for caribou populations.

It must be noted that Committee's findings provide general guidance only. If the herd's range and populations are impacted through multiple projects and disturbances in the region, the cumulative effects on caribou health may be substantial. The negative consequences of cumulative infrastructure development on barren-ground caribou have been documented in some studies from Alaska (i.e. Nelleman and Cameron, 1998).

The findings of these analyses on caribou distribution and movement in the region suggest that the Richardson Mountain range has been a consistent concentrated use area for the herd, during fall, winter, and spring seasons. The northern portion of the Richardson range has also been a consistent concentrated use area during summer. In contrast, the Eagle Plains basin has received limited occupation by caribou, consistent with findings dating back to the 1970s. Probable explanations for these observed patterns have been reported (Russell et al. 1993, Russell 2000).

During the calving season, caribou have been observed within the northern portion of the region northeast of Old Crow; a small area of concentrated calving area is present in the Barn Range straddling Vuntut National Park and Old Crow Flats SMA (see Appendix 1, Map 20). During the post-calving and early summer seasons, the herd is primarily found concentrated within the coastal plain portion of the Arctic National Wildlife Refuge in Alaska. During the summer season, caribou are present within the northeast portion of the north Yukon region near the Old Crow Range. The majority of the concentrated use areas identified for the calving and summer seasons are located inside Ivvavik and Vuntut National Parks, and the Old Crow Flats Special Management Area (SMA) region.

It is important to note that these results are consistent with published findings on Porcupine caribou distribution (i.e. Russell et al. 1992, 1993). However, the ability to accurately and completely identify and interpret all Porcupine caribou herd concentrated use areas, general use areas, and migration routes is neither implied nor guaranteed. The findings here show caribou distribution patterns observed over the past half-century; however, there may be areas used by caribou over longer time scales, which are not identified on these maps.

For example, areas that have burned within the past 50 years may become more significant as lichens recover. The observed patterns in caribou use of the region from this assessment may have been influenced by short-term environmental changes such as fire events and snowfall, and long-term changes in climate. Several elders at the Old Crow wildlife workshops commented that observing changes in caribou use of the land required long-term studies (i.e. 100 years).

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2.7.5.1.1 Habitats

Key Findings

- Approximately 47% of the region contains habitat rated by Old Crow community residents and biologists as moderate to high value for caribou during winter (see Appendix 1, Map 24)
- Southern portions of the region were mapped as high value winter caribou habitat, northern portions were mapped as lower value winter habitat
- Many suitable habitats within the region have not been occupied as often by caribou in recent times (i.e. Eagle Plains basin), likely owing to deep snow cover
- Mapping of suitable winter caribou habitat identified significant and potentially sensitive areas of value to caribou, particularly during low snow years
- Long term patterns in caribou distribution are likely influenced more by regional snow conditions than by presence of suitable habitat

Background

At the November 2004 community wildlife workshop in Old Crow, residents expressed interest in describing, rating and mapping observed habitat use of the Porcupine caribou herd. Caribou are a species of great interest and importance, and community residents have repeatedly expressed concerns about conserving caribou habitats in light of potential oil and gas exploration and development, and the uncertainty of climate change impacts. Local knowledge dating back to the 1930s and over two decades of telemetry information confirmed that most of the region is occupied by the herd (see Sections 2.7.2.1.2 and 2.7.5.1.1 above).

Caribou occupy the region primarily during winter, spring migration, fall migration, and the rut/late fall seasons. Caribou are also found in the northern portion of the region during the calving and mid-late summer seasons. There is less occupation of the region during the seasons following calving and the early summer season. The range of dates representing these seasons are reported in McNeil et al. (2005). A detailed description of the herd's range and habitat requirements of the herd have been previously reported (Russell et al. 1993; Griffith et al. 2002).

As discussed in Section 2.7.4.2 above, two workshops were held in January 2005 with biologists and Old Crow community residents to rate observed habitat use of caribou for the winter season. The workshops were intended to gather expert knowledge to identify and map suitable habitats for caribou. A map of suitable winter habitat for the Porcupine caribou herd was produced from the findings of the workshops.

Methods

In January 2005, biologists and Old Crow residents rated photos of various habitats for their relative value to caribou, for the winter season. Old Crow community residents were most familiar with and comfortable in rating observed habitat use of the herd in winter, when animals are located near Old Crow. The winter season was defined by Old Crow residents as November 1 to March 31. Details of the habitat suitability mapping workshops are reported above (see Section 2.7.4.2).

The ratings from the biologist and Old Crow community workshops were combined to produce one rating for each habitat type. The final caribou winter habitat ratings were applied to the North Yukon biophysical map (see Section 2.6.2.3). The output is a map of suitable winter habitat for caribou. The map of suitable habitat is current to May 2006.

Discussion

A map showing suitable winter habitat for caribou is provided in Appendix 1, Map 24. The map shows that high value winter habitat is generally present in the southern portions of the region, particularly in the southeast. The northern portion of the range was shown as lower value winter habitat, while the Richardson Mountains along the eastern portion of the region were identified as moderate value winter habitat. Approximately 47% of the region was mapped as moderate to high value winter habitat (35% moderate and 12% high for each class, respectively).

A comparison between the radio-collared caribou locations and the map of suitable winter habitat showed poor agreement. Many of the caribou in the region during the winter season were not found in the most suitable habitats. This was likely owing to several factors that were not considered. For example, Eagle Plains basin has an abundance of suitable habitat but there has been less occupation of that region in recent years, likely due to the presence of deep snow cover here (Russell et al. 1993). In contrast, concentrations of caribou have been consistently found in the Richardson Mountains (see Section 2.7.5.1.1 above), an area of low snow due to snow redistribution (Russell et al. 1993). We could not include snow cover in this assessment due to a lack of information on past and present snow conditions across the region.

It is important to acknowledge that the habitat ratings are based on expert opinion and subjective interpretations of observed habitat use of caribou. Workshop participants noted that caribou occupation of suitable winter habitats is dependent upon many factors including: snow depth/resistance, predation risk, competition for resources, weather, wind, timing of seasonal cycles (i.e. spring green-up), fire history, individual/group behaviours, and human disturbance. The accuracy in identifying and interpreting habitat use for caribou may have been limited by our inability to incorporate these factors.

Despite these limitations, the map of suitable winter habitat for caribou identified many significant and potentially sensitive habitats within the region for caribou. Snow characteristics are likely an important factor influencing caribou distribution in deep snow years, whereas the presence of suitable vegetation under the snow would influence caribou distribution in shallow snow years. The maps of suitable habitat identify many areas with lichen cover that caribou feed on, and if snow depths are shallow the maps are useful to identify areas that could be occupied by caribou. Russell et al. (1993) noted that long term distribution of caribou on the winter range appears to be largely dictated by regional snow patterns.

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2.7.5.2 Moose

2.7.5.2.1 Populations

Key Findings

- Most of the region is used by moose during all times of year; approximately 15% of the region has been surveyed for moose (see Appendix 1, Map 25)
- Moose appear to be increasing in numbers and expanding their range within the region
- Moose abundance in the region is highest during the summer season
- Populations of some moose within the region are highly migratory, moving from low elevation summer range in Old Crow Flats to high elevation winter range in Alaska
- Maps of suitable habitat for moose showed good agreement with habitats where moose were found on surveys

Background

Moose are present, or are expected to be present, across most of the region. Moose are of special cultural significance to northern communities, and they play a dominant role in northern ecosystems. Within the region, the community of Old Crow harvest moose for subsistence purposes. Moose are generally not harvested much when caribou are available, and harvest levels are typically very low. In the fall of 2005, only 18 moose were harvested near Old Crow. Only 10 moose were reported harvested in 2006 (Robert Kaye, VGFN, pers. comm.). Moose are also harvested during the fall season along the Dempster highway corridor.

Populations of some moose within portions of the region are highly migratory. In Vuntut National Park, moose move from low elevation summer range in western Old Crow Flats to high elevation winter range in Alaska (Mauer, 1998). Other findings suggest a more localized migration of moose between eastern portions of Old Crow Flats in summer to the Richardson Mountains and Keele Range in winter, and some summer/winter migration from the Old Crow region to the North Slope and Bell River regions of the Yukon (Yukon Fish and Wildlife Branch, 1997; Smits 1991).

Within the region, the factors most likely to impact moose in the near future are climate change and oil and gas exploration and development. The cumulative effects of these factors may be greater than each factor in isolation. Climate change is expected to result in an increase in moose habitat within the region (Rick Ward, Yukon Department of

Environment, pers. comm.). A popular hypothesis associated with climate warming is that an expected increase in shrub cover may lead to increased foraging opportunities for moose, with subsequent moose range expansion and increased abundance. Northward range expansions of moose, associated with climate change, have been evidenced in the Northwest Territories, Labrador, Ontario, and Quebec (Chubbs and Schaefer, 1997; Norment et al. 1999), often with corresponding declines in caribou populations. The effect of the arrival of moose to the northern Yukon is not currently being investigated.

Potential oil and gas development project areas and timelines are discussed in Section 4.1.2. Increased disturbance associated with development activities may also increase moose habitat by promoting willow and shrub growth along access corridors. However, any anticipated increase in habitat owing to such activities may be offset by increased hunting access and associated mortality, particularly if the use of new roads and trail networks cannot be controlled.

Several moose surveys have been conducted opportunistically in the region, spanning the period from 1987-2003 (Access Consulting Group, 2001; Smits, 1991; Yukon Fish and Wildlife Branch Unpublished reports 1997, 2000, 2003). Most of these have been winter surveys, between November and March. Moose location data from the 1987-1989 Richardson Mountains surveys have not been mapped. Appendix 1, Map 25 shows the areas surveyed for moose and locations where animal(s) were found, from 1995-2003.

The available data indicate that suitable habitats in the region have high winter densities of moose compared to other regions of northern Yukon. The Richardson Mountains winter survey during 2000 recorded the highest density of moose in suitable habitats in the Yukon, to date. However, overall winter moose abundance is expected to be lower than other seasons owing to migration out of the region (Mauer, 1998; R. Ward, Yukon Department of Environment, pers. comm.).

During the summer season of peak abundance, there are an estimated 5000 moose within the region (Yukon Department of Environment, unpublished data, 2006). This total includes an estimated 875 moose within Vuntut National Park. Local knowledge and survey information suggest that moose populations are increasing and expanding their range within the region (Gray and Alt, 2001; NYPC, unpublished data, 2006).

To gain a better understanding of moose habitat use and preferences within the region, the Yukon Land Use Planning Council and Yukon Department of Environment compared the existing moose survey locations with the maps of suitable habitat for the region (see Section 2.7.4.2). The main objective was to determine how closely the maps of suitable habitat matched where moose were actually found. As moose population distribution and status information are lacking for much of the region, this necessitated a reliance on the identification of suitable moose habitats to predict areas where moose might be found. The predictions are important to identify priority areas for moose to assist planning. The results are reported below.

Methods

Locations of moose counted on surveys were overlayed on the maps of suitable habitat (described in Section 2.7.4.2 and below in Section 2.7.5.2.2; also see Appendix 1, Maps 26-29) for each season to determine agreement between where moose were found and the ratings assigned to those habitats at the habitat suitability workshops. The comparisons were undertaken for winter, spring/summer, early fall, and late fall seasons. Much of the information on moose locations outside the winter season were obtained from the ANWR telemetry dataset.

The seasons were defined as per the habitat suitability workshops as follows (see Section 2.7.4.2 above):

(1) Winter (November 1 to March 31)[1]
(2) Spring/Summer (June 1 to July 31)
(3) Early Fall (pre-rut, August 15 to September 15)
(4) Late Fall (rut to late fall/freeze up, September 16 to October 31)

The ratings assigned to the habitats underlying each moose location were then summarized. An example of this overlay, using Old Crow 2003 survey data and the winter map of suitable habitat, is shown in Figure 2.7.5.2.1.

A detailed summary of habitats used by moose was also undertaken by overlaying the moose survey information on the North Yukon biophysical map for the winter season (see biophysical map in Appendix 1, Map 8). There was sufficient information to do the analysis for the winter season only. The information used in this assessment was from the Richardson Mountains winter survey in 2000, the Eagle Plains winter survey in 2000, and the Old Crow winter survey in 2003. A total of 439 moose were counted on these three surveys. These results were used to determine which habitats were preferred or avoided by moose, according to methods described in Johnson (1980).

Discussion

The aerial survey coverage shown in Appendix 1, Map 25 represents 847,032 hectares of area, or 15% of the region. No survey boundary is available for the ANWR telemetry dataset, so the area of coverage could not be included.

The analyses confirmed that the maps of suitable habitat developed for moose are a useful product to identify priority habitats for planning purposes. The comparison of the locations where moose were observed with the maps of suitable habitat showed that most animals were found in habitats rated as moderate to highest value. Overall, 58% of the moose locations in the region were found within habitats rated as moderate to highest value by plan partners (Old Crow residents and Yukon government biologists).

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[1] Old Crow residents noted that this season was fairly broad and that animals would be expected to move around and use a variety of habitats during this period, but there was general agreement on this definition

For the winter season, a comparison of moose locations with the habitats shown on the biophysical map also indicated that habitats rated as moderate to highest value by plan partners were preferred by moose. Moose generally avoided the habitats rated as low to lowest value by plan partners. The results and comparisons are presented in Table 2.7.5.2.1. In the winter, moose were found primarily within river/stream valleys and wetlands, upland mixed-wood forest, and higher elevation coniferous forest. Moose used some habitats equally in the winter; for example, moose preferred wetland herb habitats equally to riparian-mixedwood according to the moose use rating. These habitats have a tied rating in the table.

It is important to acknowledge that the findings are based on a limited information base; the ability to identify and interpret habitats of importance to moose is neither implied nor guaranteed, particularly outside the winter season. There may be habitats occupied by moose, over longer time scales, that have not been prioritized or identified correctly in this assessment.

Additional moose survey information would permit a more robust assessment of the maps of suitable habitat for other seasons outside the winter season. Perhaps an examination of the winter information for specific seasons important to moose (i.e. rut and post-rut) would improve the interpretations of habitat use; biologists noted that moose occupy shrubby habitats in early winter (November), and are often found in denser cover, particularly river valleys, in late winter (Rick Ward, Yukon Department of Environment, pers. comm.). These differences in habitat use would not be identified here because these periods were grouped together into the winter season.

However, despite the limitations, the maps of suitable habitat for moose in the region are generally accurate descriptions of where moose were found during surveys. Most moose counted on surveys were found in habitats rated as moderate to highest value by Old Crow residents and Yukon government biologists. For the winter season, the specific habitats where moose were found showed that moose generally preferred habitats rated as moderate to highest value, and avoided habitats rated as low to lowest value.

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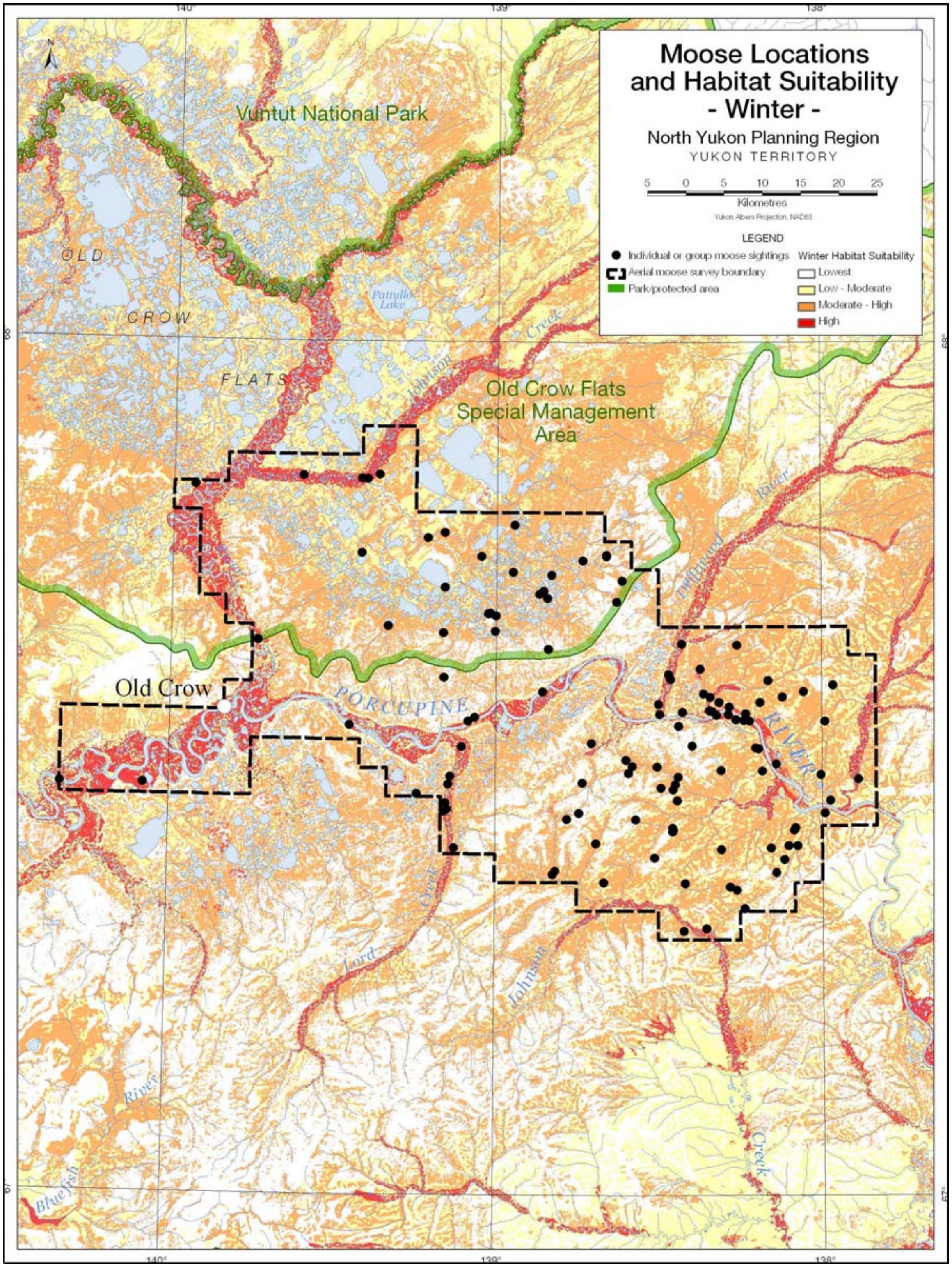

Figure 2.7.5.2.1. Example of moose survey locations (Old Crow 2003) overlayed on map of suitable moose habitat for Old Crow area, winter season (November to March).

2.7.5.2.1 Habitats

Key Findings

- Suitable moose habitat is present across most of the region (see Appendix 1, Maps 26-29)
- Approximately 70% of the region contains habitat rated by Old Crow community residents and biologists as moderate to high value for moose
- Identified suitable habitats included river/stream valleys, wetlands, and upland forests
- Mapping of suitable moose habitat identified significant and potentially sensitive areas for moose during all seasons

Background

At the November 2004 community wildlife workshop in Old Crow, residents expressed interest in describing, rating and mapping observed habitat use of moose. Moose are a species of interest and importance for community subsistence harvest. Local knowledge dating back to the 1930s and aerial survey data collected since 1987 confirmed that most of the region is occupied by moose (see Sections 2.7.2.1.2 and 2.7.5.2.1 above).

Moose occupy the region during all seasons, but moose abundance is greatest during the summer season. In the summer, moose are primarily found in river/stream valleys and wetlands. Winter moose abundance is expected to be lower than the other seasons owing to migration out of the region (Mauer, 1998; Rick Ward, Yukon Department of Environment, pers. comm.). In the winter, moose are primarily found within river/stream valleys, wetlands, upland mixedwood forest, and higher elevation coniferous forest. Local knowledge and survey information suggest that moose are increasing in numbers and expanding their range within the region (Gray and Alt, 2001).

As discussed in Section 2.7.4.2 above, two workshops were held in January 2005 with biologists and Old Crow community residents to rate observed habitat use of moose for the spring/summer, early fall, late fall, and winter seasons. The workshops were intended to gather expert knowledge to identify and map suitable habitats for moose. A map of suitable moose habitat for each season was produced from the findings of the workshop.

Methods

In January 2005, biologists and Old Crow residents rated photos of various habitats for their relative value to moose, for the spring/summer, early fall, late fall, and winter seasons. The seasons were defined as follows: winter (November 1 to March 31), spring/summer (June 1 to July 31), early fall (August 15 to September 15), and late fall (September 16 to October 31). Details of the habitat suitability workshops are reported above (see Section 2.7.4.2).

The ratings from the biologist and Old Crow community workshops were combined to produce one rating for each habitat type. The final moose habitat ratings, for each season, were applied to the North Yukon biophysical map (see Section 2.6.2.3). The outputs are maps of suitable habitat for moose. The maps of suitable habitat are current to May 2006.

Discussion

Maps showing suitable habitat for moose are provided in Appendix 1, Maps 26-29. As expected, the maps show that high value habitat is generally present within river/stream valleys, wetlands, and upland forests in the region. The majority of the region contains habitat suitable for moose; approximately 70% of the region was mapped as moderate to high value moose habitat. By season, 17% of the spring/summer habitat was moderate to high value, 43% of the early fall season habitat, 57% of the late fall season habitat, and 32% of the winter season habitat.

As indicated in the moose population section (see Section 2.7.5.2.1), a comparison between the locations of moose counted on aerial surveys and the presence of suitable habitat showed good agreement. Most moose were found in habitats rated by workshop participants as moderate to high value. Overall, 58% of moose were found within habitats rated as moderate to high value for all seasons combined.

It is important to acknowledge that the habitat ratings are based on expert opinion and subjective interpretations of observed habitat use of moose. Workshop participants noted that moose occupation of suitable habitats is dependent upon many factors including: snow depth/resistance, predation risk, competition for resources, weather, wind, timing of seasonal cycles (i.e. spring green-up), fire history, recent burn intensity, individual/group behaviours, and human disturbance. The accuracy in identifying and interpreting habitat use for moose may have been limited by our inability to incorporate these factors.

Despite some limitations, the maps of suitable habitat for moose identified many significant and potentially sensitive habitats within the region for moose. Most of the habitats are located within river/stream valleys, wetlands, and upland forests. Limited survey information confirmed that most of the moose counted during past aerial surveys were found in habitats rated as moderate to high value. This assessment also showed good agreement with the maps of suitable winter habitat produced for portions of the region by Prescott et al. (1973), particularly for the Bell River region of the North Richardson Mountains.

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2.7.5.3 Marten

2.7.5.3.1 Populations

Key Findings

- Most of the region below tree-line is used by marten during all times of year
- There is no information on marten population status or trend for the region, outside of Old Crow Flats
- Marten are a poorly studied and understood species in northern environments
- Marten are expected to be fairly tolerant of and resilient to disturbance
- A lack of information on marten populations necessitated a reliance on using maps of suitable habitat to identify priority areas for marten in the region

Background

Pine Marten are present, or are expected to be present, across most of the region south of the tree-line. A likely northern limit of marten distribution is the treed area near the Firth River in southwestern Ivvavik National Park (Gray and Alt, 2001). Marten are of special cultural significance to northern communities. Within the region, the community of Old Crow trap marten during the winter seasons to support subsistence economies.

Marten populations have not been monitored in the North Yukon, with the exception of Old Crow Flats. Parks Canada have been tracking marten populations in Old Crow Flats since 2001 (Henry, 2004). Results from that study to date suggest that marten populations fluctuate substantially between years, and locations, in the region. The need for better information on furbearer populations, including marten, has been identified for the northern Yukon (Vuntut Gwitchin First Nation et. al., 2002; Gray and Alt, 2001). Yukon Department of Environment's key area database (v. January 2006) has not identified any key areas for marten populations within the region.

Marten are a poorly studied and understood species in northern environments. The only detailed research on Yukon marten is reported in Archibald and Jessup (1984). Marten are associated with mature to old coniferous forest (Archibald and Jessup, 1984; Adamczewski et al. 2004). A survey of Yukon trapper's from 2002-2003 found the following habitat features were significant to marten: a) overhead cover from predators, b) ground cover for marten and mouse/vole prey, c) nearness to water, d) grassy openings or abundant shrubs such as willow, e) forest stands with mixed tree species, and f) areas of transition between forest types (Adamczewski et al. 2004). A detailed description of observed habitat use of marten has been reported for interior Alaska (Johnson et al. 1995). Marten diet studies in the Yukon have found voles, lemmings, snowshoe hare, berries, and birds as common food items (Slough et al. 1989).

Marten are expected to be fairly tolerant of and resilient to disturbance. Within the region, the factors most likely to impact marten in the near future are oil and gas exploration and development, climate change, and fire events. Potential oil and gas development project areas and timelines are discussed in Section 4.1.2. In other jurisdictions marten have been vulnerable to the effects of timber harvest, showing negative responses to low levels of habitat fragmentation (Hargis et al. 1999). Timber harvest is not currently a land-use activity of importance in North Yukon, outside of small scale community fuel-wood timber harvest (see Appendix 1, Map 47).

Declines in marten distribution have been attributed to a loss of mature forests by fire (Archibald and Jessup, 1984). Trapper experiences from southeast Yukon indicated that burned areas tended to have low marten abundance initially, but abundance may rebound 40-60 years following fire disturbance (Adamczewski et al. 2004). Given the recent fire history within the region (see Section 2.6.2.5.1), a decrease in marten habitat may be observed if trends toward increased fire frequency and intensity continue.

Detailed studies of marten are underway in Southeast Yukon, and these findings should provide improved understanding of northern marten populations (T. Powell, Yukon Department of Environment, pers. comm.). As better information becomes available, more detailed marten population and habitat findings will yield additional insight into habitat use of the species.

A general lack of information for marten in the North Yukon region necessitated a reliance on using maps of suitable habitat to identify areas where marten are expected to occur. These results are reported below (see Section 2.7.5.3.2).

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2.7.5.3.2 Habitats

Key Findings

- Suitable winter habitat for marten is present across most of the region (see Appendix 1, Map 30)
- Approximately 16% of the region contains habitat rated by Old Crow community residents as moderate to high value for marten during winter
- Southern portions of the region were mapped as high value winter marten habitat, particularly around Whitestone Village, compared to northern portions which had moderate value winter habitat
- Mapping of suitable winter marten habitat identified significant and potentially sensitive areas

Background

At the November 2004 community wildlife workshop in Old Crow, residents expressed interest in describing, rating, and mapping observed habitat use of marten. Marten are of special cultural significance to northern communities, particularly during the winter trapping season. Marten fur is highly valued—locally, nationally, and internationally. Local knowledge dating back to the 1930s and recent surveys (Henry, 2004; Gray and Alt, 2001) confirmed that most of the region is occupied by marten (see Section 2.7.5.3.1 above).

Marten occupy the region during all seasons. Marten are a poorly studied and understood species in northern environments; the only detailed research on Yukon marten is reported in Archibald and Jessup (1984). Marten are generally associated with mature to old coniferous forest; other important habitat features are overhead cover from predators, ground cover, nearness to water, grassy openings or abundant shrubs, forest stands with mixed tree species, and areas of transition between forest types (Archibald and Jessup, 1984; Adamczewski et al. 2004).

As discussed in Section 2.7.4.2 above, one workshop was held in January 2005 with Old Crow community residents to rate observed habitat use of marten for the winter season. The workshop was intended to gather expert knowledge to identify and map suitable habitats for marten. A map of suitable winter habitat for marten was produced from the findings of the workshop.

Methods

In January 2005, Old Crow residents rated photos of various habitats for their relative value to marten, for the winter season. Old Crow community residents were most familiar with and comfortable in rating observed habitat use of marten in winter, as this season overlaps with the trapping season. The winter season was defined as November 1 to March 31. Details of the habitat suitability mapping workshop are reported above (see Section 2.7.4.2).

The ratings from this workshop were combined to produce one rating for each habitat type. The final marten winter habitat ratings were applied to the North Yukon biophysical map (see Section 2.6.2.3). The output is a map of suitable winter habitat for marten. The map of suitable habitat is current to May 2006.

Discussion

A map showing suitable winter habitat for marten is provided in Appendix 1, Map 30. The map shows that high value habitat is generally present in mixed-wood forests within river/stream valleys in the region. Mixed-wood and coniferous forests were moderate value habitats. The vast majority of the region was rated as low value winter habitat. The map reveals areas of high value winter habitat located around Whitestone Village. Approximately 16% of the region was mapped as moderate to high value winter habitat; only 0.2% of this total was high value habitat. A comparison of observed marten locations with the map of suitable habitat could not be undertaken owing to a lack of data.

It is important to acknowledge that the habitat ratings are based on expert opinion and subjective interpretations of observed habitat use of marten. Workshop participants noted that marten occupation of suitable habitats is dependent upon many factors including: snow depth/resistance, competition for resources, weather, wind, timing of seasonal cycles (i.e. spring green-up), fire history, recent burn intensity, individual/group behaviours, and human disturbance. The accuracy in identifying and interpreting habitat use for marten may have been limited by our inability to incorporate these factors.

Despite some limitations, the map of suitable winter habitat for marten identified many significant and potentially sensitive habitats within the region for marten. Most of the habitats are associated with stands of mixed-wood or coniferous forest, particularly within river/stream valleys. A lack of marten survey information necessitated that the map of suitable habitat be used as the main information source to identify priority areas for marten.

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2.7.5.4 Waterbirds

2.7.5.4.1 Populations

Key Findings

- Important wetland and river areas for waterbirds (ducks, geese, swans, loons, and grebes) within the region include Old Crow Flats, Whitefish, Cadzow, Bluefish Basin, and the Porcupine River (see Appendix 1, Map 31)
- Breeding waterbirds occupying the Old Crow Flats depend on these wetlands and the Porcupine River as travel routes and resting areas during spring and fall migration
- Waterbird populations within the region appear to be stable or increasing, even for species of national conservation concern (Scoters and Scaup)

- Some recent studies suggest that the future health of waterbird populations in northern environments may be most affected by climate warming and loss of wetlands
- Smaller wetland areas within the region have not been surveyed but are believed to be significant to waterbird populations
- A map identifying wetland habitat that could potentially be occupied by waterbirds is discussed below (see Section 2.7.5.4.2 and Appendix 1, Map 32)

Background

An abundant and diverse waterbird community (ducks, geese, swans, loons, and grebes) occupies most of the region on a seasonal basis, from approximately April to October. Waterbirds and the wetland habitats supporting them are culturally significant to northern communities. Within the region, the community of Old Crow harvest waterbirds for subsistence purposes. Scoter species, locally known as black ducks, are the preferred duck species hunted by the community. People also used to hunt geese from an area known as “goose camp”, located approximately 25 km upstream from Old Crow.

Major wetland areas important to waterbirds in the region have been identified by the Yukon Wetlands Technical Committee (2005). These include Old Crow Flats, Whitefish Lake, Bluefish Basin, and Cadzow Lake (see Appendix 1, Map 9). The combined estimated area of these wetlands is 758,871 hectares (ha), representing 14% of the region. The majority of wetland habitat is contained within large wetland complexes formed by sediments from Glacial Lake Old Crow that drained during the Pleistocene (Pielou 1992).

Old Crow Flats (467,019 ha), located approximately 50 km north of Old Crow, was designated in 1982 as a wetland of international importance under the Ramsar Convention (Gillespie et al. 1991). Whitefish Lake, Cadzow Lake, and Bluefish Basin wetland areas are situated adjacent to the Porcupine River. The Porcupine River is a major drainage that runs north from its headwaters, where the Miner and Whitestone rivers meet, toward the Yukon-Alaska border.

The Whitefish Lake wetland area (167,334 ha) consists of approximately 1000 small lakes and ponds surrounding Whitefish Lake. The Eagle and Bell rivers flow through this area and eventually converge with the Porcupine River. The Bluefish Basin wetland area lies within the Old Crow Flats ecoregion and is comprised of shallow lakes predominately surrounded by large sedge fens with a diversity of vegetation (Yukon Ecoregions Working Group, 2004). The Cadzow Lake wetlands are located on both the south and north side of the Porcupine River surrounding Cadzow Lake, adjacent to the Driftwood River. These wetlands are located close to Old Crow Flats; the combined estimated area of Cadzow and Bluefish Basin wetlands is approximately 124,518 ha.

Waterbirds occupying the northern Yukon for breeding over-winter in a variety of locations across North and South America. Many waterbird species migrate to the Pacific coast to spend the winter. Birds also over-winter as far south as Texas, Mexico, Central

America, and northern South America. The Old Crow Flats is occupied by birds from all major North American flyways (Mossop, 1990).

There are no waterbird species of national conservation concern in the region. In fact, some waterbird species that are experiencing continental population declines have stable or increasing breeding populations on the Flats, including Scaup and Scoter species (Hawkings et. al. 1995).

Within the region, the factors that may impact waterbirds in the future are related to wetland habitat loss and degradation. Perhaps of greatest significance, global climate change models are generally predicting warmer and drier future climates at higher latitudes. Impacts to wetlands in the north include changes in ice conditions, snowfall patterns and spring thaws, as well as melting of permafrost, altered surface water flow, and an increase in wildfires. Changes to vegetation and shifts in waterbird distributions to adapt to these changes are possible consequences of these impacts. Several recent studies have documented long-term declines in surface water in Arctic environments (Hinzman et al. 2005; Riordan 2005; Smith et al. 2005), and losses of wetland habitats may negatively impact waterbird populations if the trends continue.

Exploration, development, and extraction of oil and gas products can have major impacts on wetlands and waterbirds. Disturbances to the landscape, including roads and seismic lines, are expected to have an impact on hydrology in regions with permafrost, but the extent of these impacts is not yet fully understood. Potential oil and gas development project areas and timelines are discussed in Section 4.1.2.

Waterbird surveys have been conducted either annually or opportunistically within various areas of the region, spanning the period from 1955-2005. The U.S. Fish and Wildlife Service have conducted aerial surveys of breeding waterbirds on the Old Crow Flats since 1955 (Appendix 1, Map 31). This long-term information has been summarised by the Canadian Wildlife Service to document trends in breeding populations of waterbirds (Hawkings et. al. 1995). Yukon Government and University graduate research projects have documented waterbird use of the Old Crow Flats during breeding (May to June), moulting (July to August), and staging (August to September) (Mossop and Hayes 1977, van de Wetering 1997).

Breeding waterbird surveys have been conducted by Ducks Unlimited Canada on the Whitefish Lake wetlands (2003-2005), Bluefish Basin wetlands (2003, 2005), and on the Cadzow Lake wetlands (2004-2005). Ducks Unlimited also conducted brood-rearing and fall staging surveys on Whitefish and Bluefish wetlands in 2003, and spring and fall staging surveys on the Porcupine River were conducted in 2005.

Little information has been collected on smaller wetlands outside of these major wetland areas. Aside from Old Crow Flats, there are no long-term information available for waterbird use of wetlands within the region. Most of the waterbird surveys conducted on Whitefish, Bluefish Basin, Cadzow, and the Porcupine River have between 1-3 years of information. It is likely that populations of waterbirds depend on smaller wetlands as well. A summary of waterbird population survey areas and findings is reported below.

Methods

The waterbird survey information in the region has primarily been collected during aerial helicopter or fixed-wing counts of birds. These counts have been conducted during the breeding, nesting, brood-rearing, and migrating seasons (April to October).

The United States Fish and Wildlife Service (USFWS) have conducted annual surveys of breeding waterbirds on the Old Crow Flats since 1955. A detailed account of the methods used for these surveys can be found in the USFWS standard operating procedures (U.S. Fish and Wildlife Service 1987). Mossop and Hayes (1977) discuss aerial and ground survey methods for breeding, nesting, and brood-rearing surveys.

Aerial methods for Ducks Unlimited Canada (DUC) surveys conducted on the Porcupine River and the Bluefish Basin, Cadzow and Whitefish wetland areas have been reported (van de Wetering and Hayes 2003; Leach and Hayes 2005; Leach 2006). The Porcupine River survey results from 2005 were summarized by DUC, and an estimate of the number of waterbirds per kilometer of river was produced. These results are discussed and mapped below for each 5 km portion of river, so that they show up at this scale.

Discussion

The Porcupine River is an important area for migrating waterbirds in the spring and fall. The densities of waterbirds (birds/km) from DUC surveys along the Porcupine River are shown in Appendix 1, Map 31. The Porcupine River and the adjacent wetland areas (Whitefish, Cadzow, and Bluefish Basin) are suspected to funnel birds to their breeding grounds, coinciding with spring ice break-up, to their breeding grounds via 3 routes:

1) Porcupine River ➔ adjacent wetland areas to breed;
2) Porcupine River ➔ adjacent wetland areas ➔ Old Crow Flats to breed; and
3) Porcupine River ➔ the Old Crow Flats to breed.

The use of these routes is likely dependent on timing of break-up and the range in arrival dates of various species (Leach 2006). In the fall season, the Porcupine River provides a migration travel route for waterbirds as they head south to their wintering grounds. In the fall, waterbirds begin to use the Porcupine River once the Old Crow Flats begin to freeze; however, their movement down the Porcupine River is more likely influenced by the presence of strong north winds, rather than the timing of freeze-up.

Old Crow Flats is used by more waterbirds than any other Yukon wetland area. Approximately half a million breeding and moulting waterbirds use the Old Crow Flats each year, including breeding populations of up to 100,000 Lesser and Greater Scaup, 100,000 American Wigeon, 100,000 Northern Pintail, 80,000 White-winged and Surf Scoter, 40,000 Canvasback, and 30,000 Long-tailed Duck (Hawkings, 1996). Also breeding here are Tundra Swans, White-fronted Geese, loons, and a variety of other waterbird species.

Waterbird populations depend on the Porcupine River, Whitefish, Bluefish Basin, and Cadzow wetland areas. Thousands of waterbirds are found on the Bluefish Basin and Cadzow Lake wetlands in the spring and summer (van de Wetering and Hayes 2003, Leach and Hayes 2005). An abundance of aquatic vegetation provides excellent breeding and brood rearing habitat. Up to 26 species of waterbirds have been recorded using the Bluefish Basin and Cadzow Lake areas.

The Whitefish Lake wetland area is important to waterbirds during multiple stages of their life cycle, particularly when Old Crow Flats are frozen (Leach 2006, Leach and Hayes 2005, van de Wetering and Hayes 2003). During the breeding season, this wetland area is used extensively by ducks, geese, and swans. Daily population estimates approach 6000 waterbirds (Leach and Hayes 2005, van de Wetering and Hayes 2003). Up to 21 species of waterbirds have been recorded using the Whitefish Lake area.

Information is not available for wetlands and wetland areas outside these identified important major wetland areas. As waterbird population distribution and status information are lacking for much of the North Yukon region, this necessitated a reliance on using maps of potential habitat to identify additional areas where waterbirds are expected to occur (see Section 2.7.5.4.2 and Appendix 1, Map 32).

It is important to acknowledge that the findings are based on a limited information base and some expert opinions about waterbird habitat use. The ability to identify and interpret all wetlands of importance to waterbirds is neither implied nor guaranteed. A comprehensive and accurate map showing all wetland habitats in the region is currently unavailable. There may be habitats occupied by waterbirds, over longer time scales, that have not been prioritized or identified correctly in this assessment.

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2.7.5.4.2 Habitats

Key Findings

- Waterbird potential habitat includes lakes, rivers, wetlands, river/stream valleys, and areas adjacent to lakes (see Appendix 1, Map 32)
- Approximately 8% of the region, at a minimum, contains wetland habitat that could potentially be occupied by waterbirds
- Wetland habitats identified here have not been independently surveyed, verified or otherwise field checked for mapping accuracy
- A map of waterbird potential habitat is intended to identify additional wetlands to complement existing maps of the region's major wetland areas and rivers
- Maps of waterbird potential habitat generally showed good agreement with wetland habitats identified on the North Yukon biophysical map (see Section 2.6.2.3)

Background

Aside from the four major wetland areas (Old Crow Flats, Whitefish, Cadzow, and Bluefish Basin) identified by the Yukon Wetlands Technical Committee in 2005, and large rivers such as the Porcupine, there are vast areas of lakes, rivers, wetlands, river/stream valleys, and areas adjacent to lakes that could be occupied by waterbirds. A major limitation to identifying additional wetland areas is that accurate and current maps of wetland resources are not available, nor have these areas been surveyed or otherwise assessed for their relative values to waterbird populations.

Despite this limitation, the National Topographic Database map series (NTDB) identifying lake, river, and wetlands as separate features was recently compiled in a draft database by Yukon Department of Environment (YDOE, 2003). Although the map is a rough approximation of wetland resources, some additional wetlands could be identified.

It must be noted that the map of additional wetlands is based entirely on this incomplete draft database. Much of the information is outdated and does not reflect the current status of wetland resources. A comprehensive and accurate map showing all wetland areas is presently unavailable. Some wetland habitat types on this map are not identified, some are misclassified, and many that should be continuous features (i.e. rivers) are not shown or are only partly shown.

As indicated in the waterbird population section (see Section 2.7.5.4.1 above), climate change is the single most important factor that has affected, or is likely to affect, wetland resources in the region. Several recent studies have documented long-term declines in surface water in Arctic environments, and associated changes from wetland to terrestrial habitat (Hinzman et al. 2005; Riordan 2005; Smith et al. 2005). A 5% decline in lake extent from 1972 to 2001 was recently reported for Old Crow Flats (Labreque 2005).

In addition to the wetland habitat types described here, an important consideration for waterbird populations is the availability of nesting habitat adjacent to open water areas. A detailed study of waterbird nesting locations conducted at Minto Flats, Alaska between 1989-1991 showed that on average most birds nested within 100m of open water, in lowland habitats (Petrula 1994). Nest searches in this study were conducted out to a distance of approximately 3 km from open water areas, in both high and low water years. Nests were located closer to open water, on average, in years when water levels were high.

Based on these results, the habitats around rivers (river/stream valleys) and lakes were identified and mapped to represent potential nesting habitat. It should be noted that 2 of 3 years where nest location data was collected were high water years, and the data may not represent low water conditions. However, this information provides the best available estimate of potential nesting habitat for waterbirds in the North Yukon region.

A summary of waterbird potential habitat is reported below. The map identifies areas that could potentially be occupied by waterbirds.

Methods

A map of waterbird potential habitat for the region was produced from 1:50,000 scale digital NTDB maps showing water resources. The NTDB basemaps were attributed by Yukon Department of Environment (v.2003) to identify distinct river, lake, and wetland features.

There were some overlapping features in the dataset (i.e. rivers and lakes also shown as wetlands); in these cases rivers and lakes replaced wetland features for the area of overlap. Features were only counted once to avoid double-counting areas.

A 100m buffer zone was mapped around river and lake features to identify potential nesting habitat, based on results from Petrula (1994). Buffers were not applied to wetland features from the NTDB layer; wetland features do not necessarily represent open water and likely include a variety of habitat types.

The total area of river, lake, wetland, river/stream valleys, and areas adjacent to lakes represents the habitats that could potentially be occupied by waterbirds. The total amount of open water habitat for the region (rivers and lakes), based on the NTDB information, was compared with the open water habitat shown on the North Yukon biophysical map (see Section 2.6.2.3 and Appendix 1, Map 8) to determine if the two map products agreed.

Discussion

A map showing waterbird potential habitat is provided in Appendix 1, Map 32. The total area of potential habitat is 463,439 hectares (ha), which represents 8% of the region. Of this, 159,976 ha were lake areas (size range 0.000000003 to 3624 ha), 20,908 ha were river areas, 78,638 ha were wetland areas, and 203,917 ha were river/stream valleys or areas adjacent to lakes. It must be noted that these findings are minimum estimates of potential habitat, and there is likely more wetland habitat in the region than is identified in this assessment.

As discussed above, some wetland habitat types on existing maps are not identified correctly, some are misclassified (i.e. wetlands that may currently be dry or dominated by shrubs), and many river/streams are not mapped as continuous channels. This is a particular problem for smaller river/streams in the region. The potential nesting areas mapped around river/streams and lakes are based on studies from Alaska, and there may be differences in waterbird nesting habitat use in the northern Yukon.

A comparison of open water habitat (rivers and lakes) from the NTDB map with the open water identified on the North Yukon biophysical map showed good agreement. The NTDB maps identified 180,883 ha of open water habitat (3.3% of the region) while the biophysical map identified 158,800 ha of open water habitat (2.9% of the region). However, it should be noted that the NTDB maps were partly used to produce the biophysical map, so general agreement in open water area estimates was expected.

The assessment of waterbird potential habitat area differs from other wetland summaries in the region, likely owing to the definition of wetland. The Yukon Wetlands Technical Committee assessment of important wetland areas for North Yukon (v.2005) identified Old Crow Flats, Whitefish, Bluefish Basin, and Cadzow Lake. Together, these represented 14% of the region. The soils based map of “wet” habitat (v.2005) produced by Nancy Steffen for the northern Yukon region identified 865,000 ha of wetland, representing 16% of the region (see Section 2.6.2.4 and Appendix 1, Map 9). The soils map identified many wet areas such as peat-bogs and fens; many of these areas might not be considered as suitable waterbird habitat. Additional work is required to define and map wetland habitats for regional planning purposes.

The waterbird potential habitat map shows areas that could be occupied by waterbirds. Despite the limitations, the map identified many significant and potentially sensitive wetland areas in the region. Wetlands are significant not only for waterbirds, but for other species that depend on wetlands. The assessment is likely an underestimate of wetland habitat in the region. A comprehensive and accurate map showing all wetland habitats is currently unavailable, and there may be habitats occupied by waterbirds that have not been identified correctly in this assessment.

At a coarse scale, the map of waterbird potential habitat identified additional wetland areas for planning purposes, to complement existing maps of the large wetland areas and rivers of known importance to waterbirds in the region.

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2.8 Fish Resources

This section summarizes the distribution and status of fish in the region. Approximately 18 species of fish occupy the region, on a seasonal or annual basis. Various sources of traditional, local, and scientific knowledge of fish distribution, status, and trends in the region are summarized. The summary focused on salmon species, game-fish (i.e. grayling, pike, whitefish, etc.), and non-game fish.

Suitable habitats that support fish species are described, identified, and mapped (where possible). Many significant and potentially sensitive areas for fish are highlighted; some of these areas (i.e. spawning and over-wintering locations) are critical fish habitat. Potential threats to the health of fish and their habitats are discussed.

2.8.1 Fish Species List and Status

Key Findings

- The region (Porcupine River watershed) is occupied seasonally or annually by approximately 18 species of fish including salmon, freshwater game-fish, and other non-game species (see Table 2.8.1 below)
- Fifteen of the fish species are annual residents; three salmon species migrate into the region during July to December
- Records of fish species are based on observed presence of fish; there are knowledge gaps in the information
- There are no fish species of national conservation concern present in the region

Background

Approximately 18 species of fish including 3 species of salmon, 8 species of game-fish, and 7 other species of non-game fish occupy the region, on a seasonal or annual basis. The information on fish occupancy of the region comes from a report prepared by Isaac Anderton of Environmental Dynamics Inc. for the North Yukon Planning Commission (North Yukon Planning Commission, 2004). The report includes records of fish known to occur within the Porcupine River watershed, which covers the entire region. The Porcupine watershed has four large tributaries: the Old Crow, Bell, Whitestone, and Miner rivers. Two major tributaries, the Eagle and Fishing Branch Rivers, also contribute to the Porcupine drainage.

Information for the report was assembled from various sources of current and historical local/traditional knowledge, and fish resource surveys conducted by various agencies. Much of the agency information comes from surveys and studies conducted in the 1970s.

The list includes records of fish known to occupy certain rivers/streams and lakes of the Porcupine River watershed. An assessment of each species' population distribution, status, and trends across the region is not available. There are no fish species of national conservation concern in the region.

Methods

A fish species list was compiled from the report prepared for NYPC by Environmental Dynamics Inc. (North Yukon Planning Commission, 2004). Each species in the list was documented as present in one or more tributaries or lakes within the Porcupine River watershed. The information came from a variety of sources, including published and unpublished reports (most from the 1970s), and from a local knowledge fisheries workshop conducted by NYPC on November 2nd, 2004 in Old Crow, Yukon. Details of the fisheries workshop are provided below (see Section 2.8.2).

Discussion

Listed below are 18 species of fish which occupy the North Yukon Planning Region (Table 2.8.1). Three salmon species occupy the region during summer, fall, and early winter migration and spawning seasons. The remaining 15 freshwater species generally occupy the region at all times of year. Information was assembled from records of fish presence in 31 river/streams and 30 lakes in the region. The historical information spanned the period from approximately the 1940s to present. The complete fisheries resource assessment report with specific details of each species, locations they can be found in, and references can be obtained from the NYPC website (North Yukon Planning Commission, 2006).

It should be noted that the fish report is not a comprehensive survey of all fish species in the region, but rather a compilation of existing fish information from a variety of survey data, local/traditional knowledge, and incidental sightings. The Porcupine River watershed contains many remote areas with limited access and approximately 2000 lakes (North Yukon Planning Commission, 2004); information is not available for many areas of the watershed. Some of the species listed here may be rare or absent from the region; alternatively, the fact that a species is not recorded does not mean it is absent.

Despite the limitations of the available information, this list currently provides the most comprehensive source of knowledge for determining fish presence in the region.

Table 2.8.1. Occurrence of fish species in the North Yukon Planning Region.

Number	Species	Season (x=present)			
		Spring	Summer	Fall	Winter
	Salmon species				
1	Chinook		x		
2	Chum			x	
3	Coho				x
	Freshwater game-fish species				
4	Arctic grayling	x	x	x	x
5	Least cisco	x	x	x	x
6	Broad whitefish	x	x	x	x
7	Lake whitefish	x	x	x	x
8	Burbot (loche)	x	x	x	x
9	Inconnu (coney)	x	x	x	x
10	Northern pike	x	x	x	x
11	Lake whitefish/Inconnu hybrid[1]	x	x	x	x
	Other non-game fish species				
12	Longnose sucker	x	x	x	x
13	Lake chub	x	x	x	x
14	Slimy sculpin	x	x	x	x
15	Spoonhead sculpin[2]	x	x	x	x
16	Round whitefish	x	x	x	x
17	Trout perch	x	x	x	x
18	Arctic lamprey	x	x	x	x

References

North Yukon Planning Commission. 2004. Porcupine River watershed fisheries information summary report. Prepared by Isaac Anderton, Environmental Dynamics Inc. December, 2004. 48 pp.

North Yukon Planning Commission. NYPC maps and publications website. Accessed November 8, 2006. URL: http://www.nypc.planyukon.ca/index.php?option=com_docman&task=cat_view&gid=97&Itemid=338

[1] Hybrid species presence was documented in 1970s, no further information available
[2] Distribution limited to portions of upper La Chute River

2.8.2 Traditional and Local Knowledge Synthesis

2.8.2.1 Vuntut Gwitchin First Nation

2.8.2.1.1 Old Crow Community Fisheries Workshop

Background

From October 27th to November 4th, 2004, the NYPC and plan partners hosted a series of local knowledge workshops to discuss regional heritage, fisheries, and wildlife values with community residents in Old Crow. The workshops were held to gather community input on important cultural areas, and significant current and historical areas for fish and wildlife populations within the region. All information that was generously shared by residents was documented and mapped.

The fisheries workshop was held on November 2nd, with participation of staff from the NYPC, Vuntut Gwitchin First Nation, Yukon Department of Environment, Department of Fisheries and Oceans, North Yukon Renewable Resource Council, Environmental Dynamics Inc., Canadian Wildlife Service, and Ducks Unlimited Canada. A total of 19 Elders and community residents, and 12 support staff (planners and biologists) participated either fully or partially in the workshop session. A list of participants and support staff is provided in Table 2.8.2. Similar workshops to identify important areas for fish and fish trap locations have been previously conducted in the community (Anderton 2002, 2003). This workshop was intended to add to the existing knowledge base for fish, and to identify areas that were not previously reported or documented.

Various species groups including salmon, game-fish, and other non-game fish species were discussed at the fisheries workshop. Many significant areas were identified. Important land uses (i.e. fishing, fish trap location, etc.) associated with each species or species group were recorded, along with notes about seasonal or annual occupation by fish, and why the area was important. Much of the information had been previously documented, but some new areas were revealed.

The information obtained was included in an overall summary report of significant areas for fish resources in the region. The report was prepared by Isaac Anderton at Environmental Dynamics Inc. from sources of traditional, local, and scientific knowledge (North Yukon Planning Commission, 2004). The findings are reported below.

Table 2.8.2. List of VGFN community participants and support staff who contributed to or recorded knowledge of significant fish areas during the Old Crow community fisheries workshop in November 2004.

VGFN participants:	
Fanny Charlie	Irwin Linklater
Donald Frost	Stan Njootli Sr.
Marvin Frost	Stan Njootli Jr.
Stephen Frost Sr.	Hannah Netro
Edith Josie	Dick Nukon
Peter Josie	Joel Peter
William Josie	Victor Peterson
Danny Kassi	Lydia Thomas
Harvey Kassi	Peter Tizya
John Joe Kaye	
Support staff:	
Dave Breke, NYPC	Bob Hayes, DU
Shawn Francis, NYPC	Amy Leach, DU
Melissa Valja, VGFN	Jim Hawkings, CWS
Megan Williams, VGFN	Al Von Finster, DFO
Dorothy Cooley, Yukon Dept of Environment	Isaac Anderton, Environmental Dynamics Inc.
Val Loewen, Yukon Dept of Environment	Bev Brown, NYRRC

2.8.3 Identified Fish Areas

Key Findings

- Sources of traditional, local, and scientific knowledge confirmed that many of the region's river/streams, lakes, and wetland areas are, or have been, occupied by fish (see Appendix 1, Maps 33-39)
- Significant fish areas generally included the Porcupine River, portions of several major rivers and streams (i.e. Fishing Branch and Miner Rivers), and lakes within the regions' major wetland complexes: Old Crow Flats, Bluefish-Cadzow, and Whitefish
- Over-wintering and spawning areas are the most significant and sensitive fish habitats
- All river/streams, lakes, and wetland areas should be considered potential rearing habitat for fish
- Fish are generally poorly understood in the region
- The community workshop highlighted many potentially sensitive areas for fish populations within the region, particularly for areas lacking scientific information

Background

Various sources of current and historical information on fish populations and habitats in the region were gathered, reviewed, interpreted, and compiled into a report prepared for NYPC by Environmental Dynamics Inc. (North Yukon Planning Commission, 2004). The report contained a summary of existing sources of traditional, local, and scientific knowledge of fish in the region. The fish species summaries included salmon, game-fish, and several other non-game species. The information in the report was used to identify significant areas for various fish species in the region.

Information shared at the November 2004 workshop in Old Crow was included in the report, in addition to other sources of traditional knowledge (Anderton and Frost, 2002, 2003; Steigenberger et al. 1975). The community knowledge of significant areas generally spanned the period from the 1940s to present, although many of the stories told at the workshop reflected a historical knowledge base much older than this time period. Knowledge of fish trap locations and use dated back to the late 1800s. Much of the scientific data came from survey work conducted in the 1970s.

Fish harvesting in the region is an important cultural and subsistence activity. Both freshwater game-fish and salmon are harvested by the community of Old Crow for human consumption, as well as for dog food. Traditional knowledge indicated that historical fish harvests were much higher than present, when fishing effort was spread throughout the watershed. Current fishing activities and harvests are undertaken closer to Old Crow.

Various fisheries around Old Crow take place for approximately eight months of the year, from spring break-up in May until January. These activities include gill-netting for fish throughout the open water season, and during the late fall/early winter through the ice. Jigging for arctic grayling and burbot through the ice is undertaken during the late fall and early winter. Fishing for salmon is undertaken during the seasons when fish migrate upstream past Old Crow. Generally, Chinook salmon are harvested during July, Chum salmon in September, and Coho salmon during October to December.

The findings in the report provided a comprehensive overview of current and historical knowledge of fish distribution within the region. The complete report with fish summary information for specific river/streams, lakes, and wetland areas within the watershed is posted on the NYPC website (North Yukon Planning Commission, 2004).

Methods

Existing sources of traditional, local, and scientific information from reports and personal communications were reviewed, compiled, and summarized by Isaac Anderton at Environmental Dynamics Inc. Maps of significant areas for fish species were prepared from the findings of the report, using geographic information system (GIS) tools to define the boundaries of the identified locations. The maps showed fish species present in various river/streams and lakes, known or suspected over-wintering areas for fish, and salmon spawning areas. Historic fish trap locations were also included in the maps.

Salmon spawning and fish over-wintering habitats were mapped in two categories: “identified and inferred” and “suspected or potential”. The first category identified areas where salmon spawning or fish over-wintering have been documented, or where it can reasonably be assumed that these activities take place. The second category identified areas where spawning or over-wintering was possible or probable based on physical or biological elements (i.e. good gravel bottom, year-round open water, etc.). The categories do no imply that spawning or over-wintering occurs within the entire area identified on the map, but the activities can occur anywhere within an identified area.

Information gathered at the local knowledge fisheries workshop held in Old Crow, Yukon on November 2nd, 2004 identified additional significant current and historical areas for fish in the region. Significant areas were identified based on their relative importance to fish for various seasons and life functions (i.e. spawning, over-wintering, etc.).

Significant areas for various species and species groups were discussed and drawn on 1:250,000 scale paper maps of the region. The main species discussed included salmon and game-fish (i.e. chum, whitefish, grayling, burbot) of importance to community subsistence harvest. A few areas for other non-game fish species that are not generally harvested were also identified.

Discussion

Appendix 1, Maps 33-39 show significant fish areas identified from the available sources of traditional, local, and scientific knowledge (North Yukon Planning Commission, 2004). The maps show river/streams, lakes, and wetland areas where various fish species are or have been present. A note about the general level of knowledge and understanding (from very low to moderate) for each area is provided. Identified and potential over-wintering areas are shown, along with spawning habitat maps for salmon species. Historic fish trap locations are also shown.

Significant salmon spawning areas included the Porcupine, Fishing Branch, and Miner Rivers. Significant over-wintering areas included the Porcupine River, portions of several major rivers and streams, and lakes within Old Crow Flats, Whitefish, and Bluefish wetlands.

Rivers, streams and lakes that have not been identified in this report may be significant spawning or over-wintering habitat, but due to a lack of information this cannot be confirmed or supported. In the absence of information, all rivers, streams, lakes, and wetland areas should be considered potential rearing habitat for fish.

Potential threats to fish stocks within the region include habitat loss, degradation, barriers to fish migration, impacts on water quality, and climate change effects (North Yukon

Planning Commission, 2004). Industrial activities associated with exploration and development can contribute to impacts on fish resources; in particular, water extraction and consumption due to industrial development demands can have substantial impacts on fish populations and habitats, especially during the low flow winter period.

A few fisheries workshop participants were also concerned that the detonation of explosives associated with seismic activities had killed many whitefish in the past (i.e. 1950s).

Global climate change models are generally predicting warmer and drier future climates at higher latitudes, which may adversely impact water resources and fish dependent on these resources. These impacts can have particular significance for areas identified as over-wintering or spawning habitat.

Based on scientific evidence, fish over-wintering habitats are considered critical areas for fish. Critical areas for salmon include over-wintering habitat or areas with sufficient ground-water discharge for fish to spawn. Winter water flows are believed to represent a significant factor limiting fish habitat availability and productivity in the Porcupine River watershed. Ground-water storage, winter temperatures, and water flows are contributing factors to the availability of suitable winter habitat. Substantial data gaps limit the identification of areas that may provide suitable winter habitat.

Other factors that affect fish habitat quality are natural water quality and levels of dissolved nutrients (i.e. nitrates, phosphates, and potassium). Sources of water from limestone (i.e. North Ogilvie Mountains) are typically “hard” water sources that are productive fish habitats. Sources of water from bedrock formations of sulphurous shale (i.e. Eagle Plains) tend to be less productive fish habitats. However, information on water quality and nutrients for specific areas in the region are very limited.

Most of the identified significant lakes for fish populations are located within the Old Crow Flats, Bluefish-Cadzow wetlands, and Whitefish wetlands. A few additional lakes are located along the Porcupine, Bell, and Eagle Rivers. Lakes without fish tend to be shallow, and lack a direct connection to a river, stream or other waterway (I. Anderton, Environmental Dynamics Inc., pers. comm.).

The following provides general information on the locations and functions of significant areas for fish, based on the information summarized in the report.

Salmon

Salmon populations and habitats are generally better understood than other species in the watershed. The map of significant areas for salmon confirmed that most of the major rivers and streams within the Porcupine watershed are, and have been, used by salmon (Coho, Chum, and Chinook). Local knowledge and scientific information indicated that salmon are present in the region from approximately July (Chum migration) to December (Coho migration).

The major Chinook spawning destination is the Miner River. The major Chum spawning destinations are the Fishing Branch and Porcupine River near Old Crow. Coho are not as well understood, but some spawn in the Fishing Branch River. Historic information suggested that the three species occupied the Bell River in the past.

Game-fish

The map of significant areas for game-fish confirmed that most of the region's major rivers, streams and lakes have been occupied by all species of game-fish. Local knowledge of fish distribution was available for all seasons. Information on lakes was available for selected locations north of the lower Porcupine River.

Other non-game fish species

The map of significant areas for other non-game fish species identified many areas in the region, particularly within the Porcupine River. Most of these species were found in the region's major rivers and streams. Trout Perch have been found in the Porcupine, Bell, and Eagle Rivers. The Spoonhead sculpin has only been found in the LaChute River system. Arctic Lamprey has been noted in the Porcupine and Bell Rivers. The other fish species have not generally been found in the region's lakes, with the exception of the longnose sucker which has been found in lakes adjacent to the Porcupine and Bell Rivers.

Summary

The NYPC fisheries summary report highlighted significant current and historical areas for fish in the region, from a variety of traditional, local, and scientific sources of knowledge. It is important to acknowledge that while the information identified general areas of significance to fish, many of the identified areas are important cultural areas as well (see Sections 3.1.1 and 3.2.1). Many of the river, streams and lakes are important fishing, hunting, and trapping areas. The information provided a valuable assessment on the state of current knowledge of fish populations, particularly for areas lacking scientific data.

Generally, the level of understanding of fish in the region is poor, particularly for the region's lakes and wetlands. The understanding of salmon species is better than the other fish species. There are many knowledge gaps in the information base for areas that are visited infrequently (i.e. seasonally) or that have not been visited recently.

The traditional and local knowledge records are as accurate as the recollections of community member's current and historical knowledge of fish distributions within the region. Many of the observations are associated with stories that are not adequately captured in this type of summary. Some observations could not be linked to a particular location within the region; these are not included in the maps here but all workshop materials, observations, and products are available from NYPC and VGFN government.

The full fisheries summary report prepared by Isaac Anderton at Environmental Dynamics Inc. (North Yukon Planning Commission, 2004) is available from the North Yukon Planning Commission website (NYPC, 2006).

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Section 3: Human History, Heritage Resources and First Nations Land Use

The North Yukon Planning Region contains a remarkable assemblage of heritage resources spanning at least 2 million years of earth history. Paleontological resources associated with Beringia, the unglaciated Pleistocene refugium of northwest North America and north eastern Siberia, are recognized as being of global significance. The region hosts some of the oldest and best preserved examples of early human habitation and land use in North America. First Nations and Elders oral history and tradition provide an unbroken link to the recent past. The entire planning region is part of the vast Gwich'in homeland of northwestern North America.

This section provides a summary of the human history, heritage resources and First Nation land use, both current and historical, in the North Yukon Planning Region.

3.1 Human History and First Nations Traditional Land Use

Human history of the region in linked to Beringia. The region contains the oldest archaeological evidence of human habitation in North America. Historically, First Nations travelled throughout the region. First Nations traditional land use focused on harvesting and using the seasonal wildlife, fish and plant resources of the region. It is only since about 1960 that First Nations have resided in relatively permanent communities.

Key Findings

- Human history of the region is linked to the Beringian environment.
- The earliest indisputable and widespread evidence of human occupation of the region is 12,000 years.
- The planning region contains the oldest archaeological sites in North America. There is evidence of human occupation in the northern Yukon about 24,000 years ago (Bluefish Caves), and hints of the presence of humans in the Old Crow Basin as far back as 40,000 years ago.
- Direct Vuntut Gwitchin – European contact occurred in approximately 1840.
- At the time of initial European contact, at least four groups of Gwich'in utilized the land and resources of the North Yukon Planning Region: Vuntut, Tukudh, Black River and Tetlit

- It is only in relatively modern times that First Nation geographic boundaries have taken on a rigid nature
- As a result of European contact and the fur trade, the period 1900-1950 was a period of rapid cultural and economic change for the Gwich'in residents of the region.

Background

Understanding human history of the region requires an understanding of Earth history and the biophysical setting of the region. The geologic time period in which we live is called the **Quaternary Period**. It is subdivided into two epochs; the **Pleistocene epoch** which extends from about 2 million to 10,000 years ago, and the **Holocene epoch**, which refers to the period from about 10,000 years ago, the time of the retreat of the last glaciation, to the present.

Beringia describes the area of land in northern Yukon, Alaska, the periodically exposed sea floor of the Bering Sea and Arctic Ocean continental shelf, and northeastern Siberia that remained largely unglaciated during the Pleistocene epoch. The North Yukon Planning Region is entirely within the area considered to be Beringia.

Palaeontology is the study of animals and plants of earlier times. The key to the study of organisms and their environments of earlier times is the remains or evidence of animals and plant fossils.

Archaeology may be defined as the study of the human past through material remains, with the aim of ordering and describing the events of the past and explaining their meaning. Of most interest to archaeologists are those objects made or modified by humans, called artefacts. Archaeology also includes any research or information that illuminates past times, from recorded history to oral history and traditional knowledge.

In the North Yukon Planning Region, the oral history of the Vuntut Gwitchin, Tetlit Gwich'in and other First Nation cultural groups, records the story of their past. When combined, oral history and archaeological investigations provide a more complete picture of life in the recent past.

Available Information

A large amount of information regarding human history and traditional land use is available for the North Yukon Planning Region, and northern Yukon and NWT in general. The Old Crow basin and surrounding regions have received some of the highest levels of archaeological and paleontological investigation in North America. Ice-age mammal fossils were collected along the Porcupine River as early as the 1870s. Vuntut Gwitchin culture and lifeways were described as early as the 1930s. Research on Pleistocene mammals, archaeology and the paleoecology of Beringia occurred throughout the 1950s to present, with many VGFN citizens participating in these investigations. The

Yukon Refugium Project (1975-1979) and the Northern Yukon Research Program were two of the larger multidisciplinary research programs conducted in the region.

Gray and Alt (2001) provide an accessible summary of human history of the northern portion of the region. Greer (1989), Greer et al. (1995) and Sherry and VGFN (1999) provide overviews of human history in the Dempster Highway and Richardson Mountains areas. VGFN and Yukon Department of Tourism (1999), Appendix Two, provides a comprehensive synthesis of human history of the planning reigon. The VGFN Oral History Project, information collected during this and previous planning workshops (e.g., Old Crow Flats SMA Elders Workshop, October 2000) and the Dene Traditional Trail Mapping Project (Dene/Metis Mapping Project 1989) provide a record of First Nation land use and place names during the Historic period. Limited information is available for the western portion of the planning region, in the vicinity of Kandik River.

3.1.1 The Pleistocene (2 million years – 12,000 years)

Human history of the region is linked to the Beringian environment. The past two million years of Earth history has been the time of the Ice Ages, which saw most of the northern hemisphere covered by extensive ice sheets. The northern half of Yukon is one of the few regions in Canada that remained largely free of ice during this period. Hopkins et al. (1982) provide a detailed and intriguing description of the Berigian environment. The Beringian history of northern Yukon has been the focus of international scientific studies for more than 30 years; ongoing research, including the current International Polar Year projects, is producing new information on this significant chapter in human history. Many Vuntut Gwitchin members have assisted in these paleontological and archaeological investigations.

As a result of northern Yukon remaining largely unglaciated, the landscape preserves an exceptional record of past animals, environments and human occupations. The silts of the Old Crow Flats and Old Crow Basin Ecoregions preserve one of the best assemblages of extinct Pleistocene animals and plants in North America, if not the world. Pleistocene mammal species such as mammoth, mastadon, steppe bison, giant moose, giant sloth, giant beaver, short-faced bear, several varieties of horses and camels have all been found.

The unglaciated portions of interior Alaska and Yukon are also thought to be home to the first people to colonize North America. Morlan (1996) states that the earliest indisputable and widespread evidence of human occupation of western Beringia dates back to about 14,000 years ago. In eastern Beringia, on the North American side of the land connection, conclusive evidence dates back to 12,000 years (i.e., the North Yukon Planning Region).

However, despite the lack of conclusive and widespread evidence, there is evidence of human occupation in the northern Yukon about 24,000 years ago, and hints of the presence of humans in the Old Crow Basin as far back as about 40,000 years ago (Morlan 1996). The oldest archaeological site in the Western Hemisphere is Bluefish Caves. While still the source of debate, clues of human occupation of the caves date to approximately 24,000 years ago. The caves are located near the Bluefish River 50 km southwest of Old Crow, and are considered to be of global significance.

3.1.2 Pre-History (12,000 years ago – 1800)

Knowledge of the human prehistoric record is based on archaeological research. Some areas of the region, most notably Old Crow Flats, Bluefish Caves, Tl'oo K'at and Rat Indian River have been the focus of much archaeological research. Most of the region has received only limited study, due to remoteness.

In the vicinity of Old Crow, the Vuntut Gwitchin are thought to have inhabited the region continuously for several thousand years (Morlan 1973). Some sites in Vuntut National Park, in the foothills of the Barn and British Mountains, contain sites representing human occupations spanning at least the past 10,000 years. Tl'oo K'at, a gathering site in continuous use for at least 1,000 years, is located approximately 10 km upstream of Old Crow on the north bank of the Porcupine River. The Rat Indian Creek site, and adjacent Old Chief Creek, record at least 2,000 years of nearly continuous use, including winter semi-subterranean house pits.

In the Richardson Mountains and foothills, specifically in the Rock River area, material evidence for human presence dates to approximately 12,000 years ago, with a record of at least four different pre-historic groups of people spanning the Holocene, including the direct descendents of modern Gwich'in (Greer 1989; Gotthardt 1989). Little is known about the lifeways of these early people as they are recorded only by their stone tool technology. A lack of organic preservation at the Rock River sites limits the direct record of these peoples. The technology and lifeways of prehistoric Athapaskans are better known and preserved from sites such as Tl'oo K'at and Rat Indian Creek along the Porcupine River (Greer 1989).

In the Ogilvie Mountains, upland sites similar in their setting to the Richardson Mountains and foothills and Barn and British Mountains, also appear to occur. One site called Poulton Station has produced a stone point, which in nearby Alaskan sites is dated to 12,000 years ago. Cached wood at Bear Cave Mountain is dated to 8,000 years ago.

3.1.3 Historic Period (1800 – 1950)

Similar to other First Nations across North America, the period 1800 – 1950 was a period of rapid cultural and economic change for the Gwich'in First Nations of northern Yukon. European trade goods entered the area in the early 1800s and direct Vuntut Gwitchin - European contact occurred around 1840. Several trading posts and settlements in or adjacent to the planning region were established, and the fur trade introduced a cash economy to the region, resulting in changes to traditional economic and land use patterns.

Understanding the history of the region during the historic period establishes important context in which to understand and interpret current First Nation land use values and culturally significant areas.

3.1.3.1 First Nation Cultures

At the time of European contact in approximately 1840, at least four groups of Gwich'in utilized the land and resources of the North Yukon Planning Region – these were the Vuntut, Tukudh, Black River and Tetlit (Figure 3.1.1) (Greer 1989; Sherry and VGFN 1999). The total Gwich'in population at that time has been estimated at 5,000 people (Krech 1978). While each group was generally focused on the areas shown in Figure 3.1.1, the cultural boundaries were fluid. As noted by Greer (1989), there was speedy communication, frequent interaction and even co-residence between Han and Gwich'in as well as intra-Gwich'in. Bilingualism or multilingualism as well as intermarriage between the groups were not uncommon. Due to geopolitical factors, establishment of territorial and international boundaries, the creation of permanent settlements and recent land claims processes, it is only in relatively modern times that First Nation geographic boundaries have taken on a rigid nature (Greer 1989).

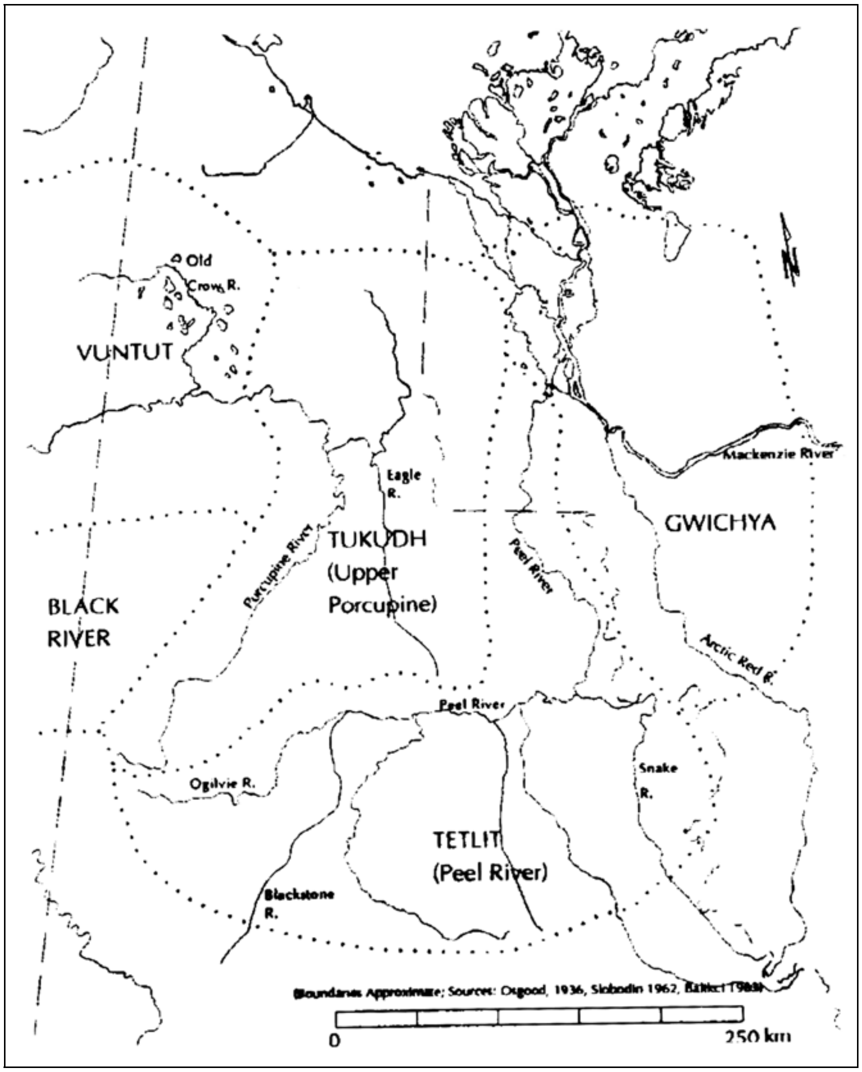

Figure 3.1.1. General distribution of Gwich'in First Nation cultural groups during the period of early European contact. Source: Greer et al. (1995).

Vuntut Gwitchin

The homelands of the Vuntut Gwitchin - *"those who dwell among the lakes"* - were centred on the drainage of the Old Crow River and Old Crow Flats. The Vuntut homelands extend west through the Coleen River drainage and east to the Berry Creek drainage, north to the divide of the British Mountains and south to the divide of the Keele Range, in both Alaska and the Yukon (Osgood 1934 and 1936; Leechman 1954; Balikci 1963; Morlan 1973). The community of Old Crow is the home of the Vuntut Gwitchin First Nation.

Tukudh Gwich'in

The area occupied by the Tukudh Gwich'in was the headwaters of the Porcupine River (Fishing Branch, Miner and Whitestone Rivers) downstream to the drainage of Berry Creek, the entire Bell River and Eagle River drainages, and east to the divide of the Richardson Mountains (Osgood 1934; and Morlan 1973, based on personal communication in 1970 with Elder Alfred Charlie). The Tukudh are not formally recognized in the structure of any of the Gwich'in First Nations today. Tukudh families gradually dispersed to Old Crow, Ft. McPherson, Dawson and Mayo during the early to mid-1900s in response to emerging settlements and changed land use patterns. In the planning region, Whitestone and Johnson Creek Villages were important Tukudh settlements used during the fur trade period. The Blackstone Uplands in the Ogilvie Mountains, near the present route of the Dempster Highway, was known to be an important Tukudh area (Greer 1989).

Tetlit Gwich'in

Tetlit Gwich'in – "*people who live at the head of the waters*" – used the upper and middle Peel River drainage, including the Snake, Bonnet Plume, Wind, Hart and Ogilvie Rivers (Slobodin 1962). Ft. McPherson is the primary community where Tetlit Gwich'in reside today. Tetlit Gwich'in land interests are formally recognized in the North Yukon Planning Region through the Tetlit Gwich'in Secondary Use Area along the western foothills of the Richardson Mountains.

Black River Gwich'in

The Black River Gwich'in used the Fishing Branch, Kandik River and Keele Range areas. Similar to the Tukudh, this cultural group is not currently recognized in the structure of Gwich'in First Nations. Black River families dispersed to Old Crow, Ft. Yukon and other communities in response to changing land use practices.

3.1.3.2 Vuntut Gwitchin Traditional Land Use

This section focuses on the traditional land use patterns of the Vuntut Gwitchin during the Historic Period (1800 – 1950), as summarized by the Vuntut National Park Resource Description and Analysis (Gray and Alt 2001). Traditional land use patterns of the Tukudh and Tetlit Gwich'in are described in Greer (1989), Greer et al. (1995) and Sherry and VGFN (1999). A synthesis of culturally significant areas, as identified by the VGFN Oral History Project, is reported in Section 3.2.4 and shown on Appendix 1, Map 40; most relate to traditional land use.

Anthropologists and archaeologists have described the annual round of Vuntut Gwitchin traditional activities of the late pre-contact and early post-contact periods based on interviews with Elders and archaeological research. The following is based largely on a summary by the archaeologist Morlan (1973), and draws also on the original ethnographical sources of Osgood (1934, 1936), Leechman (1954), and Balikci (1963). Morlan (1973) reconstructed the annual cycle in general terms from his archaeological work and from accounts obtained from Elders of Old Crow.

Spring

The spring season was the time of community caribou hunts at crossing places along the Porcupine River to intercept the northbound caribou migration. Hunting took place at several localities along the Porcupine River, between the Bell River to the east and Coleen River in Alaska to the west. Major camps are said to have been located on the river bank a few miles below high bedrock outcrops which afforded good lookout localities. Tl'oo K'at, Ddhah T'èe (Caribou Lookout) and Rat Indian Creek were major hunting camps and meeting places. Muskrat and bird hunting probably began in the late spring, both along the Porcupine River and in Old Crow Flats.

Summer

Major summer camps were located along tributary streams of the Porcupine and Old Crow Rivers where fish traps were set for salmon and other fish. Other summer activities included egg and berry gathering, rabbit snaring, and, in late summer, the capture of moulting birds. Balikci (1963) reports that the last fish traps "were seen along Old Crow River about 40 years ago (about 1920)." Morlan was unable to find any signs of a trap and associated camp that are said to have been located near the mouth of Old Crow River. River ice and water erosion may have destroyed or removed any evidence of the camp.

Morlan (1973) investigated the sites of two fish trap sites in Old Crow Flats and found the remains of both the trap and the camp at one of them. John Tizya, a former Vuntut Gwitchin chief, organized the construction of a fish trap at Tsdu-ho-ko in the late 1800s, and in 1899 a large group of people stayed at the site to run the trap. Thereafter only one family occupied the site regularly until 1929 when Tizya operated the trap for the last time (Morlan 1973).
Another fish trap site along the Porcupine River that has a historical reference is the outlet stream from Cadzow Lake. The location of all known historical fish traps is shown on Appendix One, Map 40, and is further discussed in Section 3.2.3.3.

Fall

By late August or early September it was time to move to the northern edge of Old Crow Flats to construct or mend the caribou fences or caribou surrounds used to trap and kill large numbers of caribou and, presumably, to establish nearby camps. The entire fall season, at least in the early post-contact period, was devoted to the operation of the caribou fences and the butchering and storing of meat.

The known caribou fences in the region area shown on Appendix One, Map 40. The major fences are located at Thomas Creek, Timber Creek, Black Fox Creek and in the Driftwood-Berry Creek areas. They were located strategically to intercept the seasonal caribou migration. The caribou fence complexes were used by particular family groups, and are tied to the history of families and the community of Old Crow. The fences represent an economic pattern and type of technology that was once common throughout the western subarctic, of which today few traces now remain (Greer 1989).

The fences were still used in the early 1900's, during the fur trade period. A description of the annual activities of a Gwich'in man around 1900, as recorded by Balikci (1963), includes the following description of the use of a caribou fence. "Elias... moved south across the mountains (from Herschel Island) to the caribou corral of Thomas, where some people had been hunting caribou. Soon after breakup he descended to Crow Flats, where he spent the summer fishing with fish traps set across creeks. In September he moved north again to the caribou corral owned by Thomas. About a dozen families had camped together there and hunted caribou with snares. They did this even though they had guns, in order to save ammunition. Elias spent the winter in the mountains, trapping foxes, wolverine and wolves."

Winter

Little is known of winter activities, but it is certain that the winter season would have been a difficult one. According to Old Crow Elders, the people did not split up into small, one or two-family units, but remained together through the winter in groups, to help one another and to take advantage of the guidance of a strong leader (Morlan 1973). Such groups were probably clustered around the hunters who led the operation of the caribou fences in the fall. The groups are said to have sought shelter from the high winds and extreme cold of the open Old Crow Flats in the protected valleys and hills along the south flank of Old Crow Flats. Important wintering areas mentioned by Elders were the upper reaches of Surprise and Potato Creeks. Sizeable numbers of Vuntut Gwitchin spent the winter months at Potato Hill (Morlan 1973; VGFN Oral History Project).

Individuals or families hunted and fished in particular areas at various seasons. For example, a family or two may have travelled north to the Firth River to fish for arctic char after leaving the fall camp at the caribou fence. Hunters may have crossed the Old Crow Range in search of moose along the lower Bluefish River, and others may have visited the winter range of the caribou near Lone Mountain. The Lone Mountain area south of the Porcupine River is said to have been an important place to find caribou in winter (Balikci 1963). Over the past 20 years, the Lone Mountain – Ahvee Mountain area was found to receive high levels of caribou use area through radio and satellite telemetry home range analysis (see Section 2.7.5.1 – Barren-ground caribou).

3.1.3.3 Trapping and Fur Trade

The fur trade brought significant changes to the region. Several trading posts in the present day Northwest Territories were established in the early to mid 1800s including Fort Good Hope and Peel River House. Peel River House was moved to and renamed Ft. McPherson in the late 1840's. Lapierre House was established at its current location as an outpost of Ft. McPherson in 1851. New Rampart House was established in 1891. Ft. McPherson attracted people throughout northwestern Canada including Tukudh, Tetlit and Vuntut to exchange food and furs (Slobodin 1962, Greer 1989). Through this trading activity, it was between 1820 and 1860 that guns were introduced in large scale to the region.

Russian trade goods reached Vuntut Gwitchin territory before outsiders themselves. These trade goods were probably exchanged at sites in Alaska and passed through other First Nation groups including Tanana, Han and Gwichyaa Gwich'in (Krech 1976). By 1840, Vuntut Gwitchin material exchange with Russian traders was direct (Krech 1976).

Prior to the 1900s, trapping was not pursued by the Vuntut Gwitchin as a major economic activity and therefore did not alter their land use or settlement patterns (Sherry and VGFN 1999). The fur industry did, however, bring outside people (i.e. Russian and European traders and trappers) to Gwitchin territory – these people introduced their lifestyles, technology and language to the region. Trapping activity introduced a cash economy, wage labour opportunities, and resulted in an influx of goods and materials, including many new food items. Several Hudson Bay Company and private trading posts/stores were opened throughout the region in the early 1900's (e.g., Rampart House, Old Crow). By the early 1900's, life in the north Yukon became increasingly focused on the fur trade. Between 1920 and 1950, trapping played a significant role in the Vuntut Gwitchin economy. Vuntut and Tukudh trappers and their families used Johnson Creek Village and Whitestone Village as a base from which to travel to their trap lines. The region was, and still is, rich in marten, fox, wolf, wolverine, beaver, lynx and muskrat.

The commercialisation of trapping activities did not result in unsustainable trapping practices and harvest levels (Sherry and VGFN 1999). A system of self-management regulated trapping activities and included numerous conservation practices such as the diffusion of harvesters across the landscape and resting and rotating trapping areas. For density-dependent species (e.g. muskrat and beaver), a strategy of continuous harvesting was used to regulate population numbers, thereby avoiding "boom and bust" population cycles.

3.1.4 Recent Period (1950 – Present)

The period 1950 to present represented a more settled lifestyle for the Gwich'in people. As the fur trade began to decline, the Tukudh Gwich'in of the upper Porcupine River slowly settled in Old Crow, Ft. McPherson and neighbouring communities. Wage-based economic opportunities also began to increase. Oil and gas and mineral exploration activities arrived in the Vuntut Gwitchin traditional territory in the 1950's. The Chance Creek oil discovery in 1960 initiated a 10-year period of oil and gas exploration activity in Eagle Plains. Some Gwich'in Elders participated in wage-based employment with these activities. While some wage-based employment became available, these opportunities were seasonal and short-term in nature, and the Vuntut Gwitchin still relied heavily on a mix of traditional economic activities – hunting, fishing and trapping.

The community of Old Crow, Vuntut Gwitchin culture and the Beringian environments of Old Crow Flats, Bluefish wetlands, Fishing Branch and Driftwood River were also the focus of much academic research and attention during this period. Conducted by the Geological Survey of Canada in the early 1960s, Operation Porcupine River resulted in much of the currently available bedrock geology mapping for the region. The Yukon Refugium Project and the North Yukon Research Program were two large multi-disciplinary research programs that examined archaeology, ethnography, geology, geography and ice-age environments. Many Old Crow residents assisted in these projects, and maintain long-standing friendships with the researchers of that time. In the 1970s, proposals for the Arctic Gas Project and the Dempster Lateral Pipeline resulted in significant levels of biophysical inventory effort being directed to the region.

Construction of the Dempster Highway was started in the 1960s, but not fully completed until 1979. Beyond the occasional opening of the Old Crow winter road, the Dempster Highway has not had a large impact on life in Old Crow. More frequent and regular air service came to Old Crow in the 1970s, but travel between Old Crow and outside communities was still difficult and sporadic the 1970s and 80s.

The period 1970 – 1993 can be considered the 'land claim period'. In 1972 the people of Old Crow presented a petition to the Government of Canada concerning oil and gas exploration in Old Crow Flats. In response to large-scale oil and gas proposals, the Mackenzie Valley Pipeline Inquiry (Berger 1977) also occurred during this period, setting the course for future land claim negotiations across northwestern Canada. During this period, much time and community energy was focused on land claim negotiations. Many Vuntut Gwitchin members contributed to this effort. By this time, a mixed-economy had become firmly established. The seasonal cycle of land use activities was established around the grade school year and other calendar events, and residents generally spent shorter amounts of time on the land.

The VGFN Final Agreement was signed in 1993, ushering in a new period of self-government and community capacity building. Increasing awareness of global forces and participation in ANWR-related lobbying efforts in the United States have produced a Vuntut Gwitchin culture clearly rooted with one foot on each side of 'traditional' and 'modern'. Most wage-based economic opportunities in Old Crow currently involve the delivery of government and municipal services, and transportation. Some Old Crow residents travel to other locations for wage-based work or training. While Old Crow residents do not spend as much time on the land as they did a generation ago, participation rates in traditional economic activities remain high (see Section 3.2). The total number of VGFN beneficiaries is estimated to be approximately 800, with 250 living in Old Crow.

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3.2 Heritage Resources and Vuntut Gwitchin Culturally Significant Areas

Heritage resources include sites and objects that are 45 years old or older and relate to human history, including archaeological and historic sites and artefacts. This definition also includes paleontological resources, which are fossil and other remains of extinct or prehistoric plants and animals.

Culturally significant areas refer to places where traditional land use activities occurred, including subsistence harvesting, travel routes and communities and camps. Culturally significant areas may also be the place of stories or legends. Culturally significant areas therefore represent an expanded concept of 'heritage resources'.

The *Historic Resources Act*, *R.S.Y. 2002, c.109* and *Archaeological Sites Regulation*, and VGFN Final Agreement Chapter 13, apply to the protection and management of historic resources[1] and sites in the region.

The region contains a remarkable assemblage of heritage resources spanning the last two million years of earth history, including some of the oldest and best-preserved examples of early human habitation and land use in North America. Two fur-trade era settlements are designated as Yukon Historic Sites.

Key Findings

- Appendix 1, Map 40 shows documented heritage resources and Vuntut Gwitchin culturally significant areas.
- The region contains heritage resources of global significance.
- Significant paleontological and archaeological resources result from the Beringian paleoecological setting, and people's ancient connection to the land and resources of that environmental setting.
- Two of the most important areas for paleontological and archaeological resources, Old Crow Basin and Ni'iinlii'njik (Fishing Branch) SMA, are currently protected.
- Other areas with high concentrations of archaeological resources are not currently protected, most notably the Driftwood River-Berry Creek area, and the Richardson Mountains.
- The region contains two fur trade era Yukon Historic Sites – Rampart House and Lapierre House. Important Gwich'in fur trade era communities include Whitestone and Johnson Creek villages.

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[1] "Historic resource" includes: (a) a historic site, (b) a historic object, and (c) any work or assembly of works of nature or of human endeavour that is of value for its archaeological, palaeontological, pre-historic, historic, scientific, or aesthetic features; "Historic objects" include: (a) an object that is more than 45 years old and has been abandoned, (b) an archaeological object, (c) a palaeontological object, and (d) an object designated under subsection (2) as a historic object

- The region contains a number of identified VGFN heritage routes, sites and other resources, including some of the last remaining caribou fences in North America.
- Culturally significant areas for the Vuntut Gwitchin include historical routes, harvesting areas, camps and habitations, and places of legend. Some of the most significant culturally-significant areas are contained within existing Protected Areas.

Available Information

Heritage resources have been described from a number of different sources. Greer (1989), Peepre et al. (1993), Greer et al. (1995) and Sherry and VGFN (1999) provide summaries of heritage resources and human history in the Dempster Highway – Richardson Mountains area. The Vuntut National Park Resource Description and Analysis provides an accessible summary of heritage resources in the northern portion of the planning region (Gray and Alt 2001). The VGFN Final Agreement, Chapter 13, Schedule A, lists identified heritage routes and sites. The Dene Traditional Trails Map (Dene/Metis Mapping Project 1989) illustrates historical routes and trails for the eastern portion of the region. The Yukon Historic Sites Inventory and Yukon Archaeological Sites Inventory database provides locations of documented historic and archaeological sites. Oral history interviews, documented through the VGFN Oral History Project, have been summarized by the VGFN Heritage Department. Results of a Vuntut Gwitchin Elder's workshop held during Old Crow Flats SMA planning, and a Vuntut Gwitchin Elder's heritage workshop held in support of the North Yukon regional land use plan provided additional information. North Yukon regional land use plan heritage workshop participants are listed in Table 3.2.1.

Table 3.2.1. Participant list for Vuntut Gwitchin heritage workshop held in support of North Yukon regional land use plan, October 28, 2004, Old Crow.

Participants	
Ellen Bruce	Robert Bruce Jr.
John Joe Kaye	Alfred Charlie
Charlie Thomas	Donald Frost
Joel Peter	Irwin Linklater
Stephen Frost Sr.	Edith Josie
Hannah Netro	Fanny Charlie
Peter Tizya	Dick Nukon
Support Staff	
Megan Williams (VGFN)	Mary Jane Moses (VGFN)
William Josie (VGFN)	Melissa Valja (VGFN)
Shawn Francis (NYPC)	Bev Brown (NYRRC)

3.2.1 Paleontologically Significant Areas

3.2.1.1 Major Wetland Basins

The three major wetland basins of the North Yukon Planning Region - Old Crow, Bluefish-Cadzow and Eagle-Bell (i.e. Whitefish Wetlands) - contain an exceptionally well preserved record of Ice Age animals and environments in thick deposits of frozen silts that are now being exposed as modern rivers down cut through the sediments. Today, many of the fossil bones are found washed out of the silt bluffs and re-deposited on gravel bars a short distance downstream, primarily along the Old Crow and Porcupine Rivers. Mammoth, mastodon, steppe bison, giant moose, giant sloth, giant beaver, short-faced bear, several varieties of horses and camels have all been collected from the Old Crow area.

Scientists are also recovering valuable information on past environments of the Ice Ages from these basins, including pollen, plant macrofossils and insect remains in the exposed silt bluffs along down cutting rivers. Paleoenvironmental reconstructions from Old Crow Flats are anticipated to play an important role in climate change and permafrost research in the coming years. Several International Polar Year research projects are expected to occur in Old Crow Flats.

3.2.1.2 Ni'iinlii'njik (Bear Cave Mountain and Fishing Branch)

The paleontological, archaeological and cultural significance of the Fishing Branch area was a major rationale for the creation of the Fishing Branch Ecological Reserve and Ni'iinlii'njik Wilderness Preserve. While the area has only received preliminary research, the paleontological potential of the caves associated with Bear Cave Mountain and surrounding limestone karst topography of Ni'iinlii'njik is significant. Because of the stable, below freezing temperatures inside the karst caves, paleontological remains are exceptionally well preserved – isolated bison and mammoth bones have been found lying on the cave floors, which are more than 10,000 years old. Bear dung was found in the chamber of a cave and was dated to about 35,000 years ago. It is possibile that this dung might be from the giant short-faced bear.

3.2.2 Archaeologically Significant Areas

3.2.2.1 Vuntut National Park and Old Crow Flats SMA

High densities of archaeological sites have been documented in the uplands of Vuntut National Park and Old Crow Flats SMA. The foothills of the Barn and British Mountains contain sites representing human occupations spanning at least the past 10,000 years, since the end of the Ice Age, with the possibility that some may also be late Pleistocene.

The majority of these sites probably relate to a many-thousand-year tradition of seasonal caribou interception.
The more recent expression of caribou interception technology occurs in the extensive caribou fence complexes. At least six caribou fences have been documented in the uplands of northern Vuntut National Park along Thomas, Timber and Blackfox creeks.

Historical fish traps have also been recorded at many locations within the park and SMA.

3.2.2.2 Old Crow - Lower Porcupine River

Fish traps have been documented in the vicinity of Old Crow including the Old Crow and lower Bluefish Rivers, Caribou Bar Creek, and in Bluefish Wetlands. Several important archaeological and paleontological sites are located along the lower Porcupine River. Tl'oo K'at, a gathering site in continuous use for at least 1,000 years, is located approximately 10 km upstream of Old Crow. Today, Tl’oo K’at is the site of VGFN General Assemblies.

3.2.2.3 Driftwood River - Salmon Cache - Middle Porcupine River

Spring and fall caribou interception sites are located on the major river crossings. Two of the largest of this type were Tl'oo K'at and Rat Indian Creek on the lower and middle Porcupine River. Rat Indian Creek shows at least 2,000 years of near continuous use. Discarded bone and stone tools, caribou bone and old camp fires are well preserved in the frozen river silts of these large sites. Associated with these sites are winter semi-subterranean house pits at Old Chief Creek and Rat Indian Creek.

3.2.2.4 North Ogilvie Mountains

Many archaeological resources of the Ogilvie Mountains appear to be associated with the limestone bedrock and karst (eroded limestone) landforms found throughout much of the Ogilvies. Hundreds of thousands of years of limestone weathering have produced numerous caves. Some caves record human use and hold the remains of Ice Age animals and plant macrofossils. The best examples of these limestone caves include Bluefish Cave, on the middle Bluefish River, and the cave complexes associated with Fishing Branch Ecological Reserve / Ni’iinlii’njik Wilderness Preserve. As discussed in Section 3.2.1, the paleontological potential of the caves is also significant.

Bluefish Caves

By virtue of its antiquity, Bluefish Caves is considered to be one of the most significant archaeological sites in Canada. Bones of caribou, mammoth, horse, bison and many other species have been recovered in deposits dating back to the peak of the last Ice Age, more than 20,000 years ago. A few scattered traces of human hunters are also present in the form of stone tools dating between 11,000 and 13,000 years ago. While still the source of debate, a flaked mammoth femur attributed to human activity is dated to 24,000 years ago.

Ni'iinlii'njik (Fishing Branch)

In the Fishing Branch area, only very preliminary research on human history has been carried out but initial discoveries provide an indication of the excellent archaeological potential. Two important caves in Fishing Branch are Bear Cave and Tsi-tche-han, both associated with the Bear Cave Mountain area. Wood brought into Bear Cave by early bear hunters has been dated to 8,000 years ago. Wood cached behind a low stone wall inside Tsi-tche-han dates to about 700 years ago. A third, newly discovered cave on the upper Fishing Branch River has stone axe-cut logs piled in the mouth, possibly as a meat cache, but is more recent in age, dating to the mid-1800's.

Upland sites, similar in their setting to the Richardson Mountains and Foothills and Barn and British Mountains, appear to occur in the Ogilvie Mountains as well. One site called Poulton Station has produced a stone point, which in nearby Alaskan sites is dated to 12,000 years ago.

3.2.2.5 Miner and Ogilvie Rivers

Although limited research has been conducted, the upper Miner River – Ogilvie River area has high potential for heritage resources. The area is the Tukudh Gwich'in homeland, and includes some cave sites similar in nature to Fishing Branch.

3.2.2.6 Richardson Mountains and Foothills

High densities of archaeological sites have been documented in the headwaters of the Rock and LaChute Rivers of the western foothills of the Richardson Mountains. Some sites have also been documented near Summit Lake at the headwaters of the Bell and Rat Rivers along the Yukon-NWT border. Similar to the Vuntut National Park and Old Crow Flats SMA, these sites represent human occupations spanning at least the past 10,000 years. The majority probably relate to a many-thousand-year tradition of seasonal caribou interception. As described by Gotthardt (1989), at least four distinct cultural groups are represented in the Rock River area, including the direct descendents of modern Gwich'in.

3.2.3 Historical Resources

Historical resources deal primarily with structures and locations of human occupancy more than 45 years old but post-European contact. In North Yukon, European contact is generally considered to be 1850. Historical villages, trading posts and similar features utilized since the 1800's are considered to be historic resources. Two sites, Rampart and Lapierre House, are formally designated as Yukon Historic Sites. Whitestone and Johnson Creek Villages, in addition to Rampart and Lapierre, hold special significance to the Vuntut Gwitchin. Some caribou fences were in use up to the early 1900s, at least 50 years after the large-scale introduction of guns to the region.

3.2.3.1 Historical Trading Posts and Villages

Rampart House

Rampart House is formally designated as a Yukon Historic Site and is jointly managed by the Vuntut Gwitchin and Yukon Governments (Vuntut Gwitchin First Nation and Yukon Department of Tourism 1999). Rampart House is located on the north bank of the Porcupine River at the Alaska/Yukon border, within VGFN S-site S-43A. Its location is a result of the Hudson Bay Company gradually withdrawing from the trading territory of the Russian Alaska Trading Company after the United States acquired Alaska from Russia.

Originally established in Alaska in 1847 at the confluence of the Porcupine and Yukon Rivers, Fort Yukon was a Hudson Bay Company fur trading post. After Alaska was transferred to American jurisdiction in 1867, the Hudson Bay Company eventually moved its operations to 'New Rampart House' in the early 1891. The Hudson Bay Company abandoned the operation in 1894, and Dan Cadzow, a private trader, took over the trading post in 1904. Cadzow operated the trading post until 1929.

A number of buildings dating back to the 1890s remain intact on the site, including an Anglican church and mission house, store, warehouse and residences. Some of the historic buildings, most significantly Cadzow House (constructed in 1911), have been restored using traditional construction techniques. VGFN members from Old Crow worked under the guidance of a log restoration specialist to cut and hew replacement members.

Lapierre House

Lapierre House is located on the north bank of the Bell River, near the NWT/Yukon border. Originally constructed in 1846, Lapierre House is one of the oldest non-native settlements in the Yukon. It was the only Yukon settlement listed in the 1881 federal census. Lapierre House is designated as a Yukon Historic Site and is jointly managed by the Vuntut Gwitchin and Yukon Governments (Vuntut Gwitchin First Nation and Yukon

Department of Tourism 1999). This historic site is situated within VGFN R-block VG R-14B.

The Hudson's Bay Company originally constructed Lapierre House as a small outpost of Ft. McPherson at the west end of Stoney Creek Pass in 1846. In 1851 it was moved to its present location at the confluence of the Bell and Waters Rivers. Abandoned in 1893, Lapierre House continued to be an important stop on the route between Ft. McPherson and Fort Yukon (as did Rampart House). A number of families lived at Lapierre House for at least part of the year up to the 1930s. Independent traders, the Jackson brothers, operated a store at Lapierre House between 1925 and 1935 before moving to Old Crow. Since the 1940s, the area has received limited use. There are few structural remains at the Lapierre House site today.

Whitestone Village

Whitestone Village was an active Vuntut Gwitchin / Tukuduh community during the height of the fur trade period, from approximately 1910 – 1950. Many Old Crow Elders grew up in the Whitestone area. Residents of Whitestone Village included the John Nukon family, the Joe Netro family, the Paul Josie family, Paul Ben Kassi, Paul Joe, Charlie Linklater, Joe Martin, John Thomas, and his son Charlie Thomas (Greer et al. 1995). Whitestone Village had a store, operated by Joe Netro, in the 1940s.

During the fur trade period, Whitestone Village was often not occupied permanently, with people traveling between Old Crow Flats in the spring and Whitestone in the fall and winter. A number of cabins and structures remain on the site today, and the area is still used periodically by Vuntut Gwitchin residents. Whitestone Village is located within VGFN R-block VG R-13B.

Johnson Creek Village

Johnson Creek Village was also a fur trade-based community. People living at Johnson Creek during this time were the Charlie Tetlitchi family, Moses Tizya and Balaam Judhi (Greer et al. 1995). Johnson Creek was smaller than Whitestone Village and few structures remain from this period. Johnson Creek Village is located within VGFN R-block VG R-12A.

3.2.3.2 Caribou Fences

Caribou fences or surrounds are complex caribou hunting sites which consist of lengthy wooden fence feeder arms, a corral-type structure at the head of the fence where the caribou were snared or speared, and associated winter villages and cache structures. Ten caribou fence complexes have been documented within the planning region; all but one are located north of the Porcupine River in Old Crow Basin.

The caribou fence complexes have high symbolic and cultural value for Vuntut Gwitchin. The fences are significant not just to Vuntut Gwitchin; they represent a subsistence pattern and type of technology that was once common throughout the western subarctic, of which today few traces now remain except in the North Yukon region. Caribou fences were formerly used throughout the entire western subarctic. Oral history research indicates that caribou fence technology was widespread in Yukon but no traces of these structures remain (Greer 1991). Greer (1991) believes that the only caribou fences known to still exist in the Yukon are those within the Vuntut Gwitchin traditional territory. Given the significance of these sites, the caribou fence complexes within Vuntut National Park are being proposed for recognition as National Historic Sites (M. Williams, Heritage Manager, VGFN, April 2007, personal communication).

In the early Historic Period a large part of the fall season was devoted to the repair and operation of the caribou fences and the butchering and storing of meat for the coming winter. Caribou fences, and the successful interception of caribou, provided enough food resources to sustain a small village throughout the difficult winter period.

Old Crow Basin Caribou Fences

Morlan (1973) and Greer and Le Blanc (1992) provide descriptions of the Old Crow Basin caribou fence complexes. All of the caribou fences in the Old Crow Flats area are believed to date to the late nineteenth or early twentieth century, based on the use of metal axes in their construction (Greer and Le Blanc 1992), although at least one may have originated in Precontact times. However, the Vuntut Gwitchin believe they have been using caribou fences for a very long time and that they are not structures just from the Historic or Late Precontact period.

According to Morlan (1973), the opening of Dan Cadzow's store at New Rampart House in 1904 improved the supply of ammunition and led to the abandonment of the caribou fences, which had continued to be operated for fifty years after the first rifles were introduced to the region.

Whitestone River Caribou Fence

In recent years a caribou fence has been documented in the vicinity of Whitestone Village. The fence location is not currently shown on Map 40.

Richardson Mountains Caribou Fences

Tetlit Gwich'in oral history records suggest one or possibly two caribou fences in the Rock River headwaters, near Fence Mountain. Another fence has been reported near Horn Lake, about 15 km east of McDougall Pass at Summit Lake on the Yukon – NWT border. These locations are not identified specifically on Map 40.

3.2.3.3 Fish Traps

Prior to the introduction of large gillnets, highly efficient in-stream traps and net systems were constructed and utilised to harvest fish. A variety of methods and styles were used in different types of sites and conditions. Fish traps were typically constructed out of willows across the mouths of small creeks. First, a fence structure, consisting of posts stuck in the river bottom, was made. In the middle of the fence, a cone-shaped basket was then attached – the chute-like fish basket acting as the actual trap (Sherry and VGFN 1999).

Balikci (1963) reports that the last large-scale use of fish traps occurred along the Old Crow River in about 1920, while Sherry and VGFN (1999) report that some use of fish traps by Old Crow residents continued through the 1960s. Oral history interviews provide insight into the productivity of the freshwater fishery in the Porcupine River and the efficiency of the in-stream fish traps. Vuntut Gwitchin Elders report catching thousands of fish at single fish trap location.

Fish trap use is documented throughout much of the planning region, along most major tributaries of the Porcupine River (Appendix 1, Map 40; information from Steigenberger et al. 1975; Anderton and Frost 2002, 2003; as summarized in North Yukon Planning Commission 2004). In many cases, due to ice scour, erosion and decomposition of the trap structures, there are few physical signs of the fish traps today. Fish trap use has been documented at the following locations:

- **Old Crow Area and Old Crow Flats**
  The largest concentration of fish traps was documented in and around Old Crow Flats and Old Crow area. Outside of Old Crow Flats, fish trap use has been documented on lower Bluefish River, Bluefish Wetlands, the mouth of David Lord Creek, and at the outflow of Cadzow Lake.

- **Driftwood River – Berry Creek**
  Two fish traps are documented on Driftwood River. One is located near the head-waters; another is at located at the confluence with the Porcupine River. A fish trap was also located at the mouth of Berry Creek.

- **Bell and LaChute rivers**
  Several fish traps have been documented in this area. At least three are known along the Bell River, with two in the vicinity of Lapierre House. Two are known on the lower and middle LaChute River.

- **Whitefish Wetlands – Tizya Creek**
  Two important fish traps were identified in Whitefish Wetlands – both are on Tizya Creek, the stream that connects Whitefish Lake to the Porcupine River. During community workshops, Old Crow residents stressed the importance of Whitefish Wetlands and Tizya Creek to the regional fishery (see Section 2.8.3)

- **Johnson Creek – Ellen Creek**
  Two fish traps have been identified on the lower portions of Johnson and Ellen Creeks, in the vicinity of Eagle Plains.

- **Cody Creek – Chance Creek – Whitestone River**
  The confluence of the Whitestone, Fishing Branch and Miner rivers is a biologically rich area. At least three fish traps have been noted in the vicinity of Whitestone Village, both on the Whitestone River and Chance Creek. Another trap is located at the mouth of Cody Creek.

3.2.3.4 Significant Heritage Routes and Sites

VGFN Routes and Sites

Heritage routes record important travel and trade routes between locations within the region and with other First Nations or communities outside of the region. The VGFN Final Agreement (Chapter 13, Schedule A) lists VGFN heritage routes and sites of special significance (Table 3.2.2; Figure 3.2.1), and that must be considered in regional planning. All identified sites are north of the Porcupine River; routes are located throughout the planning region. Some routes and sites can be considered historic, in that they were used extensively since post-contact while others may have been used for many hundreds of years. Some of the sites include caribou fences within Vuntut National Park and Old Crow Flats SMA. Many of the identified VGFN routes, with the exception of the Bell River – Summit Lake corridor, are the same as those shown on Figure 3.2.2, as identified through the Dene Traditional Trails Mapping project (Dene/Metis Mapping Project 1989).

Table 3.2.2. VGFN heritage routes and sites as identified in Chapter 13, Schedule A, of VGFN Final Agreement.

Number	Description	Location
1	Route	Old Crow to Whitestone Village
2	Route	Old Crow to Fort McPherson via Salmon Cache and Lapierre House
3	Route	Whitestone Village to Johnson Village
4	Route	Johnson Village to La Chute via Whitefish Lake
5	Route	Whitestone Village route connecting with the Old Crow – Fort McPherson route (route 2) at the western approach to the Northwest Territories border
6	Route	Whitestone Village route connecting with the Old Crow – Fort McPherson route (route 2) via Upper Stony Creek
7	Route	Old Crow to Rampart House
8	Route	Old Crow to Herschel Island
9	Route	Old Crow to Fish Hole Creek (Canoe River) fishing hole
10	Route	Old Crow to Johnson Village via White Snow Mountain
A	Site	Caribou fence on Thomas Creek at its headwaters
B	Site	Caribou fence on Thomas Creek at part way down to Crow Flats
C	Site	Caribou fence on Timber Creek
D	Site	Caribou fence on Black Fox Creek
E	Site	Fishing Hole on Fish Hole Creek (Canoe River)
F	Site	Fishing Hole on the Babbage River
G	Site	Fishing Hole on the Firth River

Other Trails and Routes

The Dene Traditional Trail Mapping Project (Dene/Metis Mapping Project 1989) illustrates the extensive travel and trade network that existed historically throughout the planning region and adjacent areas. Some of these trails and routes are still used today. With the exception of the Bell River – Summit Lake corridor, the major routes between Ft. McPherson, Aklavik and Old Crow, are similar to those identified in VGFN Chapter 13, Section A. This map also illustrates the importance of Whitefish Wetlands as a meeting area for Old Crow and Ft. McPherson residents, a point made by VGFN Elders during workshop consultations.

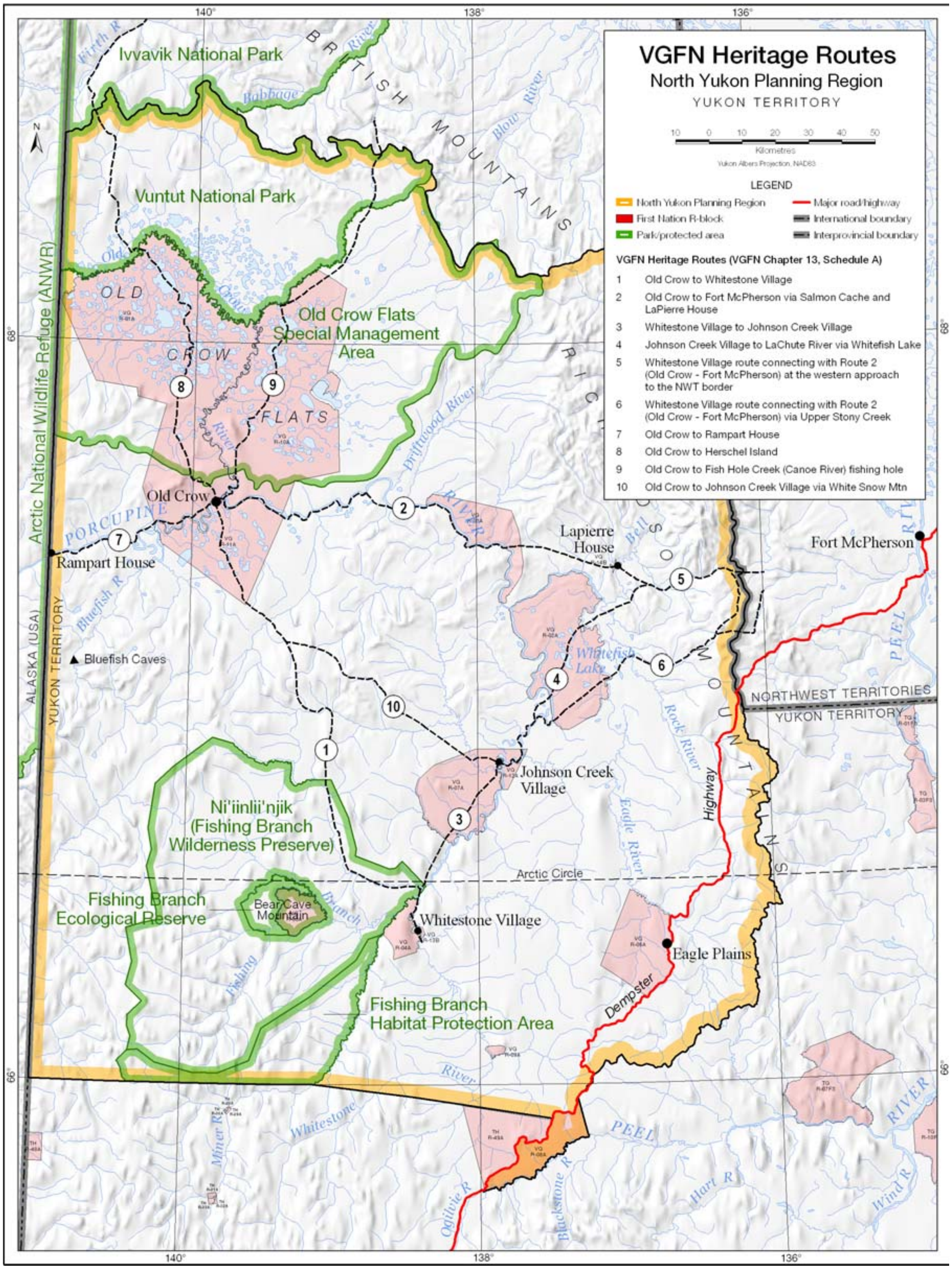

Figure 3.2.1. VGFN heritage routes as identified in VGFN Final Agreement, Chapter 13, Section A.

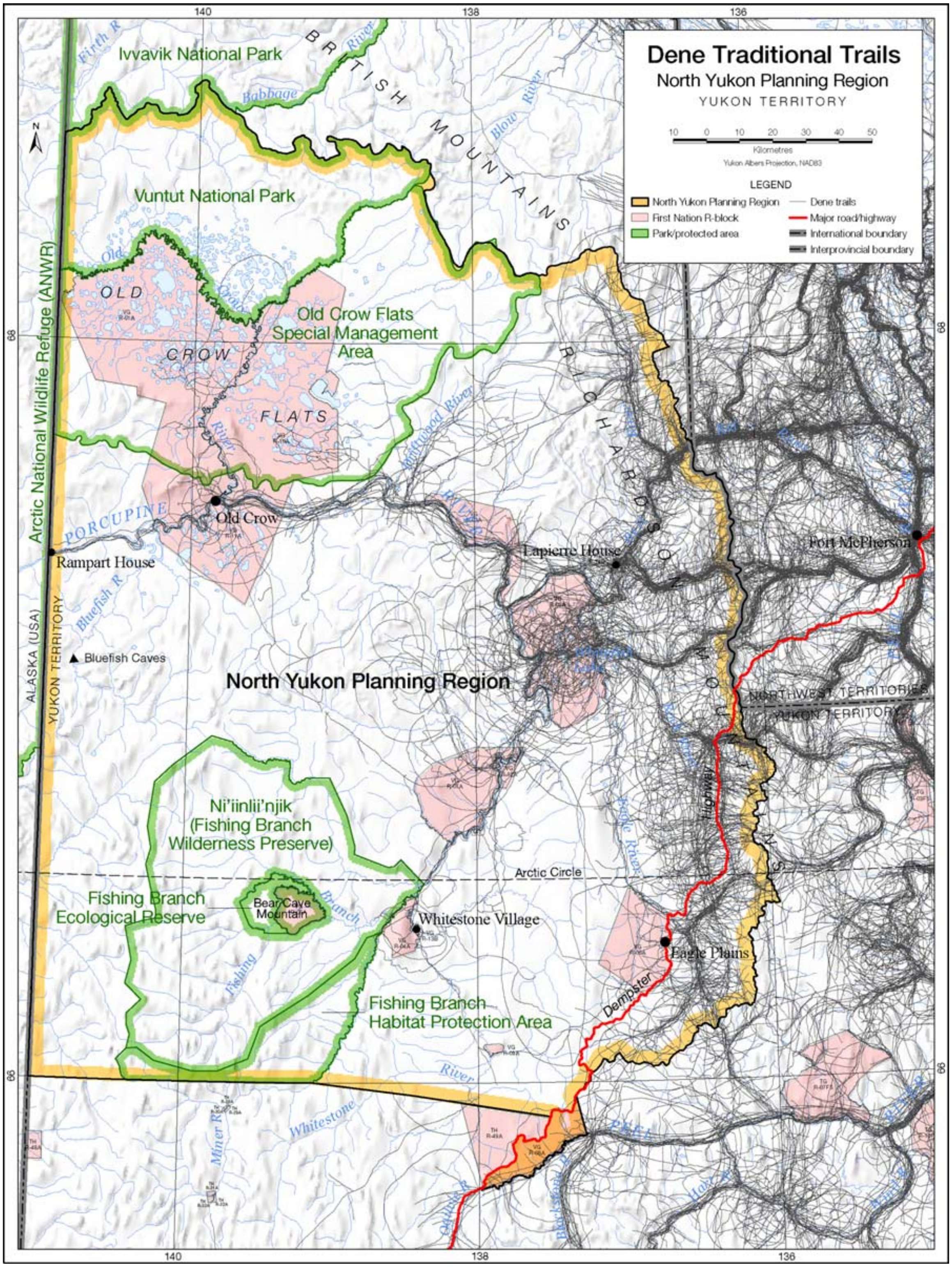

Figure 3.2.2. Routes and trails in North Yukon Planning Region identified through Dene Traditional Trail Mapping Project. Information used with permission from Gwich'in Social and Cultural Institute.

3.2.4 Vuntut Gwitchin Culturally Significant Areas

Table 3.3.1, at the end of Section 3, provides a detailed listing of VGFN culturally significant areas identified from the VGFN Oral History Project and Elder's workshops. VGFN culturally significant areas shown in Appendix 1, Map 40, are described in Table 3.3.1. These areas are additional to the Heritage Routes identified in Chapter 13, Section A of the VGFN Final Agreement (Figure 3.2.1).

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3.3 Current First Nations Land Use

While technology and mode of travel are now different, Vuntut Gwitchin and neighbouring First Nations continue to use the land and resources of North Yukon Planning Region in a manner similar to historic times. Subsistence harvesting of caribou, moose, waterfowl, fish and berries/edible plants is still an important cultural and economic activity for residents of Old Crow and other communities. Many of the areas utilized historically are used today, but less frequently.

The regional economy can be considered a “mixed economy” where both traditional subsistence harvesting and wage-based activities co-exist. Similar to other First Nations communities in the North American arctic, residents of Old Crow actively seek participation in a cash economy as a means of supporting subsistence activities, while desiring to maintain subsistence harvesting activities and opportunities, and the resources upon which those activities depend (Berman and Kofinas 2004).

Understanding contemporary land use patterns and their link to economy and culture is important to avoiding potential future land use conflicts and achieving goals related to Chapter 11 of the VGFN Final Agreement. The strong link between traditional land use and economy warrants some of the information presented in this section to be repeated in the assessment of traditional economic activities in Section 4.1.7.

Key Findings

- Appendix 1, Map 41 and Table 3.3.1 show the results of the Vuntut Gwtichin current land use synthesis
- For Vuntut Gwitchin, land use, culture and traditional economy are interconnected
- Subsistence hunting, fishing and plant gathering remain important cultural and economic activities in Old Crow
- Many of areas utilized historically are still utilized today, but less frequently
- The area around Old Crow and along the Dempster Highway currently experiences the highest level of subsistence harvest and land use
- In the past 50 years, travel routes utilized for harvesting and trapping have been influenced by recent human features (seismic lines, winter roads and Dempster Highway) but some traditional trails and routes are still utilized
- The major rivers are important travel routes. In the area of Old Crow, summer travel on the land is largely confined to the major river corridors. In winter, under suitable snow and ice conditions, travel is possible throughout the region.
- Summer water levels and winter ice conditions have a large effect on people’s ability to use the major rivers as travel routes. Both are influenced by climate change

Methods

The focus for documenting and understanding current First Nations land use was Vuntut Gwitchin citizens residing in Old Crow. Current Vuntut Gwtichin land use was recorded through Old Crow community workshops and through the assistance of the Vuntut Gwitchin Natural Resources and Heritage Departments (fall 2004 to spring 2006), the North Yukon Renewable Resources Council, Ducks Unlimited Canada, and Environment Canada. NYPC members residing in Old Crow also contributed a large amount of knowledge regarding current use areas, patterns and trends. Previous academic and community based research conducted in Old Crow was also referenced, including the Arctic Borderlands Ecological Knowledge Co-op. Experienced Old Crow land users also provided comment on current land use in the Tetlit Gwich'in Secondary Use Area of the Richardson Mountains – Dempster Highway Corridor.

Discussion

Appendix 1, Map 41 illustrates the results of the Vuntut Gwtichin current land use synthesis. Table 3.3.1, located at the end of this section, provides detailed information for Old Crow current land use areas (shown in light orange on Map 41). Current land use activities and the location of those activities are discussed below.

3.3.1 Hunting

The hundreds of years tradition of seasonal Porcupine Caribou Herd interception by Vuntut Gwitchin people remains an important cultural and economic activity. Caribou and moose continue to receive the majority of hunting effort. Old Crow residents harvest approximately 600 caribou annually – about 2 animals per resident (Yukon First Nations Harvest Surveys 1988-94; Kofinas 1998; personal communication Vuntut Gwitchin Government, Natural Resources Department). Caribou is the most frequently consumed wild food in Old Crow. Survey results from the early 1990s found households serving caribou on average 240 times per year (Wein 1994).

Caribou harvesting is not undertaken for sport or recreation, but as an activity central to Vuntut Gwitchin sense of self, the transmission of cultural traditions, and to over-all community well being (Berman and Kofinas 2004). Important caribou harvesting periods coincide with the annual fall and spring migration of the Porcupine Caribou Herd, but caribou may be hunted throughout the winter period when available or when long distance travel permits.

Annual moose harvest rates are estimated to be approximately 10-20 animals (Robert Kaye, VGFN Natural Resources Department, personal communication, October 2006) with most hunting activity occurring in the fall period along the middle Porcupine River. Waterfowl (ducks and geese), muskrat, ptarmigan and rabbits are also taken when available. Section 2.7 provides a detailed description of regional wildlife populations and habitats.

Important Hunting Areas

The entire area around Old Crow is utilized for caribou hunting, with some of the most important locations being along the Porcupine River, where hunters intercept caribou along their spring and fall migration. Some of the Porcupine River sites, such as Tl'oo K'at and Rat Indian Creek, have been utilized as caribou hunting locations for at least 1,000 years. A variety of areas may be utilized depending on the distribution of caribou and snow and travel conditions. When caribou winter in the Old Crow area, important hunting areas include Ahvee Mountain, Lone Mountain, Sharp Mountain, White Snow Mountain and Caribou Bar Creek-Rampart House. However, caribou hunters will travel as far as Whitefish Wetlands, Rock River and the Bell River area when required and when conditions allow.

Based on previous Old Crow research and user interviews, Berman and Kofinas (2004) illustrated the relative accessibility of late winter caribou hunting areas from Old Crow (Figure 3.3.1). They report that approximately 40% of late winter caribou hunting effort occurs as day trips around Old Crow, with overnight and weekend trips accounting for approximately 95% of the hunting effort. Along with caribou distribution, snow and travel conditions play an important role in determining the selection of hunting areas.

Outside of Old Crow area, the Dempster Highway corridor is the focus of the majority of non-Vuntut Gwitchin First Nation and non-First Nation caribou harvesting effort. Ft. McPherson and Aklavik residents make occasional trips into the Richardson Mountains via Rat River - Summit Lake and the headwaters of LaChute and Rock Rivers.

Moose hunting is generally confined to mainstream rivers including the Porcupine, Bell and lower Eagle during the late summer-early fall season. The majority of moose hunting effort takes place along the Porcupine River in the vicinity of Old Crow, but areas as far upstream as Whitestone Village are used occasionally.

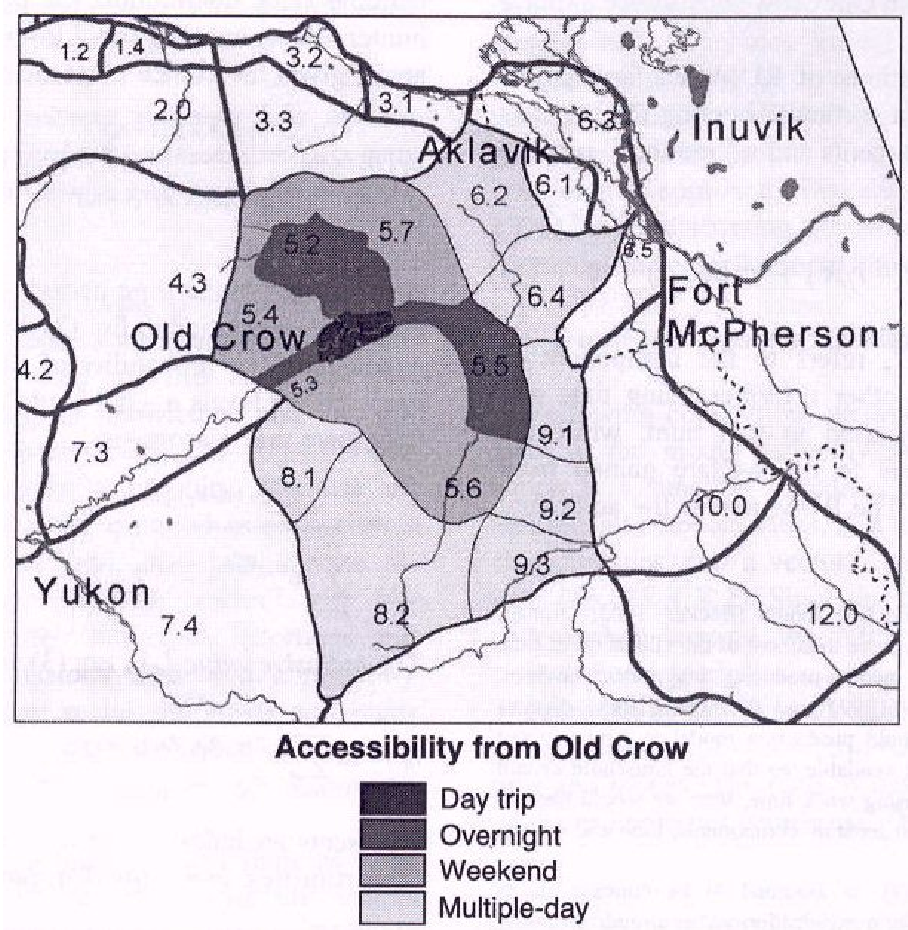

Figure 3.3.1. Relative accessibility of late winter hunting areas from Old Crow. Land units (e.g. 8.1) represent Porcupine Caribou Herd range zones as identified by Old Crow hunters. Source: Figure 1 from Berman and Kofinas (2004).

3.3.2 Fishing

Seasonal fish harvesting is an important activity in Old Crow. Fish harvesting utilizes both freshwater (e.g. whitefish) and salmon (King, Chum and Sockeye) at various times of the year. Similar to hunting, most fishing activity is centred on the Porcupine River and its major tributaries. The late-summer and fall periods are the most important salmon harvesting times. King and Sockeye salmon is an important food item for Old Crow residents while Chum (dog) salmon is generally utilized as food for dog teams. The large number of historical fish traps located throughout the region provides insight into the importance and abundance of the fishery resource in North Yukon (see Section 2.8 for a detailed discussion of fish and fish habitats).

Important Fishing Areas

The most important Vuntut Gwitchin fishing areas are on the Lower Porcupine River around the community of Old Crow. The 100 km reach of Porcupine River from

Driftwood River downstream to Ramparts, at the Yukon-Alaska border, receives the highest level of fishing effort. Areas on Old Crow Flats, the lower Driftwood River and Porcupine Lake, a broad slow moving stretch of the Porcupine River adjacent to Whitefish Wetlands, are also utilized frequently. Tizya Creek, the outflow of Whitefish Wetlands to the Porcupine River, enters at Porcupine Lake and has been noted as a fishery resource of potentially regional significance (see Section 2.8).

3.3.3 Trapping

VGFN holds a single Group Trapping Concession (#401) that covers most of its traditional territory. Traditional family trapping areas are located throughout this group trapping concession. In the early to mid-1900s, trapping was the most important economic activity in the planning region.

Today, Old Crow land users still participate in trapping activities but it is generally not considered a “main stay” economic activity. The fluctuating nature or fur prices and the high cost of equipment, transportation and fuel make trapping a marginal economic activity (Sherry and VGFN 1999). However, when fur prices warrant, 10-20 Old Crow land users may be actively trapping during the winter months and doing so profitably. As an example, in winter of 2005, when fur prices were high, three land users were trapping on a full time basis with six to ten individuals participating intermittently (Dennis Frost Sr., personal communication). When fur prices are low, one to five individuals may be pursuing fur, with marten, muskrat, lynx, wolverine and fox being the primary fur species. It is important to note that Old Crow land users selected marten as one of the three focal species examined for the North Yukon Regional Land Use Plan wildlife assessment (see Section 2.7.5.3, marten)

The decline of trapping as a full time occupation reflects many social and economic changes since the early to mid-1900s fur trade era: 1) the settlement of people into permanent communities (i.e., Old Crow), 2) the fluctuating nature of fur prices in current market conditions, with the resulting uncertainty of trapping as a reliable source of income, 3) the high cost of fuel, trapping equipment and supplies, 4) the increased availability of other types of wage employment, both within and outside of Old Crow, and 5) the need and desire for increased education and medical services (Sherry and VGFN 1999).

The Vuntut Gwitchin Government and the North Yukon Renewable Resources Council actively encourage and support trapping activities through a Trappers Assistance Program with the goal to increase the overall Vuntut Gwitchin participation rate in trapping activities. While trapping remains an important cultural activity in Old Crow, it is likely to remain a marginal economic activity.

Important Trapping Areas

Depending on factors such as fire history, snow conditions, animal distribution and ease of access, a variety of areas are currently utilized for trapping. Most community trails as shown on Map 41 are used for trapping or to access trapping areas during winter. While the area immediately around Old Crow receives the highest level of use, with Old Crow Flats and Bluefish Wetlands being the most important, areas as far away as Bluefish River and Lakes, Johnson Creek, Whitefish Wetlands and Whitestone Village are still utilized. 'Full-time' trappers have well established routes that consist of a network of community trails, portions of the Old Crow winter road, and historical seismic lines. Use of these trails may change over time in response to fire history and other factors.

3.3.4 Fuelwood and Forest Harvesting

The VGFN Final Agreement permits Vuntut Gwitchin citizens to harvest wood on Settlement Land and on Crown Land for traditional and non-commercial purposes. The community of Old Crow consumes approximately 600 cords of fuel wood annually. Building logs are also required for a variety of purposes. See Section 4.1.5 for a detailed discussion of forest resources and harvesting. Fuel wood cutting and hauling is an important source of employment in Old Crow.

Important Fuel Wood and Forest Harvesting Areas

The majority of fuel wood and forest harvesting occurs within a 20-30 km radius of Old Crow, with most effort focused on the Porcupine River corridor from Bluefish River upstream to the Driftwood River. Areas that are easily accessible by winter snowmobile travel often dictate harvesting locations, with timber quality being of secondary importance. Most forest harvesting occurs in winter. In summer, areas beyond 30 km up stream of Old Crow are accessed by boat, harvested and the logs floated down to Old Crow; these locations may be as far upstream as Whitefish Wetlands. Winter wood camps may stock pile logs for water transport in summer.

David Lord Creek is recognized as one of the most productive forest areas in the region and is the source for large diameter building logs. David Lord Creek is identified as a Commercial Forest Reserve in the VGFN Final Agreement (Section 17.4.2.10)

3.3.5 Berry and Plant Harvesting

Many Old Crow residents harvest cranberries, blueberries, mossberries and cloudberries in proximity to the community during late summer and early fall. Berries are used for a variety of cooking purposes. A detailed description of Vuntut Gwitchin plant names, species harvested, and uses is provided by Sherry and VGFN (1999).

Important Berry and Plant Harvesting Areas

The area immediately around Old Crow is used most frequently for berry harvesting, with Crow Mountain being of particular importance. Berry harvesting is frequently combined with fall family moose hunting trips along the Porcupine and Bell rivers.

3.3.6 General Traveling and Recreation

Old Crow land users and other First Nations utilize a large number of routes, trails and waterways to travel across the planning region. A large amount of travel is for subsistence harvest; some travel is for recreation-land experience. The pattern of travel and the accessibility of the region differ greatly depending on season. Summer-fall and winter travel periods are discussed below. Spring, the period of melting snow prior to and including river break up, is the most difficult time of the year for travel on the land. The Dempster Highway provides all season road access to the Mackenzie Delta communities but has had a limited effect on travel patterns for Old Crow residents.

Summer and Fall

During the summer and fall seasons (late May – October), the major rivers are the highways of the Vuntut Gwitchin traditional territory. The Porcupine, Old Crow, Bell and Eagle Rivers are the most important summer use corridors and provide travel routes for hunting, gathering, general travel and recreation. Low water conditions on the major rivers present difficulties for summer and fall travel, and can have a large impact on the accessibility of the region to land users (Figure 3.3.2). Summer and fall water levels are expected to decrease as a result of climate change effects, potentially creating difficulties for residents to travel and access the land.

Figure 3.3.2. Water levels have a large impact on summer river travel. July 2004 – extremely low water on Porcupine River did not permit motorized boat travel. Photo: J. Meikle, YG.

Winter

In winter, depending on snow and ice conditions, much of the planning region becomes accessible to snowmobile, dog team or snowshoe travel. Winter travel can generally be undertaken from mid-November to end of April. A number of recognized community use trails are shown on Map 41. The Old Crow-Ft. McPherson trail facilitates winter travel between the two communities, and is traversed annually by at least one travel party. The Herschel Island trail, following Timber Creek in Vuntut National Park and the Babbage River of Ivvavik National Park, is also utilized periodically. The Old Crow winter road is only usable during winter, and forms part of the winter trail network. Portions of winter trail networks and routes utilize the frozen Porcupine, Old Crow, Bell and Eagle Rivers. Several historical seismic lines are also used as travel corridors. Ice conditions on frozen waterbodies and watercourses are a major factor influencing the use of these features as travel corridors.

3.3.7 Participation Rates in Traditional Economic Activities (Time on the Land)

While people do not spend as much time on the land as they did a generation ago, a large number of Old Crow residents still participate in traditional economic activities and travel. Tetlichi et al. (2004) report that 50% of community members participate in day or weekend trips multiple times per year. Approximately 25% of Old Crow residents participate in extended travelling and hunting trips up to one week in duration. An additional 25% report they spend from four to eight weeks, either on their own or through their jobs, on the land (jobs were related to parks management, wildlife management, and historic site restoration).

There is some debate as to the effect of participation in a wage-based economy on hunting participation rates. While it is generally acknowledged that some form of wage-based work is required to finance hunting activities (fuel, equipment and transportation purchases), it must also be recognized that participating in wage-based work uses up potential hunting time (Kirkvliet and Nebesky 1997). Berman and Kofinas (2004), based on survey results of participating Old Crow land users, found that having a full-time worker in the household reduced the likelihood of not hunting at all but reduced the likelihood of hunting often by an even greater amount. This suggests that Old Crow hunters with full time work may be more likely than unemployed or part-time employed hunters to go hunting once in a season, but less likely to hunt more often. This finding suggests that as the level of wage-based employment increases, traditional harvesting activities becoming less of a "core activity".

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Table 3.3.1. Vuntut Gwitchin traditional land use and culturally significant areas.

NOTE: Table 3.3.1 is to be used with Appendix 1, Maps 40 and 41.

Methods:

Information was summarized from VGFN Oral History Project interviews (VGFN Transcripts) by VGG Heritage Department Researchers. Oral history interviews are tape-recorded conversations with Elders and experienced land users. Geographic locations were mapped and checked by VGFN Elders and land users during land use and heritage workshops between 2004 – 2006. Current land use information was provided by VGG Natural Resources and Heritage Departments, Old Crow land users, and NYPC Old Crow members.

Terminology:

Poly #:	Polygon number referenced on Maps 40 and 41
Name:	Geographic location of land use or cultural area
Description:	Description of area, activity or value
Source:	Information source. Most of information was obtained from oral history interview tapes (transcripts). Additional information obtained during workshops and meetings is attributed to the contributing individual
Era:	General statement about period of use. Historical use refers to areas more than 45 years old. List of current use areas is not considered to be comprehensive, nor exclusive, and may change over time.

Table 3.3.1. Vuntut Gwitchin traditional land use and culturally significant areas.

POLY #	NAME	DESCRIPTION	SOURCE	ERA
1	Van Tat, Old Crow Flats	Historical and current hunting, trapping and fishing area. Old Crow Flats is the heartland of the Vuntut Gwitchin people.	VGFN Transcripts	Historical and Current
8	Ni'iinlii Njik, Fishing Branch River	Historical fishing, hunting and trapping area. It is a major spawning salmon source for bears. Archaeologically significant. A clean water source for the Vuntut Gwitchin.	VGFN Transcripts	Historical
9	Ch'inèetsii Njik, Miner River	Historical fishing, hunting and trapping area. Part of the clean water source for the Vuntut Gwitchin.	VGFN Transcripts	Historical
10	Ch'ii Ch'à'an, Bear Cave Mountain	Historical fishing, hunting and trapping area. Archaeologically significant caves. Culturally significant as the location of part of long ago story of K'aiiheenjik. Caribou wintering area and bear dens.	VGFN Transcripts	Historical
11	Sheihveenjik, Whitestone River area	Historical fishing, hunting and trapping area.	VGFN Transcripts	Historical
12	Tèetl'it Gwinjik, Peel River	Historical trapping area.	VGFN Transcripts	Historical
13	Tth'ahzraiinjik, Blackstone area	Historical fishing, hunting and trapping area for Johnson Creek people. It is located along the RCMP patrol route from Old Crow.	VGFN Transcripts	Historical
14	East Porcupine/Lower Chance Creek	Historical and current fishing, hunting and trapping area.	VGFN Transcripts	Historical and Current
15	Vihtr'ihnèejùu Nihtak , Sharp Mountain South	Historical hunting and trapping area. It is an important landmark.	VGFN Transcripts	Historical and Current

POLY #	NAME	DESCRIPTION	SOURCE	ERA
16	Chiidaagaii Njìk, Whitestone Village	This was a winter village in use until the late 1940s and home to Joe Netro's store. Warmer climate made this a good place to spend the winter. The original cabins are in ruins. There is one contemporary trapping cabin. An important berry picking location.	VGFN Transcripts	Historical and Current
17	Zheh Gwatsàl, Lapierre House	Historical hunting fishing and trapping area. This is also an historic trading post where people got supplies. A winter village for some Gwitchin, it is located along the historical and contemporary route to Fort McPherson.	VGFN Transcripts	Historical and Current
18	Ch'inèetsii Njik , Miner River - below mouth of	Historical trapping area.	VGFN Transcripts	Historical
19	Ellen Vitèechik , Ellen Creek - mouth of	Historical trapping area.	VGFN Transcripts	Historical
20	Ch'aghòo Njìk , Johnson Creek - mouth of	Historical hunting, fishing and trapping area.	VGFN Transcripts	Historical
21	Neet'ai, Schaeffer Creek - mouth of	Historical fishing area.	VGFN Transcripts	Historical
22	Ellen Vitèechik, Ellen Creek - below	Historical hunting, fishing and trapping area.	VGFN Transcripts	Historical
23	Ch'inèetsii Njik, Miner River - mouth of	Historical hunting, fishing and trapping area.	VGFN Transcripts	Historical
24	Ch'inèetsii Njik, Miner River - upper	Historical hunting, fishing and trapping area.	VGFN Transcripts	Historical
25	Dempster Highway area	Historical hunting and trapping area and travel route.	VGFN Transcripts	Historical
26	Vihsraiinjik, Cody Creek	Historical trapping and hunting area.	VGFN Transcripts	Historical

POLY #	NAME	DESCRIPTION	SOURCE	ERA
27	Sriijaa Vàn, Bluefish Lake	Historical and current trapping and hunting area.	VGFN Transcripts	Historical and Current
28	Kâachik, Johnson Creek Village to the Dempster	Historical trapping area.	VGFN Transcripts	Historical
29	Kâachik, Johnson Creek Village	Winter village in use until 1940s. Trapping, fishing and hunting area.	VGFN Transcripts	Historical and Current
30	Kâachik, Johnson Creek - below	Historical and current trapping and hunting area.	VGFN Transcripts	Historical and Current
31	Ch'oodeenjìk, Porcupine River - head of	Historical and current trapping and hunting area.	VGFN Transcripts	Historical and Current
32	Ch'ineetsii Ddhàa, Ogilvie Mountains	Historical hunting and trapping area.	VGFN Transcripts	Historical
33	Rampart House	Historical trading post operated by Hudson Bay Company and later, independent trader Dan Cadzow. Historical home for many Gwitchin, especially in the summers.	VGFN Transcripts	Historical and Current
34	Six Mile	Historical trapping and hunting area.	VGFN Transcripts	Historical
35	Tl'iiyeenjìk (David Lord Creek) David Lord's Cabin area	Historical and current fishing, trapping and hunting area.	VGFN Transcripts	Historical and Current
36	Troo Chòo Njìk (Driftwood River area) Police Cabin	Historical location of RCMP patrol cabin. Current cabin used by hunters and other travelers.	VGFN Transcripts	Historical and Current
37	Naddhah Nii 'èe, Salmon Cache	Historical hunting, fishing and trapping area. Located along the route to Ft. McPherson.	VGFN Transcripts	Historical and Current

POLY #	NAME	DESCRIPTION	SOURCE	ERA
38	Dinniizhòo, Potato Hill or Game Mountain	Historical gathering location.	VGFN Transcripts	Historical
39	Ch’anchał, King Edward Mountain	Located on the route from Old Crow to Crow Flats. Historical camping area for dog team travelers on the way to trap in Crow Flats.	VGFN Transcripts	Historical and Current
40	Zhoh Drìn Chòo, White Snow Mtn	Hunting area. Historical gathering location. Located on Johnson Creek trail. It is a caribou wintering ground.	VGFN Transcripts	Historical and Current
41	Ch'itr'ihkąįinjìk, Chance Creek	Historical hunting and trapping area. Historical fish trap location. Long ago story location.	VGFN Transcripts	Historical
42	Truh Chi', Timber Hill	Historical hunting and trapping area in Crow Flats.	VGFN Transcripts	Historical
43	Gwazhàl, White Mountain	Historical trapping area.	VGFN Transcripts	Historical
44	Ch'iizhàk Niinlaii, Pine Creek area	Historical hunting, fishing and trapping area.	VGFN Transcripts	Historical
45	Sheihveenjik, Whitestone River - mouth of	Historical hunting, fishing and trapping area.	VGFN Transcripts	Historical
46	Ch'oodeenjìk, Porcupine River - upper	Historical and current hunting, fishing and trapping area. Major travel route for Gwitchin people and crossing location for migrating Porcupine caribou herd.	VGFN Transcripts	Historical and Current
47	Hart River area	Historical hunting and trapping area.	VGFN Transcripts	Historical
48	Old Crow	Historical and current hunting, trapping and fishing nucleus. Current centre of the Vuntut Gwitchin people.	VGFN Transcripts	Historical and Current
49	Lieman Creek	Historical hunting and trapping area.	VGFN Transcripts	Historical

POLY #	NAME	DESCRIPTION	SOURCE	ERA
50	Vihsraii Ddhàa, Cody Hill	Historical hunting and trapping area.	VGFN Transcripts	Historical
51	Driftwood Village	Historical winter village. No current visible structures.	VGFN Transcripts	Historical
52	Tl'oo K'at	Historical fishing, hunting and gathering location. Current gathering location for Vuntut Gwitchin Government Annual General Assembly.	VGFN Transcripts	Historical and Current
53	Chyah Ddhàa, Second Mountain	Historical and current hunting area. High cultural use and significance.	VGFN Transcripts	Historical and Current
54	K'ohdàkna'òok'ii, Top of the Hill Mountain	Historical hunting and trapping area. High cultural significance.	VGFN Transcripts	Historical
55	Tsii'ideh, King Edward Ridge	Location where trail from Old Crow to Crow Flats crosses the mountains. Bear dens.	VGFN Transcripts	Historical and Current
56	Diniizhòo Njìk, Potato Creek	Historical fishing and trapping location.	VGFN Transcripts	Historical
57	Jiindehchik	Missing information	VGFN Transcripts	Historical
58	Van Tat Gwatsàl, Little Flats area	Historical and current fishing, trapping and hunting area.	VGFN Transcripts	Historical and Current
59	Ch'ihilii Njik, Fish Lake	Historical and current fishing, hunting and trapping area. Located along the route between Ft. McPherson and LaPierre House.	VGFN Transcripts	Historical and Current
60	Ddhah T'èe, Caribou Lookout	Historical and current hunting and fishing location on the Porcupine River. A major caribou crossing point.	VGFN Transcripts	Historical and Current

POLY #	NAME	DESCRIPTION	SOURCE	ERA
61	Tèechìk Gwatsàl, Big Joe Creek	The creek joins a system of lakes south of Old Crow. The mouth of the creek is a current ice fishing area. Historical fish trap location.	VGFN Transcripts	Historical and Current
62	Jak Chahnjìk, Berry Creek - mouth of	Historical fish trap location.	VGFN Transcripts	Historical
63	Than Natha'aii, Lone Mountain	A marker for navigating on the land south of Old Crow. Caribou hunting area.	VGFN Transcripts	Historical and Current
64	Theetoh Nagwidaanaii, Goose Camp	Historical and current camp location for fishing, hunting and trapping.	VGFN Transcripts	Historical and Current
65	Chuuts'aii Nàlk'at, Crow Mountain	Historical and current hunting and berry picking camp location. Major caribou crossing location.	VGFN Transcripts	Historical and Current
66	Troo Chòo Njìk, Driftwood River - upper	Historical hunting and trapping area. High cultural significance.	VGFN Transcripts	Historical
68	Neegoo Zràii Njik, Blackfox area	Historical hunting and trapping area. Caribou fence location. Located on the trail from Old Crow to Crow Flats.	VGFN Transcripts	Historical and Current
69	Chiiveenjik, Bell River - mouth of	Historical and current fishing, hunting and trapping area.	VGFN Transcripts	Historical and Current
70	Ts'iivii Shùhnjik, Timber Creek	Historical and current hunting and trapping location. High cultural significance.	VGFN Transcripts	Historical
71	Tl'iiyeenjìk, David Lord Creek - upper	Historical and current hunting and fishing area. High cultural significance.	VGFN Transcripts	Historical and Current

POLY #	NAME	DESCRIPTION	SOURCE	ERA
72	Ch'ijuhdlàii, Porcupine Lake	Wide area of slow moving water on the Porcupine River. Hunting and fishing area.	VGFN Transcripts	Historical and Current
73	Oglivie River	Historical hunting and trapping area.	VGFN Transcripts	Historical
74	Neet'ai, Schaeffer Creek - Crow Flats	Historical and current hunting and trapping area. Part of a river travel system for camps located in Crow Flats. Fish trap location.	VGFN Transcripts	Historical and Current
75	Troo Chòo Njìk, Driftwood River - head of	Historical hunting and trapping area. High cultural significance.	VGFN Transcripts	Historical
76	Sriinjik, Bluefish River - mouth of	Historical and current hunting and trapping area. Current cabin location.	VGFN Transcripts	Historical and Current
77	Chii Vee, Useful Lake	Historical hunting and trapping area.	VGFN Transcripts	Historical
78	Tanch'òhłii	Historical fishing and trapping area.	VGFN Transcripts	Historical
79	Gwidinii'ee	Historical and current hunting and trapping area.	VGFN Transcripts	Historical and Current
80	Ch'izhìn Njìk, Eagle River area	Historical hunting and trapping area. Portage location on the trail to Ft. McPherson. Caribou wintering area.	VGFN Transcripts	Historical and Current
81	Cho'odeezhuneedazraii	Historical hunting area.	VGFN Transcripts	Historical
82	Ellen Vitèechik, Ellen Creek	Historical hunting and trapping area.	VGFN Transcripts	Historical
83	Natl'at Khadìtrèe, Cranberry Hill	Historical hunting and trapping area.	VGFN Transcripts	Historical
85	Ch'idzèe Njik, Caribou Bar Creek	Historical trapping area.	VGFN Transcripts	Historical

POLY #	NAME	DESCRIPTION	SOURCE	ERA
86	Chyàh Njìk, Crow River - mouth of	Historical and current fishing and hunting location.	VGFN Transcripts	Historical and Current
87	Chyàh Njìk Thidii Chii, Crow Point	Historical and current fishing and hunting location.	VGFN Transcripts	Historical and Current
89	Rampart House Mountains	Mountains located north of Rampart House. Rampart to Crow Flats trail passes through here. Historical hunting and trapping area.	VGFN Transcripts	Historical and Current
90	Gwak'àn Choo, Burnt Hill area	Historical and current hunting area. Located along trail from Old Crow to Crow Flats.	VGFN Transcripts	Historical and Current
91	Eagle Plains area	Historical and current hunting and trapping area.	VGFN Transcripts	Historical and Current
92	Chiiveenjik, Bell River - head of	Historical hunting and trapping area.	VGFN Transcripts	Historical
93	Vi'altl'ii Ddhaa	Historical gathering location.	VGFN Transcripts	Historical
94	Hungry Lake	Caribou wintering grounds.	VGFN Transcripts	Historical
95	Porcupine Flats	Portage location to LaPierre House. Historical and current fishing, hunting and trapping area.	VGFN Transcripts	Historical and Current
96	Vihsraii Niivyàa, Curtain Mountain	Located along the trail between Old Crow and Ft. McPherson. Hunting and trapping area.	VGFN Transcripts	Historical and Current
97	Ch'izhìn Njìk, Eagle River - mouth of	Historical hunting, fishing and trapping location.	VGFN Transcripts	Historical
98	Trinzhoo, Mount Millen	Located on route to Ft. McPherson.	VGFN Transcripts	Historical and Current

POLY #	NAME	DESCRIPTION	SOURCE	ERA
99	Chii Naagaii Njìk, Rock River	Historical trapping area. Located on route to Ft. McPherson.	VGFN Transcripts	Historical and Current
100	Mount Dennis	Historical hunting area.	VGFN Transcripts	Historical
102	Chuu Vihk'àa, Blue Bluff	Historical and current hunting, fishing and trapping area.	VGFN Transcripts	Historical and Current
103	Vatthàa Gòolii, Gopher Bluff	Historical and current hunting, fishing and trapping area. Portage location.	VGFN Transcripts	Historical and Current
104	John Joe Vavan	Historical and current hunting and trapping area. Location of John Joe Kyikavichik's cabin.	VGFN Transcripts	Historical and Current
105	Nohddhàa	Used as a marker for navigating on the land south of Old Crow. Caribou hunting area.	VGFN Transcripts	Historical and Current
106	Lydia Lake	Historical and current hunting and trapping area.	VGFN Transcripts	Historical and Current
107	Tabitha Lake	Historical and current hunting and trapping area.	VGFN Transcripts	Historical and Current
108	Troo Shah	Historical hunting and trapping area.	VGFN Transcripts	Historical
109	Dinjik K'àii Njìk, Moose Creek	Historical hunting and trapping area.	VGFN Transcripts	Historical
110	Gwak'àn Choo, Burnt Hill	Historical and current hunting area. Located along the trail from Old Crow to Crow Flats.	VGFN Transcripts	Historical and Current
111	Tsiik'it	Historical hunting area.	VGFN Transcripts	Historical

POLY #	NAME	DESCRIPTION	SOURCE	ERA
112	Vitr'èh'tr'ohłii	Historical hunting area.	VGFN Transcripts	Historical
113	Natha Nee'a	Historical hunting and trapping area.	VGFN Transcripts	Historical
114	Vihsraii Ddhàa, Mason Hill	Historical hunting and trapping area.	VGFN Transcripts	Historical
115	Summit Lake	Historical hunting and trapping area.	VGFN Transcripts	Historical
116	Sharp Mountain - Miner River	Historical hunting and trapping area.	VGFN Transcripts	Historical
200	Nohvàn, Tack Lake	Joel Peter's spring and winter trapping area.	Joel Peter	Historical and Current
201	John Joe Kaye Cabin	Location of John Joe's cabin.	John Joe Kaye	Historical and Current
202	John Joe Kaye Trapping Area	John Joe Kaye's trapping area between Lone Mountain and David Lord Creek.	John Joe Kaye	Historical and Current
203	Donald Frost Cabin	Donald Frost's cabin located below Bluefish River.	Donald Frost	Historical and Current
208	Nest Mountain (Ch'it'oo Ddhàa Choo)	Chief Peter Moses trapline.	VGFN Transcripts	Historical
209	Nest Mountain (Ch'it'oo Ddhàa Tsal)	Elias Kwatlatzi trapline.	VGFN Transcripts	Historical
210	Ch'idrìi Ddhah, Heart Mountain - west	Joe Kyikavichik trapline. Joel Peter's grandfather trapped in Heart Mountain - Upper Pine Creek area.	Joel Peter	Historical
211	Troo Chòo Njìk, Driftwood River	Ellen Bruce's father trapped south to Cranberry Hill and east to Berry Creek	Ellen Bruce	Historical

POLY #	NAME	DESCRIPTION	SOURCE	ERA
212	Troo Chòo Njìk, Driftwood River - under Caribou Mountain	Shiitsiivihtr'ih means cache made from stone.	Ellen Bruce	Historical
214	Troo Chòo Njìk, Driftwood River Trapping Area	Peter Tizya's historical trapping area on Driftwood River.	Peter Tizya	Historical
215	Jak Chahnjìk, Berry Creek Trapping Area	Peter Tizya's historical trapping area on Berry Creek.	Peter Tizya	Historical
216	Chiiveenjik, Bell River	Historical and current hunting, trapping and fishing area.	VGFN Transcripts	Historical and Current
217	Sheihveenjik, Whitestone - Ch'itr'ihkąįįnjìk, Chance Creek Trapping Area	Dick Nukon's historical trapping area from Whitestone Village.	Dick Nukon	Historical

Section 4: Regional Assessment

This section provides an assessment of the current and future economic conditions (Section 4.1), existing land use impacts (Section 4.2), and conservation priorities (Section 4.3) for the North Yukon Planning Region. Topic summaries follow each section. Important Sustainable Development considerations and potential land use impacts are discussed in Section 4.4.

4.1 Economic Assessment

4.1.1 Tourism and Recreation

This section summarizes tourism and recreation resources, activities and potential in the North Yukon Planning Region. The focus of this section is on current and potential economic activity. Recreation is considered to be Yukon residents participating in self-guided land-based activities. There is currently limited information regarding recreation activities in the region but they are identified where possible. First Nations land use, including travel and traditional economy, are described in Sections 3 and 4.1.7.

Key Findings

- Appendix 1, Map 42 shows important tourism resources and areas of interest.
- Outside of the Dempster Highway corridor, current levels of tourism activity in the North Yukon Planning Region are low.
- About 80% of Old Crow visitors travel to the community for government or business-related purposes. These visits currently result in limited economic benefits to Old Crow.
- Old Crow residents do not desire mass tourism. Future tourism activities must respect Vuntut Gwitchin culture and values, and occur at a pace and scale residents are comfortable with.
- Future tourism products and experiences will be marketed around intact wilderness landscapes, wildlife and Vuntut Gwitchin culture.
- Improvements to Old Crow tourism infrastructure will be required if tourism is to grow.
- While the region holds impressive natural and cultural features, North Yukon will likely appeal to a small and specialized market.

- Small-scale, carefully managed tourism will provide a limited number of seasonal employment opportunities for Old Crow residents.

Background

Northern Yukon offers both opportunities and challenges for tourism development. Virtually all of the region is perceived by visitors as pristine wilderness, with a network of protected areas, including a new National Park (Vuntut National Park) and two Special Management Areas (Old Crow Flats and Ni'iinii'njik), internationally recognized wetlands, significant wildlife displays and sites relating to the fur trade. The area lays claim to one of the oldest recorded sites of human occupation in North America and is rich in features tied to First Nations history and culture.

The remoteness of the North Yukon Planning Region has allowed the Vuntut Gwitchin people to maintain a traditional, subsistence-based economy and retain strong ties to the land that support physical, cultural and spiritual wellbeing. The Vuntut Gwitchin Government is interested in tourism but minimizing potential negative impacts of this activity on their people, culture and the land is very important.
Current tourism activity in the North Yukon region is low, tourism products and services are modest and the tourism market is not well developed. Although the region holds impressive natural and cultural features, North Yukon will likely continue to appeal to a small and specialized market.

Available Information

This assessment summarizes of a significant amount of tourism-related planning activity that has occurred over the past decade. Information comes from a variety of sources including:

- North Yukon Land Use Planning workshops, meetings and information sessions in Old Crow and Whitehorse
- Old Crow residents and businesses
- Protected / Special Management Area plans and planning exercises, including Vuntut National Park Management Plan (Parks Canada et al., 2004), Old Crow Flats SMA Management Plan (Yukon Department of Environment and Vuntut Gwitchin Government, 2006), Ni'iinii'njik (Fishing Branch) Wilderness Preserve, Ecological Reserve and Habitat Protection Area Management Plans (Yukon Department of Environment and Vuntut Gwitchin Government, 2004a,b.)
- Historic Site Plans for Rampart and Lapierre House (Vuntut Gwitchin First Nation and Yukon Department of Tourism, 1999)
- Yukon Government Department of Tourism and Culture, Draft Visitor Exit Surveys and staff interviews
- Draft North Yukon Tourism Strategy (Yukon Department of Tourism and Culture, 2006)

The Draft North Yukon Tourism Strategy is the result of seven years of research, workshops, study tours and meetings, including recent participation in North Yukon Regional Land Use Planning and Old Crow Flats SMA planning. Over the past two years, Yukon Government, Vuntut Gwichin Government and Vuntut Development Corporation staff partnered to complete a draft Strategy. The Strategy was presented and endorsed at the VGFN General Assembly, in September 2006. The three partners plan to work together to implement the Strategy (see Section 4.1.1.5 for more information on the Strategy). The Strategy does not directly address Demspter Highway-related tourism activity.

4.1.1.1 Guiding Principles and Goals for North Yukon Tourism

Vuntut Gwitchin people have been very clear that their important and special relationship with the land and wildlife should not be compromised by tourism development. Respect for cultural values, wildlife and the environment; local jobs and benefits; cultural sharing and teaching; and locally managed and controlled growth were common themes related to tourism development.

Three principles or guiding rules for tourism were developed for the North Yukon Tourism Strategy:

- Focus on tourism development that respects and supports the Vuntut Gwitchin way of life;
- Tourism development should occur at a pace and level the community is comfortable with; and
- The Vuntut Gwitchin people should develop and benefit from tourism.

Using these principles, three tourism goals were developed:

- Establish and maintain local support for tourism.
- Avoid mass tourism. Focus on businesses and markets that bring a high rate of return with minimal impact on the community or the land. Attract fewer visitors that spend more money on products that the community and the land can support.
- Monitor benefits and impacts. Keep the community informed about what is going on, track tourism impacts on the land and people, and rely on traditional knowledge to help decide whether change is needed.

4.1.1.2 Current Tourism Situation

Researchers, business and government workers, wilderness enthusiasts and tourists have travelled through northern Yukon for decades. While information on Dempster Highway travelers is available, comparatively little is known about tourists who visit Old Crow and remote parts of the planning region. We do know that the majority of travelers to Old Crow come for business and government-related visits; writers, film crews and researchers visit occasionally (Table 4.1.1.1). A smaller number come for wilderness adventure or to simply visit the community.

With few goods and services to offer, the economic and social impact of tourism has been minor. In 2005, visitors who stayed at Old Crow's two commercial accommodations, the Porcupine and Ch'oo Deenjik bed and breakfasts, spent an estimated $25/day (not including accommodation costs), for total visitor-related spending of about $192,000 in the community. This is likely less than actual expenditures as it does not include visitors who stayed with friends or in other government-operated lodging.

Table 4.1.1.1. Estimated number of visitors to Old Crow, by group or sector.[1]

Group or Sector	Percentage of total visitors *
Government-related visitors	**78**
Government of Canada	5
UFA Boards and Committees	25
Vuntut Gwitchin Government	17
Yukon Government	31
Business-related visitors (tradespeople and contractors)	**7**
Specialty visitors (media, film crews, writers and researchers)	**13**
Tourism visitors	**2**

* Based on estimated total 1420 user nights for 2005.

4.1.1.2.1 Tourism Markets

Tourism is a '*market driven'* industry which means tourism products and services need to match the needs and interests of visitors. It is important to consider the priorities, capabilities and concerns of people who live in North Yukon. It is just as important to address market demand if tourism is to succeed.

[1] Data provided by Choo' Deenjik Bed and Breakfast, Old Crow. Records were not available for Porcupine Bed and Breakfast; visitor user groups and user nights have been assumed similar to Choo' Deenjik.

Tourism markets include tourists that visit the North Yukon now (current markets) or may visit in the future (potential markets). Markets are often defined by what the users do (e.g., wilderness travelers) or where they are from (e.g., Canadian market).

Market research helps identify who visitors are and what attracts them. Surveying current visitors and North Yukon residents, contacting business owners and tourism operators studying similar northern destinations, interviewing experienced tour operators, and researching tourism trends help identify who visits North Yukon now, who might visit in the future and what these visitors want and need.

Current Markets

Current visitors to North Yukon can be divided into four markets: 1) business travel, 2) adventure (wilderness) travel, 3) speciality travel and 4) Dempster Highway travel.

- **Business Travel and Village Visitors**
  About 1200 business travelers come to North Yukon each year. Most fly in to Old Crow and stay in company housing or one of two privately owned bed and breakfasts. Their work usually takes place in or near Old Crow, and they do little apart from business. In 2005, about 30 tourists stayed in bed and breakfasts in Old Crow; data is not available on what they did while in the community.

- **Speciality Travel**
  In 2005, about 180 specialty travellers visited the region. Speciality travelers include researchers and various media. Several Old Crow residents have taken these visitors on trips, but most trips do not occur regularly.

- **Adventure Travel**
  Most of the 60-70 adventure travelers to North Yukon each year participate in self-guided canoe trips on the Eagle, Bell or Porcupine rivers. Most are tourists, though a small number of recreational canoeists also visit the region. Adventure travelers may visit historic sites, watch wildlife, fish and hike during their trip, and stop at Old Crow for supplies or to camp. Some self-guided hiking parties access the Wright Pass area of the Richardson Mountains from the Dempster Highway. A few self-guided ski touring parties travel the region and recreational snowmobiling occurs along the western foothills of the Richardson Mountains, near the Dempster Highway.

- **Dempster Highway Travel**
  About 7000-8000 people travel the Dempster Highway annually during the summer months. They include independent motorists and guided groups in vans and buses. Approximately ten tour companies, serving some 500 clients, operate on the Dempster Highway. Most travel in vans and camp as they go. Tours emphasize themes such as wildlife, birding and natural history, and most include

hiking. Tombstone Campground and Eagle Plains Lodge are the two focal points for most commercial tourism activities. Based on 1999 visitor exit surveys, Dempster Highway travellers spent on average $41 per user night in the region (Yukon Department of Tourism, 1999).

Potential Markets

Potential markets include visitors who might come to the Yukon in the future. In North Yukon, these include:

- **Existing Markets –** visitors who might be interested in new or improved tourism products while they are in North Yukon, and;
- **New Markets –** new visitors who might be attracted by new products. Market research suggests three potential new markets:
    - Learning travelers looking for structured tours where they can study and experience northern nature, history or culture in a wilderness setting;
    - Wilderness travelers seeking guided adventure trips with northern themes; and,
    - Village visitors looking for an authentic traditional village experience.

4.1.1.3 Tourism Resources

Tourism resources include natural, historic and cultural features and infrastructure that support current and potential tourism. Some features outside of the study area are included because they are important to the overall appeal of North Yukon as a tourism destination.

4.1.1.3.1 Natural Features

The North Yukon wilderness landscape is distinguished by interesting arctic and sub-arctic ecosystems hosting healthy wildlife populations, and a number of intriguing ecological features. Interesting and timely science and natural history topics like climate change, arctic ecosystem dynamics, Arctic National Wildlife Refuge (ANWR) and traditional knowledge in wildlife management could be interesting themes for tours. While North Yukon landscapes may not surpass the appeal of other northern destinations, there are opportunities. Wilderness rivers, wildlife and unique northern landscapes are road accessible from the Dempster Highway; North Yukon is seen as authentic and undiscovered; and Gwitchin people can provide a unique cultural component to an adventure or learning experience in a remote wilderness setting.

Wilderness Rivers

The Porcupine River flows across the region from near Fishing Branch to Alaska. It offers one of the longest road-free entry-level canoe routes in the Yukon or Alaska. The Porcupine River can be reached from the Dempster Highway via the Eagle River, by air via Summit Lake and the Bell River, or from NWT by lining up the historic Rat River route from the Peel River. Parties can exit by air from Old Crow or continue down to the Yukon River Bridge in central Alaska. Inexpensive road access and lack of hazards make the Eagle-Porcupine suitable for most paddlers.

Parks and Protected Areas

The North Yukon Planning Region contains three large, remote protected areas:

- **Old Crow Flats Special Management Area**
  Old Crow Flats Special Management Area includes important waterfowl staging areas and nesting wetlands as well as outstanding resources for palaeontology and archaeology. While there are few tourism activities in the Flats now, there is local interest in taking visitors to the Flats to learn about the land, wildlife and traditional life in this special place. Vuntut Gwitchin culture and traditional lifestyle would be an important part of tours. Using a local guide would help to ensure the land is treated with respect and visitors are safe. Potential tourism opportunities include wildlife viewing, boat tours, dog mushing, ski touring, snowmobile and trapline tours.

- **Vuntut National Park**
  Vuntut National Park has similar landscape features and natural values as Old Crow Flats Special Management Area, but has the added recognition of a federally-managed National Park. The northern portion of the park is in the British Mountains, a striking landscape, but is very difficult and expensive to access. Vuntut National Park currently receives a very limited number of visitors (less than 10 non-researcher visitors per year).

- **Ni’iinlii’njik Special Management Area**
  The heart of Ni’iinlii’njik (Fishing Branch) Wilderness Preserve and Ecological Reserve includes a portion of the Fishing Branch River where grizzly bears feed on spawning salmon in late autumn. The karst-salmon-grizzly bear ecological setting of Bear Cave Mountains and the Fishing Branch River offers a unique, remote grizzly bear viewing opportunity. In 2006, the Vuntut Development Corporation, Yukon Department of Environment (Parks) and Bear Cave Mountain Eco Adventures partnered to offer guided bear viewing tours. Increasing public understanding and appreciation of bears, their ecology and appropriate human behaviour in bear habitats is part of the bear viewing program.

Wildlife

The planning region contains significant concentrations of wildlife and excellent opportunities for general wildlife observation, study and photography. These features could be main themes for learning vacations and supporting themes for wilderness adventure and community based tours. In addition to the Bear Cave Mountain grizzly bear viewing, the following are significant wildlife resources:

- The **Porcupine Caribou herd** and its importance to the Vuntut Gwitchin people is a common theme in North Yukon Parks and throughout the VGFN traditional territory. Caribou can be viewed throughout most of the region, including along the Dempster Highway. The relationship between the caribou and Vuntut Gwitchin people – from ancient to current times – could be an interesting and compelling part of a visitor experience;
- **Waterfowl** and **muskrats** on Old Crow Flats and other major wetlands;
- **Birdlife** along the Dempster Highway;
- **Crane** migration; and,
- **Trapping** – wildlife regulations now allow limited trapline tours, and there may be interest in this opportunity.

The Vuntut Gwitchin First Nation is not interested in developing commercial guiding/outfitting tourism-related opportunities that rely on harvesting wildlife or fish for profit. Future potential wildlife-related activities should be based on viewing and experiential learning.

4.1.1.3.2 Historic Features and Heritage Resources

The North Yukon has historic sites that illustrate ancient to recent history of the Vuntut Gwitchin, with themes of interest to history-minded wilderness travelers. The tourism value of historic sites can be influenced by location and whether tourism is an allowed or welcomed activity.

- **Rampart House and Lapierre House**
  These Historic Sites are significant to fur trade and recent history, and are valued for their connection to people living today. Rampart House Historic Site is of major historical and archaeological significance with easy traveling distance of Old Crow. With the reconstruction of Cadzow House, Rampart House historic site could be the focal point of a tour or an important part of a Porcupine River trip. Lapierre House is decaying but with interpretation, could be part of a wilderness tour itinerary.

- **Whitestone and Johnson Creek Villages**
  Whitestone and Johnson Creek Villages were important fur trade-era Gwitchin settlements. Old Crow Elders of present and recent past have strong family and cultural connections to these places. Several useable structures are still present at Whitestone Village. Whitestone Village is located at the confluence of the Whitestone, Porcupine and Fishing Branch rivers; Bear Cave Mountain is located nearby.

- **Archaeological and Paleontological Resources**
  The Beringian environment, wildlife and people's ancient history in this landscape are important themes for northern Yukon wilderness and cultural-based tourism activities. The archaeological and paleontological significance of sites such as Bluefish Cave, Old Crow Flats, Klo-kut, Rat Indian Creek and the Richardson Mountains has appeal to heritage-minded travellers. These sites could form important destinations or be combined with other wilderness travel activities. A more detailed listing of paleontological and archaeological resources is provided in Section 3.2.

- **Winter Trails and Routes**
  Several trails and routes in the region may offer some winter tourism potential. The Ft. McPherson Trail travels between the communities of Old Crow and Ft. McPherson, crossing the Richardson Mountains in the vicinity of LaChute River. Annual snowmobile trips between the two communities have taken place in the recent past. In the winter of 2006, the Old Crow Winter Road was used for a dogsled race between Eagle Plains Lodge and Old Crow. Future races are anticipated. Historical winter travel routes between Old Crow and Herschel Island, running along the Babbage River on the Yukon North Slope, have also been identified.

4.1.1.3.3 Cultural Assets

Cultural features and activities that show Vuntut Gwitchin ties to the land and wildlife can be of significant interest to visitors, however it is very important that Vuntut people decide what aspects of their culture are appropriate to share with visitors. Visits with Elders, storytelling, games, clothing, language, living on the land and celebrations and gatherings are significant themes and components for village and wilderness-based tours.

4.1.1.3.4 Tourism Infrastructure

Tourism Infrastructure includes airports, roads, health, recreation, interpretative signs and other basic public and private sector services that support tourism.

- **The Dempster Highway**
  The Dempster Highway is a unique attraction in itself, with an international reputation as one of the last wilderness highways in North America and the only Canadian highway to cross the Arctic Circle. In the planning region, the highway between Eagle River (km 471) and the NWT border (km 471) is particularly important for tourism, offering visitors spectacular wilderness vistas, opportunities to see and experience arctic landscapes and wildlife, and access to alpine and tundra hiking in the Richardson mountains. The Arctic Circle crossing at km 402 provides viewing and interpretation and is a common stop for van tours and independent travelers. Eagle Plains Lodge at km 370 – the only visitor facility between Dawson City and Fort McPherson – provides all-season lodging, meals and vehicle service.

- **Old Crow**
  The only community in the planning region is the traditional and close-knit Vuntut Gwitchin village of 300 residents. Most of the approximate 300 residents are Vuntut Gwitchin members. Old Crow lacks road access but does have the basic visitor services and facilities to serve existing visitors. Improvements are required if tourism is to expand.

  Important tourism infrastructure includes a new airport terminal with scheduled air service provided by Air North to Whitehorse and other northern centres; RCMP policing services; a permanently staffed nursing station; a community centre; modern communication services (internet); a store and two privately run bed and breakfasts with a total of eight guest rooms.

  In Partnership with the Vuntut Gwitchin and Yukon governments, Parks Canada plans to complete a new Visitor Information Centre in Old Crow by 2008. The Centre will be the main source of visitor information in Old Crow, providing orientation, information and interpretation to visitors about the Vuntut Gwitchin traditional territory. The Centre will include exhibits, information on other Parks and special places in northern Yukon, and potentially a place to coordinate tourism activities.

4.1.1.4 Tourism Products

A tourism product is a service, activity or experience that a tourist can buy – a meal, a wilderness or cultural tour, or a locally made art or craft. Tourism products are based on tourism resources. For example, a historic site could be a tourism resource. A guided visit to the site with a Vuntut Gwitchin interpreter is a tourism product that can provide a meaningful experience for the visitor and income for the guide and others involved in the tour. Infrastructure such as community interpretive signs and historic buildings could be part of a guided community tour.

Tourism product development should be guided by market demand and by what is considered acceptable to the Vuntut Gwitchin First Nation and the community of Old Crow.

Existing northern Yukon tourism products include equipment rentals, occasional guided wilderness tours, accommodation in Old Crow and at Eagle Plains, and Bear Cave Mountain Eco Adventures.

In Table 4.1.1.2, North Yukon visitors are sorted into three broad categories that include existing and potential markets. The table shows how visitor interests, such as wilderness adventure or First Nation culture, can be experienced as an activity (product) for each market. Most activities are potential products that were identified by Old Crow residents and other participants through tourism, land use, park or other planning.

Table 4.1.1.2. Summary of North Yukon Planning Region tourism and recreation resources and activities (also see Appendix 1, Map 42).

Tourism Asset	Feature	Current Activities	Potential Activities
Historic Features and Heritage Resources	Lapierre House	Kayaking/rafting/canoeing, viewing	Interpretation or tour
	Rampart House	Kayaking/rafting/canoeing, viewing	Interpretive tour
	Whitestone Village (VG R-13B)	Kayaking/rafting/canoeing, viewing	Kayaking/rafting/canoeing, viewing
	Johnson Creek Village	Kayaking/rafting/canoeing, viewing	Kayaking/rafting/canoeing, viewing
	Old Crow area	Boat tours, dog mushing, hiking, skiing, kayaking/rafting/canoeing, viewing, wildlife viewing	Various[2]
	Bell-Porcupine fur trade route	Kayaking/rafting/canoeing, viewing, wildlife viewing	Kayaking/rafting/canoeing, viewing, wildlife viewing
	McPherson Trail and Old Crow Winter Road (dog-sledding and snowmobile travel routes)	Recreational and competitive dog mushing, snowmobiling, hiking	Dog mushing, snowmobiling, hiking
	Routes to Herschel Island	Recreational snowmobiling	Wildlife viewing, skiing, Various
	Caribou fences[3] (Vuntut National Park, Driftwood River)	Viewing	Viewing, interpretation
	Beringia and pre-contact archaeology sites (Richardson Mountains, Bluefish Caves, Bear Cave Mountain, etc.)	Scientific study	Hiking, learning tours, viewing, wildlife viewing, scientific study
Natural Features	Wilderness rivers (Bell-Porcupine Rivers, Eagle-Porcupine Rivers, Fishing Branch-Porcupine Rivers, Crow River)	Kayaking/rafting/canoeing, viewing, wildlife viewing	Kayaking/rafting/canoeing, viewing, wildlife viewing
	Southern Richardson Mountains (near Dempster Highway)	Hiking, skiing, viewing, wildlife viewing, recreational snowmobiling	Hiking, skiing, viewing, wildlife viewing, snowmobiling, biking, photo safari, flightseeing tour
	Summit Lake and Bell River (northern Richardson Mountains)	Kayaking/rafting/canoeing, viewing, wildlife viewing	Kayaking/rafting/canoeing, flightseeing tour, bird watching, photo safari

[2] Interpretive panels will be posted at the new visitor reception centre in Old Crow
[3] In January 2007, Parks Canada proposed that caribou fences within Vuntut National Park be designated as National Historic Sites.

Table 4.1.1.2 (cont'd). Summary of North Yukon Planning Region tourism and recreation resources and activities (also see Appendix 1, Map 42).

Tourism Asset	Feature	Current Activities	Potential Activities
Natural Features cont'd…	Arctic Circle viewpoint (Dempster Highway)	Interpretive display, viewing, hiking, biking, skiing, recreational snowmobiling & all terrain vehicles	Interpretive display, viewing, hiking, biking, skiing, snowmobiling, all terrain vehicles, bus tour
	Old Crow Flats (including Timber and Blackfox Creeks – routes to Herschel Island)	Recreational snowmobiling	Wildlife viewing, skiing, Various
	National Parks and Special Management Areas (Vuntut, Old Crow Flats and Ni'iinlii'njik (Fishing Branch)	Hiking, wildlife viewing, viewing scientific studies, kayaking/rafting/canoeing, recreational snowmobiling (Old Crow Flats)	Hiking, wildlife viewing, viewing scientific studies, kayaking/rafting/canoeing, recreational snowmobiling (Old Crow Flats)
	Bear Cave Mountain (Grizzly bear-salmon congregation)	Wildlife viewing, scientific studies	Wildlife viewing, bird watching, flightseeing tour, photo safari
	Bluefish Caves and Hotsprings on Bluefish River	Scientific studies, interpretation	Interpretation, scientific studies
	Tundra vegetation, permafrost, interesting hydrology	Hiking, viewing, wildlife viewing	Hiking, viewing, wildlife viewing
	Wildlife Features: Porcupine Caribou Herd, waterfowl, bird-watching, moose, crane migration, muskrat, Arctic birds	Wildlife viewing, scientific studies	Wildlife viewing, scientific studies, learning tour
Cultural Assets	Vuntut Gwitchin culture	Learning, scientific studies	Learning, scientific studies

Table 4.1.1.2 (cont'd). Summary of North Yukon Planning Region tourism and recreation resources and activities (also see Appendix 1, Map 42).

Tourism Asset	Feature	Current Activities	Potential Activities
Tourism Infrastructure and Services	Old Crow accommodations (Bed & Breakfasts) & community services	Old Crow accommodations (Bed & Breakfasts) & community services *Omit*	Old Crow accommodations (Bed & Breakfasts) & community services
	National Parks and Special Management Areas (Vuntut, Old Crow Flats and Ni'iinlii'njik (Fishing Branch)	Hiking, wildlife viewing, viewing scientific studies, kayaking/rafting/canoeing *Move to Tourism Resources.*	Hiking, wildlife viewing, viewing scientific studies, kayaking/rafting/canoeing
	Old Crow Vuntut National Park Visitor Centre and interpretive displays (future)		Interpretive displays
	Old Crow area	Boat tours, dog mushing, hiking, skiing, kayaking/rafting/canoeing, viewing, wildlife viewing	Various[4]
	New airport terminal with scheduled service	Visitor services, community information, local arts showcase	same
	Dempster Highway Corridor	Vehicle tours, camping, wildlife viewing, viewing, hiking, biking, skiing, snowmobiling, all terrain vehicles, bus tour, photo safari	Various
	Eagle Plains Lodge	Camping, wildlife viewing, hiking, skiing, biking, snowmobiling, all terrain vehicles, bus tour, photo safari, interpretive display	Various
	Rock River Territorial Campground	Camping, wildlife viewing, hiking	Camping, wildlife viewing, hiking

[4] Interpretive panels will be posted at the new visitor reception centre in Old Crow

4.1.1.5 Tourism Potential

There is potential for developing a carefully managed tourism industry in North Yukon. Old Crow residents are interested in developing tourism businesses and the region has resources to support a sustainable tourism sector. The Vuntut Gwitchin Government is also interested in tourism, but minimizing the impact of tourism on the land, people and culture is important. Before tourism can develop, the community must be ready for, and comfortable with the activity. Tourism should be locally managed, involve and benefit the community, and rely on traditional knowledge.

The Draft North Yukon Tourism Strategy (Yukon Department of Tourism and Culture, 2006) is designed assist the people of Old Crow establish a responsible and profitable tourism sector that respects Vuntut Gwitchin traditional values. It includes guiding principles and goals for tourism development, describes current and potential tourism markets, products, resources and challenges, and presents short and long term approaches for developing North Yukon's tourism industry. The initial focus of the Strategy is to develop tourism that directly benefits residents of Old Crow and reflects local priorities, capabilities and interests.

The Strategy proposes a two-stage approach to developing tourism:

> **Stage One** aims to increase revenues from visitors already coming to Old Crow by improving products and services so that visitors will want to stay longer and spend more. Opportunities include improving accommodations, and adding new products like food services, a campground, and tours and rentals. Stage one will build local tourism skills and experience and provide new and improved tourism products and services to about 50 of Old Crow's existing visitor market by 2010.
>
> **Stage Two** uses new tourism skills, experience and infrastructure to develop products for new visitor markets. Research suggests three potential new markets:
>
> - Learning travelers looking to study and experience northern nature, people, culture and history;
> - Wilderness travelers seeking guided adventure trips with northern themes; and,
> - Village visitors looking for an authentic, traditional First Nations village experience.
>
> The Strategy sets an objective of delivering new products for 50-100 new visitors by 2013. Northern Yukon can reasonably aim for wilderness tour visitation, both guided and self guided, comparable to those reported for Ivvavik National Park (125-140 tourists/year) (Yukon Department of Tourism and Culture, 2006).

4.1.1.6 Socio-economic Considerations

Tourism development in North Yukon must be sensitive to the needs of Vuntut Gwitchin residents – visitor numbers can not grow too quickly and activities must respect traditional life and values. Mass tourism will therefore not occur in North Yukon. Small-scale, carefully managed tourism such as being contemplated by the Draft North Yukon Tourism Strategy will provide a limited number of seasonal employment opportunities for Old Crow residents.

Tourism development can be difficult or divisive if it is not accepted and supported by the community. Details on potential impacts of tourism development on social/cultural values are discussed in Section 4.4.

4.1.1.7 Ecological Considerations

Wilderness tourism relies on wilderness landscapes, parks, and special places and ecosystems that support interesting or abundant wildlife and plant communities. Wilderness tourism activities should be conducted without degradation, disruption or disturbance to the environment and ecological processes. Unmanaged tourism activities can result in disturbance to and/or loss of fish and wildlife habitats, impact fish and wildlife populations, and impact subsistence harvesting activities. The Fishing Branch Ecological Reserve has been noted as a sensitive area where tourism activities have the potential to disrupt the bears, the environment, and the cultural and heritage sites (Yukon Department of Environment and Vuntut Gwitchin Government. 2004b). Potential impacts of tourism activities on ecological resources are discussed further in Section 4.4.

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4.1.2 Oil and Gas Resources

This section summarizes petroleum reserves and resource potential, existing natural gas and oil dispositions, future anticipated activity, and considerations surrounding current and future natural gas and oil management.

The planning region is expected to contain a significant portion of Yukon's total estimated natural gas and oil potential. Resource assessments in the region to date suggest substantial natural gas potential, and moderate oil potential. Three main oil and gas basins occur in the region: Eagle Plains, Kandik, and Old Crow Flats. Eagle Plain basin contains the majority of the region's total natural gas and oil potential, and is the area of highest interest to industry. Future development scenarios are discussed, with particular focus on the Eagle Plains basin.

Key Findings

- There are three oil and gas basins in the region: Eagle Plain, Old Crow, and Kandik (see Appendix 1, Map 43). The region contains a significant portion of Yukon's total estimated natural gas and oil potential
- Resource assessments suggest substantial natural gas potential, and moderate oil potential. The estimated mean natural gas resource for the region is 7.9 trillion cubic feet (Tcf); the estimated mean oil resource is 536 million barrels (MMbbls). All resource estimates are based on limited knowledge and are uncertain
- Eagle Plain is anticipated to be the basin of highest interest for exploration and development, at least in the near future. Eagle Plain contains proven reserves and the majority of total natural gas and oil potential (6.1 Tcf natural gas and 437 MMbbls oil, respectively). The current established petroleum resource in Eagle Plain is 83.7 billion cubic feet (Bcf) natural gas and 11 million barrels (MMbbls) oil
- Potential production of the Eagle Plain natural gas resource will not likely occur until 2020-2025. Production will depend on prior construction of pipeline infrastructure, and access to that infrastructure
- Pipeline capacity is expected to play an important role in influencing the pace and scale of any future natural gas development scenario
- Oil resource estimates are insufficient, at present, to construct a separate oil pipeline. Oil development is anticipated to be on a smaller, localized scale and may occur separately from and prior to the natural gas scenario
- Old Crow and Kandik basins are of less interest in the near future due to limited exploration history, existing Protected Area status (Old Crow), and remoteness (Kandik)

Background

The region contains a significant portion of the Yukon's total estimated natural gas and oil potential. There are three recognized oil and gas basins, Eagle Plain, Old Crow, and Kandik (see Appendix 1, Map 43). Natural gas and oil resource assessments completed for the Eagle Plain (Osadetz et al. 2005), Old Crow (Hannigan, 2001), and Kandik basins (Hannigan et al. 2000) suggest substantial natural gas potential and moderate oil potential. Eagle Plain basin is considered to contain the majority of the region's natural gas and oil potential, and it is the area of highest interest for exploration and development in the near future.

Based on information in these assessments, the current mean estimate for the total North Yukon region natural gas resource is 7,853 Bcf (7.9 Tcf). The current mean estimate for the total North Yukon region oil resource is 536 MMbbls. These resource estimates represent approximately 50% of Yukon's total mean estimated natural gas and oil resources (Yukon Oil and Gas Branch 2005). It must be noted, however, that: 1) the information used to produce these estimates is uncertain, and 2) the estimates include the entire basins. Portions of the three basins are outside the planning region and/or are unavailable for exploration (i.e., located in Protected Areas).

A natural gas and oil 'primer' summarizing key concepts, facts, and units of measure are reported in Table 4.1.2(a) below. An overview of natural gas and oil reserves and resource potential for the three basins is provided below.

Methods and Available Information

The methods and assumptions used to determine the distribution, status, and potential reserves of oil and gas in the region have been reported (Hannigan et al. 2000; Hannigan, 2001; National Energy Board of Canada, 2000; Osadetz et al. 2005; Yukon Oil and Gas Management Branch, 2005). These sources represent the major published oil and gas resource assessments for the region.

Table 4.1.2(a). Oil and natural gas "primer" summarizing key definitions, concepts, facts and units of measure.

Abbreviation	Definition	Unit of Measure
Mcf	Million cubic feet	Unit of measure of natural gas volume
Bcf	Billion cubic feet	Unit of measure of natural gas volume
Tcf	Trillion cubic feet	Unit of measure of natural gas volume
MMbbls	Million barrels	Unit of measure of oil volume

One cubic meter (1 m^3) gas = 35.3146667 cubic feet (ft^3) gas
One cubic meter (1 m^3) oil = 6.2898108 barrels (bbls) oil

Oil and Gas quick facts:

- 1 cubic ft (1 ft^3) = 1 basketball
- 1 barrel (bbl) = 1 fuel drum (42 U.S. gallons, or 158.99 litres), or 1 standard bathtub
- Oil and gas companies are generally interested in a frontier area (i.e. no infrastructure) if they contain >1000 Bcf (1 Tcf) natural gas. In Yukon, it would require discovering approximately this much gas to make development economically feasible.
- 1 Bcf natural gas contains enough energy to heat 8,600 Canadian homes for one year
- The Mackenzie Delta/Beaufort Sea has an estimated discovered resource of 13 Tcf natural gas in four major plays and an overall estimated resource potential of 46-52 Tcf natural gas-in-place
- Prudhoe Bay, Alaska has an estimated oil resource of 22,000 MMbbls. Prudhoe Bay has been in production since 1977 and currently produces approximately 900 MMbbls of oil per day.
- The Alaska North Slope holds a total estimated potential of 100-126 Tcf natural gas-in-place, none of which has been produced due to a lack of pipeline infrastructure to transport it to a market.

Oil and Gas definitions:

Pool: a natural gas or oil pool consists of an accumulation (or reservoir) of gas or oil that occurs in a single rock layer in a single trap.

Play: all pools that occur or are inferred to occur in a similar rock type with a similar history of origin. A play in a region may be proven (i.e. a well has actually intersected a pool) or conceptual (i.e. inferred to exist based on knowledge of geology in a region).

Resource: all oil and gas pools that are known or inferred to exist

Reserves: the portion of a resource that has been discovered and is therefore known to exist

Potential: the portion of a resource that is inferred to exist but has not yet been discovered

Discussion

Table 4.1.2(b) provides an estimate of the total natural gas and oil resource potential for the North Yukon Planning Region, and for each of the three recognized oil and gas basins. Additional detail on the natural gas and oil potential for each basin is provided in the sections below.

It is important to note the assessments of the region's resource potential are based on an incomplete knowledge base, and there is much uncertainty in the estimates. Old Crow and Kandik basins are remote areas with limited exploration history, and both areas are considered to contain conceptual natural gas and oil plays. Eagle Plain basin has received limited exploration activity in recent times. It is anticipated that these estimates are conservative and likely underestimate the number of natural gas and oil pools.

Current estimates for natural gas and oil resources in the region represent a wide range of values, dependent on the methods, models, and assumptions used to estimate resource potential. A detailed discussion of the reason(s) behind the existing range of values is provided by Osadetz et al. (2005) and Fekete (2006). It is worthy to note the resource potential estimates reported in Table 4.1.2(b) are substantially higher than reported by previous assessments (e.g. National Energy Board of Canada, 2000).

Regardless of the reason(s) for the differences in resource estimates, there is currently no 'correct' number. A range of plausible estimates is possible, based on interpretation of existing information. As future potential exploration progresses and the basins become better understood, re-evaluations of reserves and potentials will be required, and will undoubtedly occur. This situation highlights the significant uncertainty that exists regarding total petroleum potential of Eagle Plain and adjacent northern Yukon basins. The uncertainty around resource potentials is a consideration for the level and pace of potential energy sector activity discussed in Section 4.1.2.5, below.

Development of the natural gas resource will depend on prior construction of pipeline infrastructure, and access to that infrastructure. The estimates of oil resources are insufficient, at present, to construct a separate oil pipeline; oil development is anticipated to be on a smaller, localized scale and separate from the natural gas scenario. These considerations highlight the requirement to evaluate and manage oil and gas basins that occur in different management areas/jurisdictions (e.g. FN traditional territories, Yukon Environmental and Socio-economic Assessment regions, other planning regions, etc.) in an integrated manner.

Table 4.1.2(b). Total estimated natural gas and oil resource potential for the North Yukon planning region. Sources: Hannigan et al. (2000), Hannigan (2001) and Osadetz et al. (2005).

Basin	Hydro-carbon	Plays	Pools (mean)	Resource (mean)		Notes
Old Crow Basin	Gas	3	10.6	1,149	Bcf	• Majority of Old Crow Basin is designated as Protected Area (Old Crow Flats SMA)
	Oil	0	0	0	MMbbls	
Kandik Basin	Gas	3	48	649	Bcf	• Approximately half of Yukon portion of Kandik Basin occurs outside the region. • Kandik Basin petroleum resource in the planning region assumed less than reported as only a portion of the basin is within the planning region.
	Oil	2	33	99	MMbbls	
Eagle Plain	Gas	9	114	6,055	Bcf	• A portion of Eagle Plain basin extends outside the region; other portions are within Protected Areas. • Eagle Plain petroleum resource within the region assumed less than reported here
	Oil	6	32	437	MMbbls	
Total NYPR	Gas			7,853	Bcf	• In-place accessible resources within region are: o 4-6 Tcf natural gas; 1-2 Tcf recoverable considered very probable (Fekete, 2006), o 300-500 MMbbls oil • Majority of accessible resource occurs in Eagle Plain.
	Oil			536	MMbbls	

References

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4.1.2.1 Geological Setting

4.1.2.1.1 Eagle Plain Basin

The Eagle Plain basin is located in the central portion of the planning region (see Appendix 1, Map 43). A portion of the Eagle Plain basin extends to the south of the planning region boundary, into the Peel Watershed Planning Region, and a portion underlies the Ni'iinlii'njik (Fishing Branch) Wilderness Preserve and Habitat Protection Area. Eagle Plain basin is bounded to the east by the Richardson Mountains, to the south by the Ogilvie Mountains and to the west by the Nahoni and Keele ranges. The portion of the Eagle Plain basin within the region is approximately 18,000 km^2 in size and accounts for approximately one third of the region.

Eagle Plain is an under-explored structural basin with proven Cretaceous (65-140 million years), Carboniferous (300-360 million years), and Devonian (360-400 million years) oil and gas measures within the Northern Yukon Fold Complex (Osadetz et al. 2005; Yukon Oil and Gas Management Branch, 2005). It has a maximum sediment thickness of 5,800 m. During Cambrian (510-570 million years) through Carboniferous time, it was the site of continuous subsidence and deposition as part of the western continental margin miogeocline. Lower Paleozoic platform carbonates of the Bouvette and Ogilvie formations are bounded and interfinger with carbonaceous basinal shales of the Richardson Trough on the east. During the Late Paleozoic, sedimentation is dominated by clastic sediments with lesser carbonate. Paleozoic sedimentary rocks are in turn unconformably overlain by Cretaceous marine siltstone, shale and sandstone deposited as a foreland succession in response to Cordilleran deformation.

North-trending anticlines, synclines and thrust faults related to Cordilleran deformation occur throughout the basin. Eagle Plain is divided into the northern Bell sub-basin and the South Eagle sub-basin. The sub-basins are separated by the east-west trending Eagle Arch. Similar to most other areas in the region, Eagle Plain remained unglaciated during the Pleistocene period. Major river valleys and the Whitefish wetlands areas contain extensive Quaternary sediment cover in the form of alluvial, colluvial and glacio-lacustrine materials.

4.1.2.1.2 Old Crow Basin

The Old Crow basin is located in the north-western portion of the region and lies almost entirely under the Old Crow Flats Special Management Area (see Appendix 1, Map 43). Old Crow basin is approximately 6,800 km^2 in size and accounts for 12% of the region.

The Old Crow basin is a shallow intermontane depression of Paleogene (25-65 million years) origin (Hannigan, 2001; Yukon Oil and Gas Management Branch, 2005). The basin occurs within the Northern Yukon Fold Complex, and is flanked by intensely deformed and uplifted Proterozoic (570-2,500 million years) to Mesozoic (65-250 million years) sedimentary rocks of the British Mountains, Richardson Mountains, Old Crow Range and Keele Range. The Old Crow basin consists of essentially flat-lying Tertiary (4-65 million years) to Recent, non-marine sediments with coals unconformably overlying a Proterozoic to Mesozoic basement with a suggested relief of up to 800 m. This basement relief is caused by either east-west trending marginal faults or syncline-anticline fold structures. Mesozoic strata are thought to be imperfectly preserved beneath this Eocene (40-55 million years) unconformity with their erosion occurring over the structural highs.

Rocks in the region have been deformed by two major orogenic episodes: an Early Devonian (400 million years) Ellesmerian compressional orogeny, and the latest Cretaceous to Tertiary Cordilleran (5-75 million years) compressional orogeny. Thick deposits of sediments up to 1200m thickness are interpreted to have been deposited in the basin over the past millions of years. The area remained unglaciated during the Pleistocene (<2 million years) period.

4.1.2.1.3 Kandik Basin

The Kandik basin is located in the south-western portion of the region, to the west of Ni'iinlii'njik (Fishing Branch) SMA (see Appendix 1, Map 43). The largest portion of the basin occurs in Alaska. The portion of the Kandik basin within Yukon and the North Yukon Planning Region is approximately 2,200 km^2 in size and accounts for 4% of the planning area.

The Kandik Basin is a structural depression along the Yukon-Alaska border that contains Paleozoic to Mesozoic (65-570 million years) sediments (Hannigan et al. 2000; Yukon Oil and Gas Management Branch 2005). The basin is elongated to the southwest and the largest portion (approximately 60% by area) is located in Alaska. Kandik Basin is delimited by Mesozoic (65-250 million years) sediment cover and is surrounded by outcrops of Paleozoic (250-570 million) and Precambrian (>570 million years) sedimentary rocks. The basin formed as a structurally controlled depositional site in late

Early Cretaceous (110-140 million years). Subsequent Cordilleran Orogenic compressional tectonics in Late Cretaceous (80 million) and early Tertiary (60 million years) produced folds and faults within Mesozoic sediments.

The basin basement consists of marlstones, diamictites, quartzites and siliceous carbonates of the Proterozoic (1,000 million years) Tindir Group. Unconformably overlying these strata are numerous Lower Paleozoic carbonate shale cycles with lesser intermittent siliciclastic sedimentation intervals. Recurrent Cretaceous marine clastic wedges separated by unconformities overlie the earlier interbedded carbonate-shale intervals. The uppermost succession consists of nonmarine conglomeratic sandstone and grit which unconformably overlie the Cretaceous marine succession.

Kandik Basin consists of three separate areas with preserved Mesozoic sedimentary rocks that are surrounded by exposed Precambrian-Paleozoic outcrops. The southern portion of the basin is bounded by the Tintina Fault with some 420 km of lateral strike-slip displacement. The area remained unglaciated during the Pleistocene time; alluvial sediments occur along river valleys.

4.1.2.2 Oil and Gas Plays

Key Findings

- Plays consist of known or conceptual pools of natural gas and/or oil resources that occur in similar rock with a similar history of origin
- Fifteen different natural gas and oil plays have been identified in Eagle Plain basin (9 natural gas and 6 oil)
- There are no discovered natural gas or oil plays in Old Crow or Kandik basins
- The amount of economically recoverable natural gas and oil is unknown and can only be determined through future exploration

Background

Three individual natural gas and oil resource assessments have been completed for the North Yukon: Eagle Plain basin (Osadetz et al. 2005), Old Crow basin (Hannigan, 2001), and Kandik basin (Hannigan et al. 2000).

Methods

All resource assessments utilized the Petroleum Resource Information Management and Evaluation System (PETRIMES) computer program (Lee and Tzeng, 1993), based on statistical procedures developed by the Geological Survey of Canada. Detailed methods are described in the individual resource assessment reports listed above.

Discussion

It is important to recognize that for the purposes of the PETRIMES natural gas and oil resource assessments, Old Crow and Kandik basins are currently considered to contain conceptual plays due to their limited exploration history and lack of discovered petroleum resource (Hannigan 2001; Hannigan et al. 2000). In contrast, as a result of its established reserves and higher levels of historical exploration, Eagle Plain basin is currently considered to contain some immature established plays (Osadetz et al. 2005).

It should also be noted that the PETRIMES natural gas and oil resource assessment process has tended to underestimate the number of natural gas and oil pools, often significantly (Osadetz et al. 2005). This tendency has been supported through historical analyses of oil and gas basins with similar characteristics as Eagle Plain. There is also a tendency for resource assessments early in the exploration cycle to be conservative.

4.1.2.2.1 Eagle Plain Basin

Table 4.1.2.2(a) provides an established play summary for the Eagle Plain basin. Fifteen different petroleum plays have been identified in the Eagle Plain basin (nine natural gas and six oil). Several plays are considered established as they have yielded proven discoveries or significant shows.

Based on the assessment of established natural gas plays using the PETRIMES assessment process (Hannigan, 2001), the mean estimate of total natural gas potential for the Eagle Plain basin is 6,055 Bcf (6.1 Tcf) of in-place gas. High confidence and speculative confidence estimates of total natural gas potential are 3,856 Bcf and 7,482 Bcf, respectively.

Based on the assessment of established oil plays, the mean estimate of total oil potential for the Eagle Plain basin is 437 MMbbls of in-place oil. High confidence and speculative confidence estimates of total oil potential are 250 MMbbls and 564 MMbbls, respectively.

Tt should be noted that while portions of the basin occur outside of the planning region (see Appendix 1, Map 43), the entire basin has been included in the assessment. A portion of Eagle Plain basin also underlies the Ni'iinlii'njik (Fishing Branch) Wilderness Preserve, and is therefore unavailable for exploration and potential natural gas and oil extraction.

As a portion of the basin occurs outside of the North Yukon Planning Region, the total Eagle Plain natural gas and oil resource expected to occur in the region that is available for exploration and development is potentially less than reported above. The total amount of economically recoverable natural gas and oil in Eagle Plain is not currently known, but based on the analysis of Fekete (2006), a minimum of 1,900 Bcf of economically-recoverable gas reserves is considered a conservative estimate from the currently available land base.

Table 4.1.2.2(a). Play summary for Eagle Plain basin. Source: Osadetz et al. (2005). Table adapted from Yukon Oil and Gas Management Branch (2005).

Plays	**Pools** (mean)	**Mean Play Potential** (Bcf in-place)	**Mean Play Potential - Low Estimate** (75% probability Bcf in-place) *	**Mean Play Potential - High Estimate** (25% probability Bcf in-place) *
Gas Plays				
Cretaceous Stratigraphic Gas	16	119	81	145
Cretaceous Structural Gas	16	231	165	279
Permian Stratigraphic Gas	16	2,160	1,333	2,701
Permian Structural Gas	5	72	34	95
Carboniferous Stratigraphic Gas	11	1,705	1,178	2,099
Carboniferous Structural Gas	6	118	68	150
Lower Carboniferous Stratigraphic Gas	18	323	237	388
Lower Paleozoic Stratigraphic Gas	20	880	607	1,061
Lower Paleozoic Structural Gas		448	153	564
Total Gas (Bcf)	**114**	**6,055**	**3,856**	**7,482**
Oil Plays				
Cretaceous Structural Oil	6	67	40	86
Cretaceous Stratigraphic Oil	7	41	25	51
Permian Structural Oil	4	105	50	140
Carboniferous Structural Oil	5	77	47	98
Carboniferous Stratigraphic Oil	5	78	45	101
Lower Carboniferous Stratigraphic Oil	5	69	43	88
Total Oil (MMbbls)	**32**	**437**	**250**	**564**

* Low Estimate (75% probability) and High Estimate (25% probability) as reported in Yukon Oil and Gas Management Branch 2005.

4.1.2.2.2 Old Crow Basin

Table 4.1.2.2(b) provides a conceptual natural gas play summary for Old Crow basin. There are no discovered natural gas or oil reserves. Based on the assessment of three conceptual natural gas plays using the PETRIMES assessment process (Hannigan, 2001), the mean estimate of total natural gas potential for the Old Crow basin is 1,149 Bcf of in-place gas. High confidence and speculative confidence estimates of total natural gas potential are 223 Bcf and 1,862 Bcf, respectively. There is little, if any, oil potential in the Old Crow area (Hannigan, 2001).

All of the Old Crow conceptual plays are assumed to exist but significant play-level risks are interpreted to be presence of adequate reservoir facies (i.e. porosity) and closure (some structures may be breached by erosion causing breached seal) (Hannigan, 2001).

Table 4.1.2.2(b). Conceptual natural gas play summary for Old Crow basin. Source: Hannigan (2001). Table adapted from Yukon Oil and Gas Management Branch (2005).

Plays	**Pools** (mean)	**Mean Play Potential** (Bcf in-place)	**Mean Play Potential - Low Estimate** (80% probability Bcf in-place)	**Mean Play Potential - High Estimate** (20% probability Bcf in-place)
Gas Plays				
Kekiktuk conglomerate	5	422	100	689
Upper Paleozoic carbonate	5	686	123	1,107
Mesozoic clastic	0.6	41	0	66
Total Gas (Bcf)	**10.6**	**1,149**	**223**	**1,862**

4.1.2.2.3 Kandik Basin

Table 4.1.2.2(c) provides a conceptual natural gas and oil play summary for Kandik basin. There are no discovered natural gas or oil reserves. Based on the assessment of three conceptual natural gas plays using the PETRIMES assessment process (Hannigan et al. 2000), the mean estimate of total natural gas potential for the Kandik basin (Yukon portion) is 649 Bcf of in-place gas. High confidence and speculative confidence estimates of total natural gas potential are 226 Bcf and 1,045 Bcf, respectively.

Based on the assessment of two conceptual oil plays, the mean estimate of total oil potential for the Kandik basin (Yukon portion) is 99 MMbbls of in-place oil. High confidence and speculative confidence estimates of total oil potential are 30 MMbbls and 176 MMbbls, respectively.

It should be noted that while approximately half of the Yukon portion of the Kandik basin occurs outside of the planning region (see Appendix 1, Map 43), the entire Yukon portion of the basin is included in the assessment. Resource estimates are based on the fraction of total play area contained in Yukon, with an important assumption that the petroleum resource is evenly distributed across the entire Kandik basin. The total Kandik basin petroleum resource within the North Yukon Planning Region may therefore be assumed less than the total reported here.

All plays are considered to have a high probability of existing. An important risk in each of the Kandik basin plays is the extent of erosion that may have occurred between depositional events, increasing the chance of breached seal or closure.

Table 4.1.2.2(c). Conceptual play summary for Kandik basin (Yukon portion). Source: Hannigan et al. (2000). Table adapted from Yukon Oil and Gas Management Branch (2005).

Plays	**Pools** (mean)	**Mean Play Potential*** (in-place)	**Mean Play Potential - Low Estimate*** (80% probability in-place)	**Mean Play Potential - High Estimate*** (20% probability in-place)
Gas Plays				
Tertiary/Upper Cretaceous (non-marine)	30	99	34	173
Mesozoic marine structural	8	189	68	299
Paleozoic marine structural	10	361	124	573
Total Gas (Bcf)	**48**	**649**	**226**	**1,045**
Oil Plays				
Tertiary/Upper Cretaceous (non-marine)	30	78	27	139
Paleozoic marine structural	3	21	3	37
Total Oil (MMbbls)	**33**	**99**	**30**	**176**

* Mean play potential based on fraction of total play area in Yukon and assumption of even distribution of resource within play.

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Yukon Oil and Gas Management Branch. 2005. Yukon Oil and Gas – A Northern Investment Opportunity. Yukon Department of Energy, Mines and Resources. June 2005.

4.1.2.3 Past Exploration Activities

Key Findings

- Natural gas and oil exploration in the region spans the period from 1957 to present (see Appendix 1, Maps 43 and 49)
- Eagle Plain basin has received the most exploration attention in the region
- Previous exploration resulted in three recognized natural gas and oil discoveries within Eagle Plain basin, the Birch, Blackie, and Chance fields (see Figure 4.1.2.3(a)). At least five other wells in Eagle Plain flowed gas to surface; many others displayed minor or major oil and gas shows.
- The Birch, Blackie and Chance discoveries have a total proven reserve of 83.7 billion cubic feet (Bcf) natural gas and 11 million barrels (MMbbls) oil.
- Thirty-five exploration wells have been drilled within, or in close proximity to, the planning region
- Approximately 10,000 line km of seismic surveys have been conducted
- The level of historical exploration was not sufficient to develop a detailed understanding of the oil and gas basins in the planning region

Background

While still relatively low, the planning region has been the focus of the highest level of historical natural gas and oil exploration activity in the Yukon. Exploration well locations and results are shown in Figure 4.1.2.3(a). During the period 1957–1985, 35 exploration wells were drilled within, or in close proximity to the planning region and approximately 10,000 line km of seismic surveys were conducted.

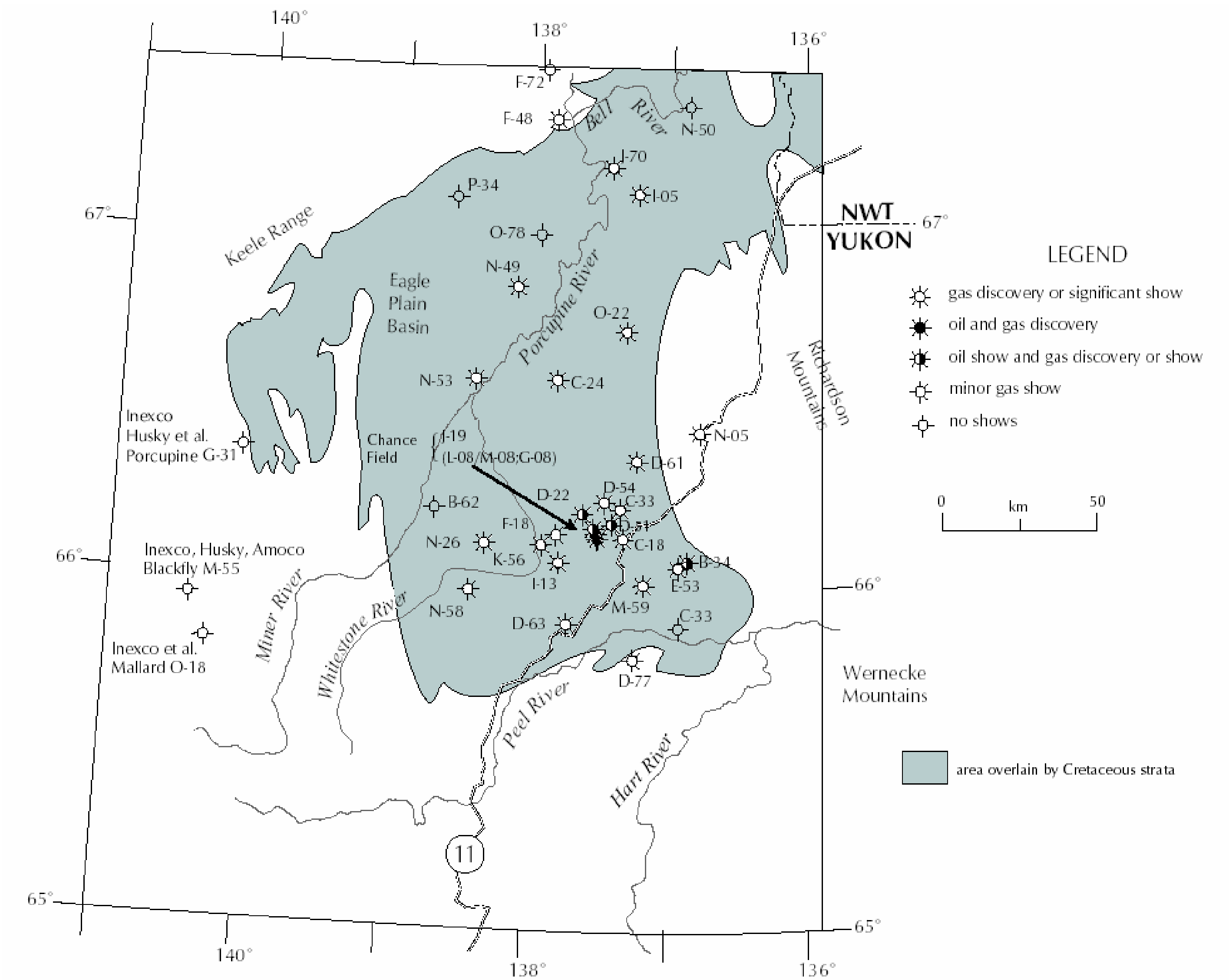

Figure 4.1.2.3(a). Locations of exploration wells in the region and major results. The wells are located in Eagle Plain and Kandik basins. Source: Figure 16 from Osadetz et al. (2005).

Historical exploration activities also resulted in the development of temporary winter roads/trails and airstrips (see Appendix 1, Maps 43 and 49). Focused on Eagle Plain, the majority of these activities took place in the 1960s and 1970s. Many linear disturbance features are still readily visible on the landscape today.

Following the Mackenzie Valley Pipeline hearings and the Berger Inquiry (Berger 1977) of the 1970s, exploration interest in the region (and in northern Canada generally) decreased dramatically. After the decision was made to not proceed with the Mackenzie

Valley Pipeline, only three wells were drilled in Eagle Plain during the period 1978-85. In the winter of 2005, an exploration well was drilled at Eagle Plain following a 20-year period of inactivity. During the period of relative inactivity, responsibility for the management of onshore oil and gas resources was transferred to the Yukon Government; this occurred in 1998. The Yukon *Oil and Gas Act* provides for integration with the Yukon First Nation Final Agreements and reflects the federal transfer of broader resource rights and responsibilities to Yukon Government through the 2003 devolution agreement.

4.1.2.3.1 Eagle Plain Basin

Eagle Plain basin has received the most exploration interest in the region. A detailed exploration history of the basin is provided in Osadetz et al. (2005). During the period 1957–2004, 35 exploration wells were drilled in proximity to the basin and approximately 10,000 km of seismic surveys were conducted. Most wells were drilled in the mid-1960s and early 1970s. The most recent exploration well (K-58) was drilled in 2005. Few seismic surveys were conducted in Eagle Plain basin after 1975. Table 4.1.2.3(a) and Figure 4.1.2.3(a) summarize the historical wells in the basin (also see Appendix 1, Map 43).

Three Significant Discovery Licenses (SDL's) resulted from historical exploration activities. In 1960, the Chance field was discovered (SDL-022); this was followed in 1963 by Blackie (SDL-021), and in 1965 by Birch (SDL-020). Since these discoveries, most exploration activities have focused on the Chance field and surrounding area. The Chance (SDL-022) and Birch (SDL-020) fields are contained within the planning region. This area is anticipate to be the initial focus of potential future oil and gas exploration activities. The Blackie field (SDL-021) is located within the Eagle Plain basin, but is in the adjacent Peel Watershed Planning Region.

Of the 35 wells drilled in the Eagle Plain basin from 1957-2004, ten wells flowed gas to surface, and numerous others had gas and oil shows. Discovered resources contain 83.7 Bcf gas and 11.1 MMbbls oil. All of the currently discovered petroleum resources are found in the South Eagle sub-basin.

4.1.2.3.2 Old Crow Basin

Petroleum exploration in the Old Crow Basin has been very limited (Hannigan, 2001). No exploration wells were drilled in the area. During the period 1969-1972, approximately 200 km of seismic surveys were conducted. The nearest exploration well is the Socony Mobil-W.M. Molar P-34 well drilled in northern Eagle Plain, approximately 50 km to the southeast (see Appendix 1, Map 43). Exploration in the Old Crow Basin was suspended in 1973 due to environmental concerns (Hannigan, 2001) and negotiations leading to First Nation land claims.

Table 4.1.2.3(a). Historical well summary for Eagle Plain basin and immediate surrounding area. Wells are listed in chronological order. Twenty-eight wells are located within the North Yukon Planning Region (marked with *); the majority occur in the Eagle Plain basin. Table adapted from: Osadetz et al. (2005) and Yukon Oil and Gas Branch well-site database.

Well Name	Well Number	Year Drilled	Total Depth (m)	Exploration Results	Current Status[1]	Current Owner/ Operator
Eagle Plain *	**N-49**	1957	2,923	Significant gas show	D&A	Union Pacific Resources
Chance *	**M-08 (L-08)**	1959	2,636	Oil and gas discovery. Gas flowed to surface.	Gas and Oil – Suspended	Northern Cross (Yukon)
Bell River *	**N-50**	1960	2,440	No shows	D&A	Petro Canada
Blackstone	**D-77**	1962	4,029	Minor gas show	D&A	Chevron
Chance *	**G-08**	1962	1,580	Oil and gas discovery. Oil and gas flowed to surface.	Oil - Suspended	Northern Cross (Yukon)
Porcupine River *	**K-56**	1963	2,286	Significant gas show	D&A	ExxonMobil
Blackie	**M-59**	1963	1,932	Gas discovery. Gas flowed to surface.	Gas - Suspended	Northern Cross (Yukon)
Molar *	**P-34**	1964	2,650	No shows	D&A	ExxonMobil
Whitestone *	**N-26**	1964	2,464	Significant gas show	D&A	ExxonMobil
Ellen *	**C-24**	1964	2,174	Significant gas show	D&A	ExxonMobil
South Tuttle *	**N-05**	1965	3,513	Significant gas show	D&A	ExxonMobil
Birch *	**B-34**	1965	1,650	Gas discovery and oil show. Gas flowed to surface.	Gas – Suspended	ExxonMobil
West Parkin *	**D-51**	1965	1,509	Oil show and significant gas show	D&A	ExxonMobil
North Cathedral *	**B-62**	1965	2,139	No shows	Temp OBS	ExxonMobil
Chance *	**J-19**	1967	1,446	Gas discovery and oil show. Gas flowed to surface.	Gas – Suspended	Northern Cross (Yukon)
East Chance *	**C-18**	1968	1,541	Significant gas show. Gas flowed to surface.	D&A	Union Pacific Resources
North Hope *	**N-53**	1970	4,280	Significant gas show	D&A	Union Pacific Resources

[1] Current Status: D&A – dry and abandoned well, Suspended – well is capable of production but is currently not producing, Temp OBS – temperature observation well

Table 4.1.2.3(a) (cont'd). Historical well summary for Eagle Plain basin and immediate surrounding area. Wells are listed in chronological order. Twenty-eight wells are located within the planning region (marked with *); the majority occur in the Eagle Plains area. Table adapted from: Osadetz et al. (2005) and Yukon Oil and Gas Branch well-site database.

Well Name	Well Number	Year Drilled	Total Depth (m)	Exploration Results	Current Status[1]	Current Owner/ Operator
Shaeffer Creek *	**O-22**	1971	3,162	Significant gas show. Gas flowed to surface.	D&A	Chevron
Porcupine *^	**G-31**	1971	2,658	No shows	D&A	Burlington Resources
East Porcupine *	**I-13**	1971	2,439	Significant gas show	D&A	Chevron
West Parkin	**C-33**	1971	1,257	No shows	D&A	Chevron
East Pine Creek *	**O-78**	1971	948	No shows	D&A	Chevron
North Parkin *	**D-61**	1972	3,353	Significant gas show	D&A	Chevron
Birch	**E-53**	1972	684	Significant gas show	D&A	Chevron
South Chance	**D-63**	1972	2,021	Significant gas show	D&A	Chevron
Whitefish *	**I-05**	1972	1,498	Significant gas show	D&A	Chevron
East Porcupine *	**F-18**	1972	2,051	Minor gas show. Gas flowed to surface.	D&A	Chevron
Ridge *	**F-48**	1973	1,869	Significant gas show. Gas flowed to surface.	D&A	Chevron
Whitefish *	**J-70**	1973	2,128	Significant gas show	D&A	Chevron
Whitestone	**N-58**	1973	2,132	Minor gas show	D&A	Murphy Oil Company
North Porcupine *	**F-72**	1974	2,252	No shows	D&A	Numac Oil & Gas
Alder	**C-33**	1978	3,714	Significant gas show	D&A	Husky Oil
West Parkin *	**D-54**	1984	1,811	Significant gas show. Gas flowed to surface.	Gas - Abandoned	Unknown
North Chance *	**D-22**	1985	1,830	Minor gas show	D&A	Unknown
?? *	**K-58**	2004	??	??	D&A	Devon Canada

[1] Current Status: D&A – dry and abandoned well, Suspended – well is capable of production but is currently not producing, Temp OBS – temperature observation well

^ Yukon Oil and Gas Management Branch considers Porcupine G-31 well to be located in Kandik Basin

4.1.2.3.3 Kandik Basin

During the period 1970-1972, three exploration wells were drilled in the Yukon portion of the basin and approximately 180 km of seismic surveys were conducted (Hannigan et al. 2000). Table 4.1.2.3(b) summarizes the historical wells (also see Appendix 1, Map 43). In 1970, the INC Husky Amoco Black-fly YT M-55 well was drilled near the eastern margin of the basin.

In the winter of 1971, Inexco conducted approximately 180 km of seismic surveys in three areas along the eastern margin of the basin. In December 1971, Inexco Husky et al. drilled Porcupine YT G-31 well on the northeast margin of the basin. The most recent exploration well (Inexco et al. Mallard YT O-18) was drilled in 1972. None of these wells encountered natural gas or oil.

Table 4.1.2.3(b). Historical well summary for Kandik basin. Table adapted from: Osadetz et al. (2005) and Yukon Oil and Gas Branch well-site database.

Well Name	Well Number	Year Drilled	Total Depth (m)	Exploration Results	Current Status[1]	Current Owner/ Operator
Black-fly	**M-55**	1970	2,070	No shows	D&A	Burlington Resources
Porcupine *	**G-31**	1971	2,658	No shows	D&A	Burlington Resources
Mallard	**O-18**	1972	3,200	No shows	D&A	Burlington Resources

* Porcupine G-31 is the only Kandik basin well located within the planning region. It is located within Ni'iinlii'njik (Fishing Branch) Wilderness Preserve. Osadetz et al. (2005) included G-31 in their assessment of the Eagle Plain Basin.

References

Berger, Thomas. 1977. Northern Frontier, Northern Homeland: The Report of the Mackenzie Valley Pipeline Inquiry. 2 Volumes. Ottawa: Minister of Supply and Services.

Hannigan, P.K., Osadetz, K.G., Dixon, J. and Bird, T.D. 2000. Petroleum Resource Assessment of the Kandik Basin, Yukon Territory, Canada. Yukon Economic Development, Oil and Gas Resources Branch.

Hannigan, P.K. 2001. Petroleum Resource Assessment of the Old Crow Basin, Yukon Territory, Canada. Yukon Economic Development, Oil and Gas Resources Branch.

[1] Current Status: D&A – dry and abandoned well, Suspended – well is capable of production but is currently not producing, Temp OBS – temperature observation well

Osadetz, K.G., Chen, Z. and Bird, T.D., 2005. Petroleum Resource Assessment, Eagle Plain Basin and Environs, Yukon Territory, Canada. Yukon Geological Survey Open File 2005-2, Geological Survey of Canada Open File 4922, 88 p.

Yukon Department of Energy, Mines and Resources. 2005. Prohibition of entry on certain lands in North Yukon order. Yukon Order in Council #2005/53, April 2005. 4 pp.

Yukon Oil and Gas Management Branch. 2005. Yukon Oil and Gas – A Northern Investment Opportunity. Yukon Department of Energy, Mines and Resources. June 2005.

4.1.2.4 Current Interests and Activities

Key Findings

- Oil and gas exploration and development activities in the region are currently low, but interest is increasing. Eagle Plain basin is the area of highest interest.
- As of September 2007, there are seventeen land parcels in the Eagle Plain basin under natural gas and oil dispositions. Sixteen of these parcels are located in the planning region (see Appendix 1, Maps 2 and 43). Thirteen of the oil and gas permits were awarded in spring of 2007. Oil and gas land parcels cover approximately 5,000 km^2, representing 9% of the planning region. All are located in Eagle Plain.
- Old Crow basin is currently withdrawn from oil and gas activities, and is not available for exploration
- Kandik Basin is a remote area with limited access and exploration history

Background

Since the 1970s, the level of industry interest and activity has been relatively low. Few exploration permits were awarded and a limited number of exploration programs conducted. The K-58 well drilled in Eagle Plain by Devon Canada Corporation in 2004 was the first drilling program since 1985. Until recently, there was only one permit and two Significant Discovery Licenses within the North Yukon Planning Region. However, interest in the Eagle Plain basin has recently increased, with the awarding of 13 oil and gas permits in the spring 2007 Yukon oil and gas disposition process. Given its proximity to the Dempster Highway and its potentially significant natural gas resource, Eagle Plain basin continues to be the area of highest exploration interest.

4.1.2.4.1 Eagle Plain

Given its proximity to the Dempster Highway, proven reserves and relatively high level of historical exploration, the Eagle Plain basin can be considered the area of highest natural gas and oil interest in the region. Established reserves in Eagle Plain are currently estimated at 83.7 Bcf of natural gas and 11 MMbbls of oil, suggesting a substantial natural gas and oil resource remains to be discovered.

Fourteen oil and gas permits and two Significant Discovery Licenses (SDL’s) are located within the Eagle Plain basin (see Appendix 1, Maps 2 and 43). Table 4.1.2.4(a) provides a summary of natural gas and oil dispositions for Eagle Plain (current to September 2007). All dispositions within the planning region are currently located within Eagle Plain.

Northern Cross (Yukon) Ltd. holds all current oil and gas permit areas. With the exception of Permit #001, the remaining 13 were awarded to Northern Cross (Yukon) Ltd. in the spring 2007 Yukon oil and gas disposition process. Devon Canada Corporation held previous permit areas in Eagle Plain but transferred their remaining land holdings to Northern Cross (Yukon) Ltd. in 2006. Permit #001 has an expiry date of November 30, 2008. All other exploration permits are active for a six year term, expiring in August 31, 2013. Work bids for the recent permit areas total approximately $20 million over the 6-year permit period.

Northern Cross (Yukon) Ltd. and Chevron Canada Resources hold two SDL’s in the portion of Eagle Plain within the planning region, SDL-020 (Birch) and SDL-022 (Chance). Northern Cross (Yukon) Ltd. is the majority owner for both licenses. SDL-020 and SDL-022 have been in effect since 1988 and were previously managed under the federal government oil and gas regime for Northern Canada. SDL’s have no expiry date. Recoverable oil was discovered at SDL-022 in the 1960s and wells have been tested over the past 20 years to establish reserve estimates and flow rates. Northern Cross (Yukon) Ltd. has submitted proposals to conduct a series of flow tests at the Chance SDL-022 in the coming years.

Table 4.1.2.4(a). Natural gas and oil disposition summary for portion of Eagle Plain basin within the North Yukon Planning Region (current to September 2007). All active dispositions within the planning region are within the Eagle Plain basin. The % NYPR field represents the percentage of the planning region held by each disposition.

Disposition	Owner	Area (km^2)	% NYPR	Expiry
Oil and Gas				
Permit #001	Northern Cross (Yukon) Ltd.	197	0.35	Nov. 30, 2008
Permit #005	Northern Cross (Yukon) Ltd.	386	0.69	Aug. 31, 2013
Permit #006	Northern Cross (Yukon) Ltd.	302	0.54	Aug. 31, 2013
Permit #007	Northern Cross (Yukon) Ltd.	343	0.62	Aug. 31, 2013
Permit #008	Northern Cross (Yukon) Ltd.	412	0.74	Aug. 31, 2013
Permit #009	Northern Cross (Yukon) Ltd.	412	0.74	Aug. 31, 2013
Permit #010	Northern Cross (Yukon) Ltd.	415	0.75	Aug. 31, 2013
Permit #011	Northern Cross (Yukon) Ltd.	319	0.57	Aug. 31, 2013
Permit #012	Northern Cross (Yukon) Ltd.	418	0.75	Aug. 31, 2013
Permit #013	Northern Cross (Yukon) Ltd.	302	0.54	Aug. 31, 2013
Permit #014	Northern Cross (Yukon) Ltd.	403	0.73	Aug. 31, 2013
Permit #015	Northern Cross (Yukon) Ltd.	428	0.77	Aug. 31, 2013
Permit #016	Northern Cross (Yukon) Ltd.	383	0.69	Aug. 31, 2013
Permit #017	Northern Cross (Yukon) Ltd.	251	0.45	Aug. 31, 2013
SDL-020 (Birch)	Northern Cross (Yukon) Ltd. and Chevron Canada Resources	19	0.03	No expiry date
SDL-022 (Chance) *	Northern Cross (Yukon) Ltd. and Chevron Canada Resources	37	0.07	No expiry date
Total		**5,027**	**9.05**	

* Note: SDL-022 (Chance) has active proposal to conduct oil flow tests

4.1.2.4.2 Old Crow Basin

No petroleum exploration activities are currently taking place in the Old Crow Basin. The majority of the Old Crow Basin is within Vuntut National Park and the adjacent Old Crow Flats SMA. Vuntut National Park and core wetlands area of Old Crow Flats SMA is permanently withdrawn from oil and gas disposition, and the east and west ‘wings’ of the SMA are withdrawn for a period of 20-years (Parks Canada, Vuntut Gwitchin First Nation and North Yukon Renewable Resources Council, 2004; Yukon Department of Environment and Vuntut Gwitchin Government, 2006). The majority of the basin that occurs outside of the Old Crow Flats SMA is currently withdrawn from disposition through the North Yukon Interim Land Withdrawal. VGFN Settlement Land (VG R-11A) also encompasses a portion of the Old Crow basin.

4.1.2.4.3 Kandik Basin

No petroleum exploration activities are currently taking place in the Kandik basin.

References

Parks Canada, Vuntut Gwitchin First Nation and North Yukon Renewable Resources Council. 2004. Vuntut National Park of Canada Management Plan. April 2004. 65p.

Yukon Department of Environment and Vuntut Gwitchin Government. 2006. Old Crow Flats Special Management Area Management Plan. Old Crow Flats Technical Working Group and Management Committee. 54 pp.

4.1.2.5 Future Exploration and Development Potential

Key Findings

- Predicting future natural gas and oil activity in the region is a difficult and uncertain task
- Future natural gas and oil activity is anticipated to be focused on the Eagle Plain basin
- Three major conditions must be met prior to natural gas development in Eagle Plain: 1) a major pipeline must be built along the Mackenzie Valley or Alaska highway, 2) capacity must exist in that pipeline to accept Eagle Plain natural gas, and 3) Eagle Plain natural gas must be accepted for delivery into that pipeline at reasonable toll rates

- The most likely and cost effective route to transport Eagle Plain natural gas would be via a pipeline constructed along the Dempster Highway to the Mackenzie Valley pipeline near Inuvik
- Assuming the Mackenzie Valley pipeline is operational by 2014 and has capacity to transport Yukon natural gas, Eagle Plain gas production could begin between 2020-2025, preceded by 10-15 years of exploration, infrastructure development, and pipeline planning and construction
- Pipeline capacity is a major consideration. Pipeline transportation capacity is considered to be the major ‘cap’ that would regulate the pace of exploration, production and associated infrastructure levels in Eagle Plain.
- The Old Crow and Kandik basins are not expected to receive significant levels of oil and gas exploration interest in the near future

Background

Predicting the specific location, pace and scale of future natural gas and oil activities in the region is a difficult and uncertain task. Future energy sector activity and timing will depend on a number of factors including the size of the current and future economically-recoverable resource, access to the resource, technological advances, operating costs, pipeline infrastructure, geopolitical factors and global commodity prices. However, it is possible to examine development scenarios that are more plausible than others, based on the best available information regarding natural gas and oil resource potential and industry trends.

With renewed interest in the Mackenzie Valley Gas Project in the Northwest Territories (Imperial Oil Resources Ventures Ltd., 2004), the North Yukon region, specifically Eagle Plain, is once again becoming an area of exploration interest for the energy sector. It is uncertain whether this will lead to new infrastructure development and production. While the level of direct interest and activity has been relatively low over the recent past, industry interest is increasing.

Fekete (2006) provided a technical analysis of a conceptual natural gas and oil scenario for the North Yukon region. The report focused on the Eagle Plain basin and developed a plausible scenario for energy sector activity in the region. The assessment greatly aids in the discussion of potential opportunities and impacts that may be associated with future natural gas and oil activity within and in close proximity to the region. Depending on the scale, location and operating practices associated with future potential energy sector activity in Eagle Plains, this situation represents potentially large economic, ecological and social risks and benefits to the region, the community of Old Crow, neighbouring communities and Yukon.

Methods

The methods and assumptions used to produce a future plausible scenario for Eagle Plain natural gas and oil development are reported in Fekete (2006). Additional methods to assess Eagle Plain natural gas and oil potential are reported in Osadetz et al. (2005).

Discussion

As described by Fekete (2006), given its proximity to the Dempster Highway, proven reserves and relatively high level of historical exploration, the Eagle Plain basin should be considered the area of highest natural gas and oil interest in the planning region, and potentially in all of northern Yukon. Two specific development scenarios are currently envisioned for North Yukon, a natural gas scenario and an oil scenario.

4.1.2.5.1 Natural Gas Scenario

A number of different factors require consideration when describing a potential natural gas scenario for the Eagle Plain basin. These include pipeline access, timing of activities, levels of exploration and infrastructure, and location of those exploration and production activities.

Resource estimates in Eagle Plain basin identify a potential natural gas resource adequate to supply a medium diameter (20 inch, or 508 mm) pipeline for approximately 20-years (Fekete, 2006). The total economically recoverable natural gas extracted over this 20-year period is estimated to be 1,900 Bcf (1.9 Tcf). The results of Osadetz et al. (2005) suggest an expected mean volume of 5 Tcf of natural gas remain to be discovered in Eagle Plain basin.

Pipeline Access

Development of the Eagle Plain basin, and the entire North Yukon region natural gas resource, depends on prior construction of pipeline infrastructure, and access to that infrastructure. Based on the analysis of Fekete (2006), the most cost-effective and direct route to transport Eagle Plain gas would be for a North Yukon Gas Pipeline (NYGP) to be constructed along the Dempster Highway to the Mackenzie Valley Pipeline (MVP) near Inuvik.

Other alternatives such as a pipeline traveling south along the Dempster Highway and down the Klondike Highway to a future Alaska Highway Pipeline, or east along the Top of the World Highway into Alaska are also possible, but are considerably longer and more costly. A NYGP connecting to the future MVP is therefore considered to be the most likely pipeline route.

Based on cost analyses performed by Fekete (2006), a medium diameter 20" (508 mm) natural gas pipeline with an initial 256 Mcf/day (million cubic feet per day) capacity, with the possibility to increase to 410 Mcf/day through additional compression, would be the most likely pipeline scenario. Resource estimates in Eagle Plain identify a natural gas resource adequate to supply a 20" gas pipeline with a maximum capacity of 410 Mcf/day for more than 20-years.

Timing of Natural Gas Scenario

Fekete (2006) described a natural gas scenario with Eagle Plain receiving focused exploration and planning for a NYGP beginning in 2010, with actual pipeline and compressor station construction occurring in 2014-2017. Other required infrastructure development required during this time would be production wells, well pads, mainline and gathering pipelines and all season access roads. Natural gas production would begin immediately following pipeline construction in 2017 (Fekete, 2006).

While the natural gas scenario described by Fekete (2006) is logical in sequencing, based on the current situation it may be considered optimistic in its timing. Despite the recent 13 oil and gas permits awarded in 2007, there is limited active exploration occurring in Eagle Plain. The $20 million work bid over a six year period for these recent parcels will result in a limited amount of exploration work. As a result of the recent cost project increases, the fate of the Mackenzie Valley Gas Project is currently uncertain. If constructed, the Mackenzie Valley Pipeline will not be operational until at least 2014.

It is also anticipated the environmental and socio-economic impact assessment associated with a potential NYGP along the Dempster Highway through the Richardson Mountains into the NWT will receive a high level of scrutiny. Unlike the Mackenzie Valley Gas Project, the NYGP will directly involve multiple northern jurisdictions, Yukon and NWT. Given these factors, a more realistic timing sequence for the Eagle Plain natural gas scenario may be as follows:

- In late 2008, a final decision to proceed with the Mackenzie Valley Gas Project is made. The pipeline is operational with gas flowing to southern markets no sooner than 2014

- In approximately 2010, focused exploration begins in Eagle Plains and is ongoing for a period of 10-15 years. By this time, it is assumed an adequate level of economically recoverable reserves would be established to justify the substantial outlay of capital infrastructure costs by industry to construct the NYGP. This 'proving up' stage would have to occur prior to detailed pipeline engineering, and potentially routing

- In approximately 2015, a ten-year period of planning and construction for the NYGP connector to MVP would occur. Also during this period, 2015-2025, initial natural gas production infrastructure (pads, wells, gathering pipelines and access roads) would be constructed

Given present circumstances and considerations, it seems unlikely that natural gas production from Eagle Plain basin would begin sooner than 2020, with a more realistic production date perhaps being 2025.

Required Exploration & Infrastructure

For Eagle Plain basin, Fekete (2006) projects the following infrastructure requirements would eventually be required to support the production of 256-410 Mcf/day natural gas for a period of 20-years (see Pipeline Access Section above for pipeline discussion):

- 700-900 natural gas wells (total exploration and development wells)
- approximately 10,000 line km of 2-D (5,000 km) and 3-D (4,600 km) seismic
- 1,300 km of gathering pipelines
- 50 km of mainline pipeline; and,
- 1,500 km of all season access roads

The length of the NYGP through the planning region is anticipated to be approximately 100 km. New infrastructure, especially access roads, would be anticipated to utilize existing historical trails and winter road routes when ever possible.

These levels of exploration and production infrastructure are based on the extraction of 1,900 Bcf (1.9 Tcf) natural gas over a 20-year period. Given the estimated 6.1 Tcf of in-place natural gas for Eagle Plain (Osadetz et al. 2005), these exploration and infrastructure levels may be conservative. Pipeline transportation capacity is considered to be the major ‘cap’ on the pace of exploration, production and associated infrastructure levels required to meet that production. Additional detail on the assumptions and possible limitations of the Fekete scenario is provided below in “Challenges, Assumptions, and Timing of Production”.

Location of Activities

Figure 4.1.2.5.1(a) shows the future anticipated area of focused exploration activities in Eagle Plain basin. As shown, the area of exploration focus is likely to be within the Chance Creek and Whitestone areas, at least in the initial phases of basin development. Portions of this focused exploration area are located outside of the planning region, and would also be expected to include Vuntut Gwitchin (VG R-06A, R-08A and R-09A) and Tr’ondek Hw’echin (TH R-49A) First Nation land selections along the Dempster Highway, should the First Nations choose to allow such activities to occur on their settlement lands.

While the Chance Creek and Whitestone areas are anticipated to be the initial areas of exploration focus, it should be expected that some level of exploration would occur across the majority of Eagle Plain basin as understanding of the basin grows (Fekete 2006).

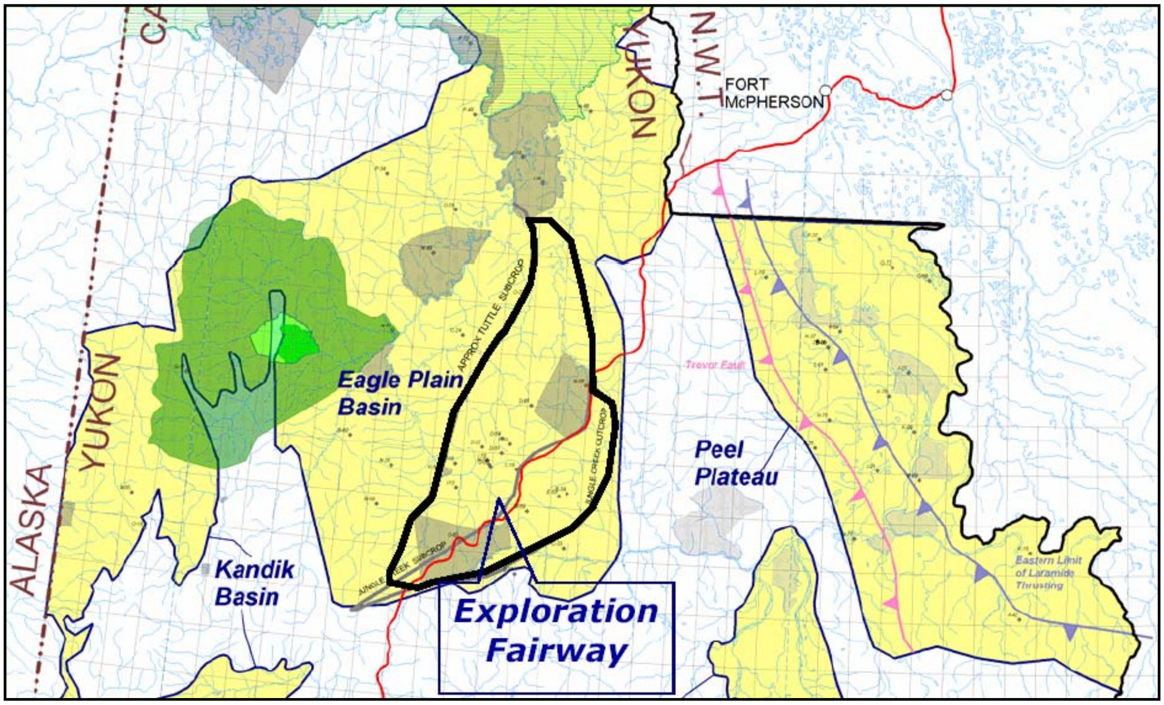

Figure 4.1.2.5.1(a). Anticipated future area of highest exploration interest/activity (i.e., Exploration Fairway) in Eagle Plain basin. Source: Figure 8, Fekete (2006).

Figures 4.1.2.5.1(b-e) show a potential 20-year development scenario of how the location of production infrastructure may unfold in Eagle Plain basin, beginning in 2025. An assumption with the scenario is that the NYGP would be built in advance along the Dempster Highway to the Mackenzie Valley Pipeline, between 2020-2025. The focused area of exploration, production activities, and infrastructure are anticipated to be within the Chance Creek area, with some activities occurring in the vicinity of the Whitestone River and Dempster Highway.

Production wells and associated infrastructure would initially be located around the existing Significant Discovery Licenses and Dempster Highway, and over time expand northward and westward from that point. Following development of the initial infrastructure to supply adequate gas volumes to the NYGP, the discovery sequence and size of gas pools would determine the specific location of production wells and associated infrastructure.

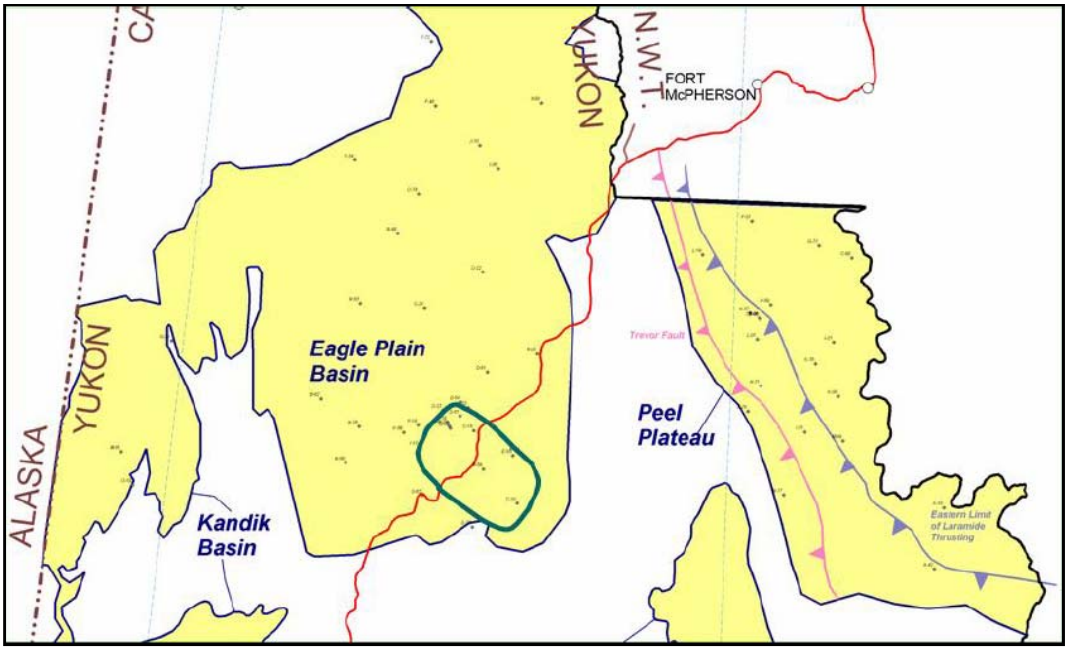

Figure 4.1.2.5.1(b). Projected five-year development pattern for Eagle Plain basin, 2025-2030. The anticipated location of activities is highlighted (green circle). Source: Figures 15, Fekete (2006).

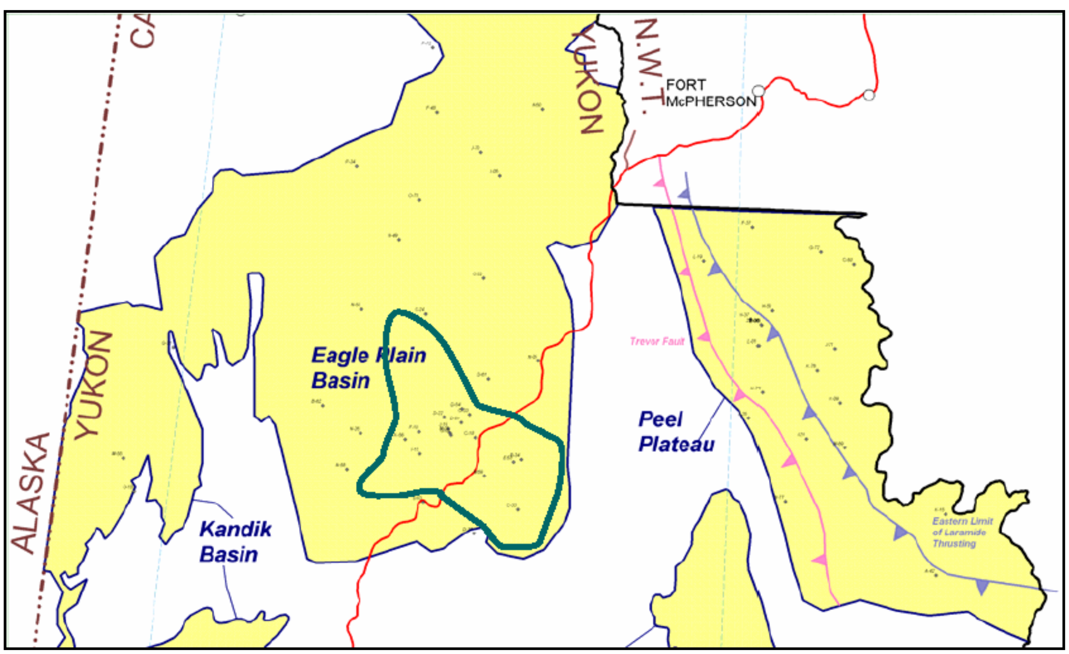

Figure 4.1.2.5.1(c). Projected ten-year development pattern for Eagle Plain basin, 2025-2035. The anticipated location of activities is highlighted (green circle). Source: Figure 16, Fekete (2006).

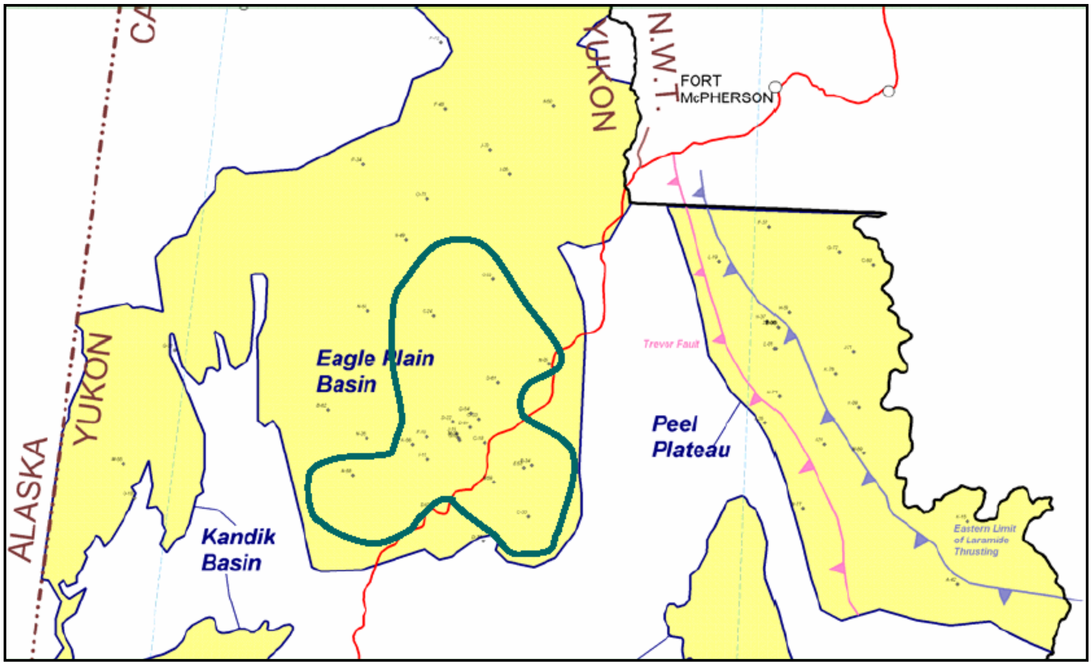

Figure 4.1.2.5.1(d). Projected fifteen-year development pattern for Eagle Plain basin, 2025-2040. The anticipated location of activities is highlighted (green circle). Source: Figure 17, Fekete (2006).

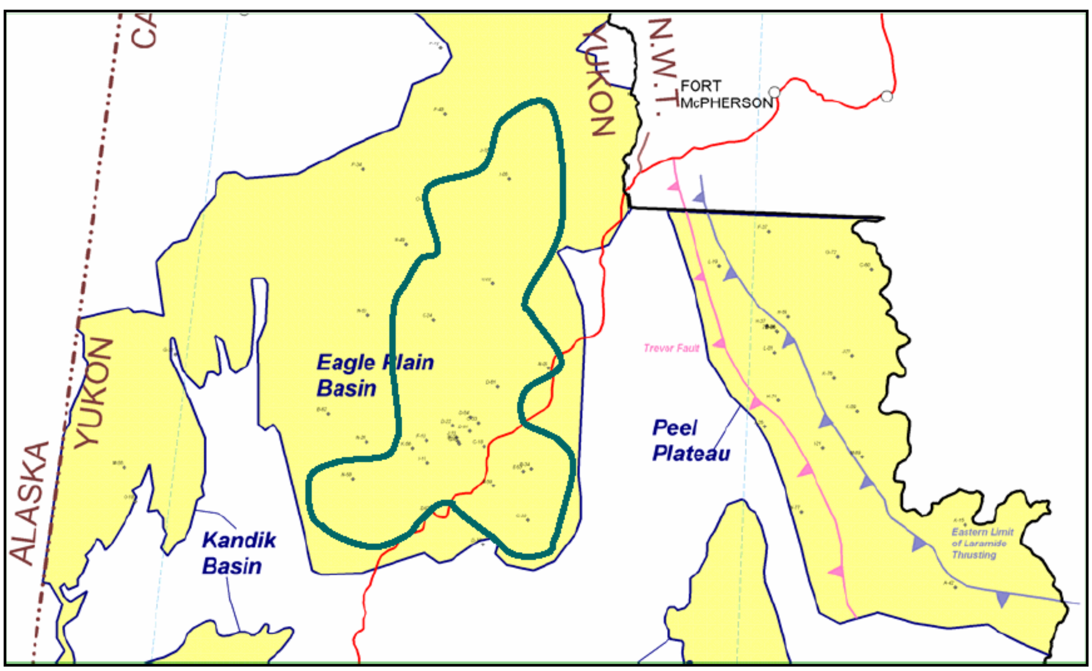

Figure 4.1.2.5.1(e). Projected twenty-year development pattern for Eagle Plain basin, 2025-2045. The anticipated location of activities is highlighted (green circle). Source: Figure 18, Fekete (2006).

Challenges, Assumptions and Timing of Production

While Eagle Plain is clearly the area of highest interest and potential in the region, significant challenges must be overcome in order for the substantial expected natural gas resources of the area to be developed. Some of the most important challenges are beyond the direct control of Yukon governments. The natural gas scenario developed by Fekete (2006), and described above, is based on three major assumptions:

- **At least one pipeline, either the Mackenzie Valley or Alaska Highway, must be constructed within the next decade; the MVP is currently considered to be the most advanced project and is a cost effective transportation option for Eagle Plain natural gas;**
- **Excess capacity must exist in either pipeline to accept Eagle Plain natural gas; and,**
- **Eagle Plain natural gas must be accepted for delivery into either pipeline at reasonable toll rates**

None of these requirements are currently met, and due to a number of factors, the future status of both the Mackenzie Valley Gas Project and the Alaska Highway Pipeline Project remain uncertain.

Given this situation, significantly increasing levels of energy sector activity, specifically exploration for natural gas resources in Eagle Plain, is not expected to occur in the coming 3-5 years. Production is still at least a decade away. While industry interest in Eagle Plain has recently increased, the current work bid amounts posted for oil and gas permits awarded in 2007 (i.e., permit #s 005 – 017) are not sufficient to result in significant levels of exploration activity across the Eagle Plain basin. In order to begin focused exploration in advance, operators will require a clear signal on the regulatory and pipeline access issues (Fekete 2006).

Without access and potential toll agreements in place, confirmation that the Mackenzie Valley Pipeline will proceed may not be enough on its own to spur natural gas exploration in Eagle Plain. The natural gas scenario timelines described here (Eagle Plain gas flowing by 2025) may reflect an optimistic schedule of events.

Conservative Development Scenario

The natural gas scenario developed by Fekete (2006) is based upon assessments of a reasonable pipeline size and the volume of natural gas required to operate that pipeline at capacity. If exploration success rates prove better than assumed, or the flow rates for some wells are significantly higher than anticipated, operators would likely have excess natural gas they would want to transport to market.

Operators will have greater incentive to continue exploration if there is a possibility for pipeline capacity to be expanded. Operators want their on-going natural gas discoveries to be brought into production quickly, thereby increasing the rate of return on their investment. If this expectation cannot be met, investment dollars will likely be directed to more immediate prospects in the Mackenzie Delta, southern Canada or elsewhere in the world (Fekete 2006).

This situation highlights the relatively conservative nature of the Fekete (2006) natural gas scenario. The most recent resource assessment of Osadetz et al. (2005) suggests a mean expected volume of natural gas at Eagle Plain three times higher than that used in the Fekete scenario. If these 'optimistic' estimates prove correct through future exploration, and the technical and economic feasibility of recovering that petroleum resource is possible, it would be unrealistic to expect operators to not produce the total recoverable natural gas resource. Increased pipeline capacity would allow a larger production scenario to become possible. Under this scenario, higher levels of activity and infrastructure would be expected during the production cycle of Eagle Plain basin. This higher level of activity and production would most likely lead to higher levels of surface disturbance, employment, government revenues, and induced land use activity. The Eagle Plain natural gas play may also extend beyond the currently envisioned 20-years. In addition to discovered reserves, pipeline capacity can be considered a major factor that will regulate the pace and scale of any future Eagle Plain natural gas scenario.

4.1.2.5.2 Oil Scenario

The current estimated Eagle Plain basin oil resource is not considered sufficient to construct an oil pipeline from Eagle Plain to southern Yukon or NWT (Fekete 2006). Therefore, future potential oil development is anticipated to be of a smaller scale and may proceed separately from, and possibly in advance of, the natural gas scenario described above (see Section 4.1.2.5.1 above).

Given this situation, the oil scenario currently anticipated for Eagle Plain does not require the construction of a pipeline. One operator, Northern Cross (Yukon) Ltd., has proposed to begin producing existing oil wells on the Chance SDL-022 in Eagle Plain. Crude oil would initially be trucked to southern refineries until such time as the well productivity is established and justifies construction of a small on-site refinery at or near Eagle Plain. This refinery would be capable of processing 2,500 bbls/day, sufficient to meet current demand for refined petroleum products in Yukon.

Timing of Oil Scenario

Northern Cross (Yukon) Ltd. anticipates acquiring the necessary licenses and permits to carry out flow tests at Eagle Plain in the coming years. The construction timing of required access roads and production wells would be determined based on project economics and results of the flow tests. Possible construction of the Mackenzie Valley Gas Project is anticipated to play an important role in determining project economics, as the proposed oil production and refining may have the ability to supply a large proportion of diesel fuel requirements during construction of the MVP.

Required Exploration & Infrastructure

Oil supply to an Eagle Plain refinery could be met by approximately 10-20 wells (Fekete, 2006). Seismic and drilling procedures discussed above for the Eagle Plain natural gas scenario (see Section 4.1.2.5.1) are also applicable to oil. Seismic surveys conducted in support of identifying natural gas resources in Eagle Plain basin would also be used for identifying oil resources. Exploration drilling would identify both natural gas and oil pools. No additional exploration wells are required over those estimated for natural gas.

In order to truck oil from storage tanks at the individual well pads to an Eagle Plain refinery, it is currently anticipated that all season access roads would be required to each well pad. Refined products would be trucked southward along the Dempster Highway to mines and towns in southern Yukon. At this time, there are no foreseeable plans to build an oil or refined products pipeline.

Location of Activities

Similar to the Eagle Plain natural gas scenario described above (see Section 4.1.2.5.1), oil development in Eagle Plains is expected to be focused on the Chance Creek area in the vicinity of the Dempster Highway. The approximate location of the current area of interest for oil resources is shown above in Figure 4.1.2.5.1(c), represented by the green circle.

The exploration area and development locations would most likely be centered on the existing Chance Significant Discovery License (SDL-022; see Section 4.1.2.3 above for discussion), and over time would likely grow to cover a much smaller area than the infrastructure required for natural gas production and transport.

4.1.2.5.3 Other Basins

Old Crow Basin

The potential natural gas and oil reserves of Old Crow basin are not well understood (Hannigan, 2001). There is little, if any, oil potential in the basin (Hannigan, 2001). The majority of Old Crow basin is not available for natural gas and oil exploration due to existing Protected Area designations (see Section 2.4.1 for discussion). Given this land status, the basin is not anticipated to receive natural gas and oil exploration interest in the near future.

Kandik Basin

The Kandik Basin, due to its remoteness and limited exploration history, is not anticipated to receive significant levels of natural gas and oil exploration interest for at least 20-years, with the potential for production occurring many years after that date. Therefore, for the purposes of this natural gas and oil assessment, future potential activity in the Kandik Basin is not currently addressed but should be recognized as possible in the very long term.

Peel Plateau

While the Peel Plateau is not within the planning region, it warrants mention as an adjacent natural gas and oil basin. The Peel Plateau would require a longer pipeline to connect to NYGP; this pipeline would have to traverse difficult terrain with deeply incised valleys, and there is no existing all season road access. Given this limitation, Fekete (2006) anticipated the tie-in of Peel Plateau natural gas wells to a potential NYGP would occur more than 20-years after production of Eagle Plain natural gas begins. Given an estimated initial Eagle Plain production date of approximately 2025, Peel Plateau production may occur around 2040 - 2050. Exploration and construction of necessary infrastructure would occur well before this initial tie-in date.

If Peel Plateau natural gas is eventually developed, the Fort McPherson Plain, to the east of the Peel River, is anticipated to be the principal exploration and development area of interest (Figure 4.1.2.5.3(a)).

Yukon North Slope

Given the significant conservation interests and various Protected Area and interim land withdrawal designations within the Inuvialuit Settlement Region, development of potential on-shore natural gas and oil resources is not anticipated in the near future. Off-shore natural gas and oil interests associated with the Mackenzie Valley Gas Project are expected to remain the focus of activities along the Yukon North Slope, and are not anticipated to have a major impact on the development of Eagle Plain basin natural gas (beyond providing a potential resource for the MVP that may alter the timing of Eagle Plain development and production).

Arctic National Wildlife Refuge

The Arctic National Wildlife Refuge (ANWR) in Alaska borders a large portion of the western extent of the planning region. Potential exploration and development of natural gas and oil resources along the north slope of the Arctic National Wildlife Refuge has been a controversial topic for many years, specifically in the ‘1002 Lands’. The debate surrounding this potential activity is anticipated to continue for some time into the future.

For the purposes of the North Yukon Planning Region natural gas and oil resource assessment, the potential future development of ANWR petroleum resources is not anticipated to have a major impact on the timing or operations of the Eagle Plain natural gas scenario as described by Fekete (2006).

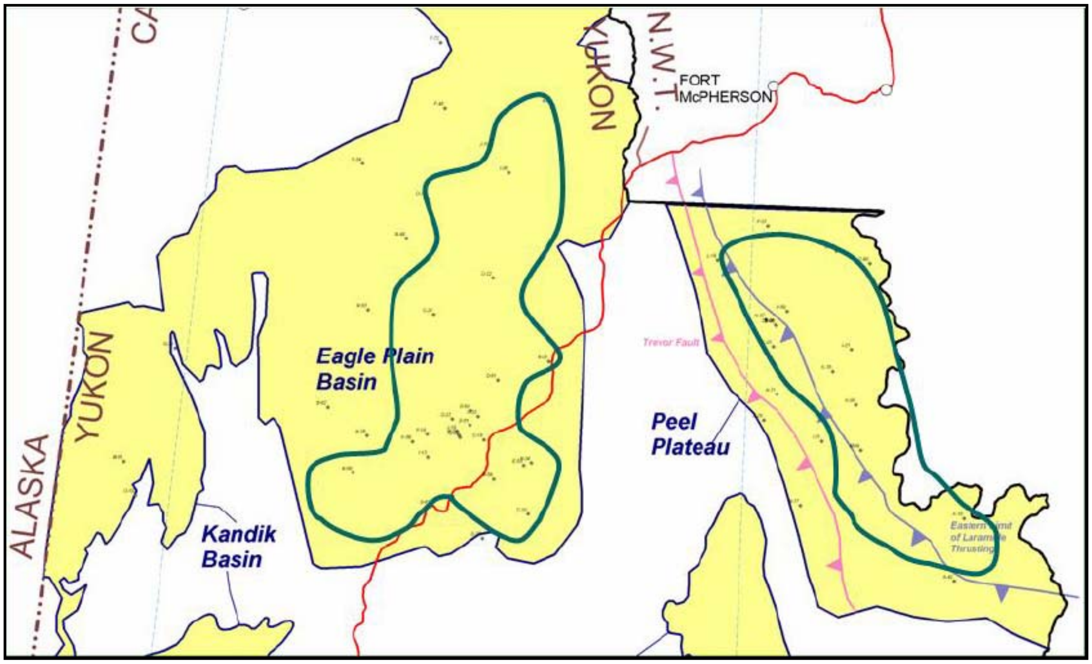

Figure 4.1.2.5.3(a). Projected fifty-year development pattern for Eagle Plain and Peel Plateau oil and gas basins, 2025-2075. The anticipated locations of activities are highlighted (green circles). Source: Figure 20, Fekete (2006).

4.1.2.6 Socio-economic Considerations

A complete socio-economic assessment of future potential energy sector activity in the region is beyond the scope of this report. Fekete (2006) provided estimates of potential employment and royalty levels for the natural gas and oil scenarios described here. Direct employment opportunities associated with the Eagle Plain natural gas and oil scenarios can be considered of three general types: 1) pipeline construction-related employment, 2) pipeline operations-related employment, and 3) ongoing exploration and production-related employment. The natural gas and oil scenarios each have different considerations.

Potential employment opportunities, royalties/revenues associated with energy sector activities, and possible impacts of energy sector activity on other land use activities are discussed in Section 4.4.

4.1.2.7 Ecological Considerations

The potential ecological impacts and environmental risks of natural gas and oil activity in northern Canada have been reviewed extensively (see Jalkotzy et al. 1997; AXYS 2001; Yukon Fish and Wildlife Management Board, 2002; Salmo Consulting et al. 2004;

Severson-Baker 2004; Yukon Energy, Mines and Resources, 2006). A detailed review of this literature is beyond the scope of this report.

Based on the potential Eagle Plain natural gas and oil scenario described here, important ecological and land use considerations specific to the region are discussed in Section 4.4.2.

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4.1.3 Mineral and Coal Resources

The mineral potential of a region describes the probability for the existence of undiscovered mineral deposits. Regional mineral potential maps are intended to be used in the regional land use planning process to identify areas of high mineral potential, areas with potentially high economic value due to the possible presence of metallic mineral resources. In the absence of high levels of exploration across large regions, such an approach is required. For the purposes of regional land use planning, the Yukon Government has made commitments to ensure that areas of high mineral potential remain open to exploration and development where options exist, and to carry out mineral resource assessments at regional and detailed scales to identify areas of high potential.

This section provides a description of existing mineral interests, regional mineral, coal and iron potential, future anticipated activity and potential considerations surrounding existing and future mineral exploration and development.

Key Findings

- See Appendix 1, Map 44 for a map of regional mineral potential. Appendix 1, Map 45 shows coal and iron potential.
- Mineral and coal exploration interest and activity in North Yukon Planning Region have historically been low, but are increasing. The region currently contains about 480 active quartz mineral claims, covering an area of 11,000 ha.
- Long-standing mineral claims are located to the west of Ni'iinlii'njik (Fishing Branch) Special Management Area, including the Rusty Springs and Alto properties. Recent quartz mineral claims have been staked in the vicinity of the Dempster Highway and Richardson Mountains.
- Relative to other areas of Yukon, the region has historically experienced lower levels of mineral exploration; understanding of regional mineral potential is therefore limited.
- Based on current information, the North Yukon Planning Region appears to host relatively lower mineral potential than other regions of Yukon. Three percent of the planning region contains ‘high’ mineral potential; eighty one percent of the region is considered to have ‘low’ or ‘very low’ potential.
- Some of the areas with highest mineral potential are located in the vicinity of Ni'iinlii'njik (Fishing Branch) SMA.
- Five percent of the region contains potential for coal deposits; one percent contains potential for iron.
- It is unlikely that coal would be pursued for large-scale production anywhere in the region. However, the possibility of coal deposits occurring in close proximity to Old Crow may represent a potential future energy source for the community.

- Given the existing situation in North Yukon Planning Region, the potential for a producing mine to be operating within the next 10-15 years is unlikely. Mine development will not likely be realized without additional transportation infrastructure.

Background

The level of direct mineral industry interest and activity in the North Yukon Planning Region is currently low, but is increasing. Relative to other areas of Yukon, the region has historically experienced low levels of mineral exploration. The region currently contains about 480 active quartz mineral claims; most were staked in 2007. The region has never hosted a producing mine. The recent increase in mineral exploration activity in adjacent areas of Yukon and NWT has also been realized in the North Yukon Planning Region, but to a lesser extent. Poorly understood geology, remoteness and the relative lack of road access have been identified as important factors contributing to the low level of mineral exploration; uncertainty regarding land status and land withdrawals associated with Inuvialuit, Tetlit Gwich'in and Vuntut Gwitchin land claim negotiations are also contributing factors.

In late 1960s and 1970s, the level of geological and mineral exploration activity in North Yukon Planning region was much higher than present. The Geological Survey of Canada conducted Operation Porcupine in the early 1960s, resulting in the currently available bedrock geology mapping for the area (Gordey and Makepeace 2003). Many of the original mineral occurrences were recorded (Deklerk and Traynor 2004) and existing mineral claims staked and investigated during this period (e.g. RUSTY SPRINGS and ALTO). Mineral exploration activity in the 1960s and 1970s was often associated with oil and gas exploration that was also taking place during that time (see Section 4.1.2). Similar to oil and gas exploration, the level of mineral exploration interest in North Yukon Planning Region decreased following the Mackenzie Valley Pipeline hearings and the Berger Inquiry (Berger 1977) of the 1970s.

4.1.3.1 Existing Mineral Interests

Approximately 480 active mineral claims, covering an area of 11,000 ha are registered in the North Yukon Planning Region (Appendix One – Map 44 and Table 4.1.3.1). These include the long standing RUSTY SPRINGS and ALTO properties to the west of Ni'iinlii'njik (Fishing Branch) Wilderness Preserve, and the recently staked FOX and RICH claim blocks in the southeastern portion of the region, in the vicinity of the Dempster Highway and Richardson Mountains. As of September 2007, an application to explore the SUN mineral claims, south of the FOX claim block, is pending. The NOR claims between Porcupine River and the southern boundary of Old Crow Flats SMA are not available for exploration due to the North Yukon Interim Land Withdrawal and VGFN R-block VG R-10A.

Until the staking of the FOX, RICH and SUN claims in 2007, the RUSTY SPRINGS and ALTO properties were the only claim areas actively investigated in the recent past. The ALTO iron deposit is the only currently recognized mineral deposit in the planning region.

Table 4.1.3.1 Existing Quartz Mineral Claims in North Yukon Planning Region (current as of September 2007).

Quartz Mineral Claims	Number of Claims	Area (ha)	Description
RUSTY SPRINGS	50	1,150	MINFILE 116K 003. Stratabound lead, silver, copper zinc drilled prospect. Eagle Plains Resources Ltd.
ALTO (Trog)	2	46	MINFILE 116K 005. SEDEX iron deposit with estimated 45 million tonnes iron reserve averaging 55% Fe. Eagle Plains Resources Ltd.
FOX	188	4,324	MINFILE 116I 069. Barium veins noted in area. Archer Cathro and Associates Ltd.
RICH	191	4,393	No MINFILE. Archer Cathro and Associates Ltd.
SUN	40	920	MINFILE 116I 070. Barium veins noted in area. Shawn Ryan (pending)
NOR	8	163	MINFILE 1160 057. Porphyry fluorite showing. Exploration discontinued following land withdrawals (North Yukon Interim Land Withdrawal (OIC 2005/53) and VG R-10A). Archer Cathro and Associates Ltd.
Total	479	10,996	Total of 479 Quartz Mineral claims, 400 recently staked and located around Dempster Highway and Southern Richardson Mountains. Existing mineral claims cover 0.20% of region.

4.1.3.2 Mineral and Coal Resource Assessment

The mineral potential of a region describes the probability for the existence of undiscovered mineral deposits. In support of the North Yukon regional land use planning exercise, the Yukon Geological Survey completed a regional mineral potential assessment in 2004-2005. This work built on earlier mineral assessments conducted in support of the Yukon Protected Areas Strategy (1999) and Norris (1997). The 2004 mineral resource assessment area was approximately 93,000 km^2 in size and covered the entire northern Yukon including the Yukon North Slope, the Vuntut Gwitchin First Nation Traditional Territory and a portion of the southern Richardson Mountains. The entire North Yukon Planning Region was included in the updated mineral assessment. Bradshaw (2005) provides the primary reference for the regional mineral resource assessment. Regional geology of the North Yukon Planning Region is described in *Section 2.6.1 – Physical Environment*.

4.1.3.2.1 Methods

Minerals

The concept of a 'mineral deposit model' is central to the methods used in the assessment of potential mineral resources in areas with limited exploration. Mineral deposit models describe the essential geological characteristics, including quantitative estimates of grades and tonnages, of groups of similar mineral deposit types (Cox and Singer 1986). Defining mineral deposit types allows the extrapolation of known mineral deposit characteristics to areas with similar geology to assess the probability of a similar mineral deposit type occurring in a different area. Fonseca and Bradshaw (2005) have correlated a number of different mineral deposit types for Yukon with British Columbia Geological Survey and United States Geological Survey mineral deposit types. Based on the regional geology conditions, 21 different mineral deposit types were examined in the North Yukon mineral assessment area (Bradshaw 2005 – Appendix Two).

Detailed methods are described in Bradshaw (2005). Briefly, the 'Tongass" quantitative method for prediction of undiscovered mineral deposits, developed by the U.S. Geological Survey, was used for this project. Quantitative mineral assessments involve statistical analyses to assist in the determination of the potential for specific geographic areas with similar geology to host undiscovered mineral deposits. The method is based on conceptual mineral deposit models (Cox and Singer 1986) that describe essential characteristics, including quantitative estimates of grades and tonnages, for groups of similar deposits. The British Columbia Geological Survey defined mineral deposit models applicable to the geological and metallogenic setting of the Canadian Cordillera (Lefebure and Ray 1995; Lefebure and Höy 1996). These grade and tonnage mineral deposit models were further modified to incorporate Yukon deposits (Fonseca and Bradshaw 2005). The 'Tongass' method is considered appropriate for frontier lands, where vast tracts of land lack detailed geological characterization and may contain a variety of mineralization styles, and is also considered to yield the most reproducible results.

Three major data sources were used as inputs to the North Yukon regional mineral assessment: 1) 1:250,000 scale Yukon Digital Geology compilation (Gordey and Makepeace 2003), 2) regional stream geochemistry (Héon 2003) and 3) Yukon MINFILE occurrences (Deklerk and Traynor 2004). Airborne geophysical data were available for the entire assessment region (Lowe et al. 1999) but due to the wide line spacing at which the data was collected, were found to be of limited utility for the purposes of the regional mineral assessment.

The mineral assessment area was stratified into 91 geographic areas (tracts) of approximately equal size. Tracts were selected based on similar rock types and settings and each was approximately 1,000 km^2 in size. Tract boundaries follow faults, intrusive contacts, lithological contacts, or limits of extensive Quaternary sediment cover. The North Yukon Planning Region contains portions of or entire units of approximately 73 assessment tracts.

Through the input of an expert mineral exploration panel workshop held in February 2004, and the application of relevant statistical procedures to those results (Bradshaw 2005), each tract was assigned a relative ranking of higher to lower mineral potential based on a four class scale (Table 4.1.3.2.2(a)). Natural breaks were not well defined in the data; therefore class breaks for the four mineral potential rank classes were determined based on rank intervals with an equal number of tracts in each rank class. Bradshaw (2005 - Appendix Six) contains a detailed listing of the tract numbers and their relative mineral ranks. The relative ranking for each tract considers not only the potential for the occurrence of a mineral deposit but also the economic value of each deposit type based on the minerals (commodities) present within that deposit type.

Coal and Iron

Methods used to identify potential coal and iron resources were different than those utilized for the metallic mineral assessment described in the previous section. Detailed methods are described in Bradshaw (2005). Potential coal resources were identified in the following manner. All MINFILE (Deklerk and Traynor 2004) occurrences with coal showings were buffered by 30km and intersected with regional geology maps (Gordey and Makepeace 2003) using GIS to identify regional geology rock units with potential coal occurrences. Some coal occurrences were known but were not included in MINFILE records, and they were also included in the intersect procedure. The resulting map layer contained regional geology units considered to have potential for coal deposits.

The iron resource assessment was performed using the following methods (Bradshaw 2005). Similar to the other metallic minerals, two deposit models were initially constructed for iron deposits, ‘Alto-type ironstone’ and ‘Rapid-type iron formation’. As the economics of exploiting iron resources are more similar to those that govern the mining of industrial minerals (e.g., asbestos and potash) than those that govern the extraction of other metals, the assessment team considered it more accurate to represent iron separately from other metallic minerals. In a similar manner as coal, MINFILE (Deklerk and Traynor 2004) occurrences with ‘Rapid-type iron formation deposits’ were buffered by 30km and intersected with specific rock units from regional geology maps (Gordey and Makepeace 2003) known to host these deposit types. For ‘Alto-type ironstone’ deposits, the ‘Alto’ MINFILE occurrence (116K 005) was buffered by 30km and intersected with the regional geology unit that hosts the Alto deposit. The resulting map layer contained regional geology units considered to have potential for iron deposits.

4.1.3.2.2 Results

Minerals

Results of the North Yukon mineral potential assessment, with focus on the North Yukon Planning Region, are displayed in Appendix 1, Map 44 and in Table 4.1.3.2.2(a), below. Table 4.1.3.2.2(b) provides an area summary of the different relative mineral potential class ranks occurring within the North Yukon Planning Region.

Based on existing information, the North Yukon Planning Region is currently considered to have relatively lower mineral potential than other areas of Yukon. Approximately 20% of the region has moderate-high potential (3% considered highest) for the 39 metallic minerals assessed (Table 4.1.3.2.2(b)). Due to the geological setting, a large portion of the planning region, approximately 45%, is considered to have very low or no mineral potential. Twenty-eight assessment tracts were considered by the estimator workshop participants to have no mineral potential for any current deposit model. These tracts are displayed on Appendix One, Map 44 in very light grey and occur primarily in the Eagle Plains, Old Crow Flats and Bell River-Richardson Mountains areas. The remaining tracts, 35% of the planning region, have potential for at least one type of mineral deposit model, with some tracts having potential for up to eight different deposit models (Table 4.1.3.2.2(a)).

Many of the high potential tracts occur in the southwest and western portions of the assessment area/planning region in the vicinity of the Ni'iinlii'njik (Fishing Branch) Special Management Area and the community of Old Crow. Near Fishing Branch, this portion of the Oglivie Mountains is underlain predominantly by Devonian and Carboniferous shales and carbonates of the Ettrain, Hart River, Road River, Gossage and Bouvette Formations and has potential for SEDEX, Nick and MVT type deposits. Several MVT occurrences are present in the region (Table 4.1.3.2.2(a)). Near Old Crow, many of the rocks are composed of the Old Crow Batholith and Proterozoic rocks of the Pinguicula Group and have potential for a variety of intrusive-related deposits.

High potential tracts in the southeast part of the planning region (tracts 26, 39 and 40) are considered to have good potential for Nick and SEDEX type deposits hosted by the Road River Formation and MVT deposits hosted by the Hart River Formation.

Table 4.1.3.2.2(a). Summary of mineral potential assessment results for geological tracts occurring within North Yukon Planning Region, and relevant deposit models assessed for each tract.

Relative Mineral Potential [2]	Tract	Rank [1]	Deposit Models Evaluated
HIGHEST	**75**	2	Cu-skarn, MVT, Plutonic Au, Sandstone U, SEDEX, Stratiform Ba, W-Mo porphyry, W-skarn
	13	3	MVT, Nick, Polymetallic vein, SEDEX, Stratiform Ba, Wernecke breccia
	6	4	MVT, Nick, Polymetallic vein, SEDEX, Stratiform Ba, Wernecke breccia
	8	5	MVT, Nick, SEDEX, Stratiform Ba
	7	6	MVT, Nick, Stratiform Ba, SEDEX
	40	7	MVT, Nick, Polymetallic vein, SEDEX, Stratiform Ba, Vein Ba
	26	9	Nick, SEDEX, Stratiform Ba
	9	10	MVT, Nick, Polymetallic vein, SEDEX, Stratiform Ba
	25	11	Nick, SEDEX, Stratiform Ba, Polymetallic vein
	39	12	MVT, Nick, Polymetallic vein, SEDEX, Stratiform Ba, Vein Ba
	16	15	MVT, Polymetallic vein, SEDEX, Stratiform Ba
	73	17	MVT, Polymetallic vein, SEDEX
	53	19	Cu-skarn, Polymetallic vein, Plutonic Au, Sn greisen, U-porphyry, W-Mo porphyry, W-skarn
	51	20	Cu-skarn, Polymetallic vein, Plutonic Au, Sn greisen, U-vein, W-Mo porphyry, W-skarn
MODERATE	**52**	21	Cu-skarn, Polymetallic vein, Plutonic Au, Sn greisen, W-Mo porphyry, W-skarn
	54	23	Cu-skarn, Polymetallic vein, Plutonic Au, U-vein, W-Mo porphyry, W-skarn
	4	25	Carlin, MVT, Polymetallic manto, Polymetallic vein
	62	26	Nick, Polymetallic vein
	47	27	MVT, Polymetallic vein, VMS Cyprus-Bresshi, Wernecke breccia
	46	28	MVT, Polymetallic vein, VMS Cyprus-Bresshi, Wernecke breccia
	49	30	MVT, Wernecke breccia
	56	31	MVT, Polymetallic vein, Plutonic Au
	50	32	MVT, Wernecke breccia
	68	34	MVT, Polymetallic vein
	60	35	MVT, Polymetallic vein
	90	36	MVT, Polymetallic vein
	14	37	MVT
	91	38	MVT, Polymetallic vein
	89	39	MVT, Polymetallic vein
	48	40	MVT

[1] Rank – relative mineral tract rank (1 = highest) with respect to entire North Yukon mineral assessment area as reported in *Appendix 6* of Bradshaw (2005).
[2] Relative Mineral Potential – colour corresponds to mineral potential legend of Map 44 (Appendix 1).

Table 4.1.3.2.2(a) (cont'd). Summary of mineral potential assessment results for geological tracts occurring within North Yukon Planning Region and relevant deposit models assessed for each tract.

Relative Mineral Potential [2]	Tract	Rank [1]	Deposit Models Evaluated
LOW	**15**	41	MVT
	88	43	MVT, Polymetallic vein
	11	44	Polymetallic vein, Polymetallic manto
	12	45	Polymetallic vein, Polymetallic manto
	61	46	Epithermal Au low-S
	43	47	Vein Ba
	71	48	Polymetallic vein
	37	50	Vein Ba
	77	51	Polymetallic vein
	23	53	Polymetallic vein
	66	54	Polymetallic vein
	76	56	Polymetallic vein
	41	57	Polymetallic vein
	36	58	Vein Ba
	63	59	Polymetallic vein
LOWEST	**10, 17**	N/A	no applicable deposit model
	18, 19	N/A	no applicable deposit model
	20, 21	N/A	no applicable deposit model
	22, 24	N/A	no applicable deposit model
	28, 29	N/A	no applicable deposit model
	30, 31	N/A	no applicable deposit model
	32, 33	N/A	no applicable deposit model
	34, 35	N/A	no applicable deposit model
	38, 55	N/A	no applicable deposit model
	57, 58	N/A	no applicable deposit model
	59, 64	N/A	no applicable deposit model
	65, 67	N/A	no applicable deposit model
	69, 70	N/A	no applicable deposit model
	72, 74	N/A	no applicable deposit model

[1] Rank – relative mineral tract rank (1 = highest) with respect to entire North Yukon mineral assessment area as reported in *Appendix 6* of Bradshaw (2005).
[2] Relative Mineral Potential – colour corresponds to mineral potential legend of Appendix One - Map 44.

Table 4.1.3.2.2(b). Area summary of mineral potential class ranks for North Yukon Planning Region.

Relative Mineral Potential [1]	Area (km^2)	Area (% Planning Region)
HIGHEST	1,539.2	2.8
MODERATE	9,224.7	16.6
LOW	19,787.0	35.6
LOWEST	25,017.0	45.0

[1] Relative Mineral Potential – colour corresponds to mineral potential legend of Appendix One - Map 44

Mineral assessment tracts of particular interest in the North Yukon Planning Region include tracts 75, 6, 13 and 8 (Appendix 1, Map 44). Tract 75, located in the Barn Mountains, contains high potential for a variety of deposit models including intrusive deposits associated with the Fitton and Hoidahl stocks, which contain molybdenum and tungsten mineralization on surface. Tract 75 also has potential for MVT and SEDEX deposits hosted in the Road River Formation. The majority of tract 75 occurs within Old Crow Flats SMA or the Inuvialuit Settlement Region, and is withdrawn from staking as per the North Yukon Interim Land Withdrawal. Tracts 6 and 13 to the south and west of the Ni'iinlii'njik (Fishing Branch) SMA contain Proterozoic rocks of the Quartet Group with the potential to host Wernecke breccia type deposits. Tract 8 is located to the immediate west of Ni'iinlii'njik (Fishing Branch) HPA and contains potential for MVT and SEDEX deposits.

Tract 39 in the Southern Richardson Mountains is one of the highest ranking mineral tracts in the planning region. Tract 39 recently received a significant amount of exploration interest. The FOX, RICH and SUN quartz mineral claims were all staked in this tract in 2007.

It is notable that tracts 46-50 and 52-54 in the vicinity of the Keele Range (Bluefish River) and Old Crow Range (Caribou Bar Creek) did not fall into the highest mineral potential category, possibly because these rocks are poorly understood. Stream geochemistry data was unavailable for this area at the time of the assessment (Figure 4.1.3.4(a)). Proterozoic, Devonian and Carboniferous rocks in this area have potential for Wernecke breccia, MVT and several different types of intrusive related deposits (Table 4.1.3.2.2(a)).

Coal and Iron

Appendix 1, Map 45 shows the location of regional geology units with coal and iron potential. Approximately five percent of the North Yukon Planning Region is considered to have potential for coal deposits, located in four general areas: 1) Northern Richardson Mountains-Upper Driftwood River, 2) Old Crow Flats, 3) Upper Bluefish River-Lone Mountain area, and 4) Old Crow-Bluefish Wetlands.

Coal occurrences have been noted in the vicinity of Bluefish River-Lone Mountain (Map 44 - mineral occurrence 116N 077), and in the vicinity of Old Crow along the Porcupine River (approximately 10km upstream from Porcupine-Old Crow River confluence, near Klo-Kut; Map 44 - mineral occurrence 116O 014).

Approximately one percent of the planning region is considered to have potential for iron deposits, located in two general areas: 1) immediately west of Ni'iinlii'njik (Fishing Branch) SMA, in the vicinity of the RUSTY SPRINGS and ALTO properties, and 2) in the Northern Richardson Mountains-Bell River area. The ALTO iron deposit is the only recorded mineral deposit in the Planning Region.

4.1.3.3 Future Anticipated Activity

4.1.3.3.1 Short-Term Outlook

Direct mineral exploration interest in the North Yukon Planning Region has historically been low, but is increasing. Similar to the Wernecke Mountains in the Peel River watershed, the Richardson Mountains in the North Yukon Planning Region have experienced some recent increase in mineral exploration interest and activity. In 2007, active exploration programs were being conducted on the FOX and RICH claims. Exploration in this area is expected to continue. Eagle Plains Resources Ltd., owners of the RUSTY SPRINGS and ALTO properties to the west of Ni'iinlii'njik (Fishing Branch) SMA, has no immediate plans to perform future additional work on these properties.

4.1.3.3.2 Longer-Term Outlook

Predicting the specific location, scale and timing of longer-term, future mineral and coal-related exploration and development activities in the North Yukon Planning Region is currently very difficult. However, consideration of important factors influencing mineral development can assist in formulating plausible scenarios for North Yukon. Mineral development depends on several important factors including: 1) mineral resources, 2) infrastructure, and 3) metal prices and technology.

Mineral Resources

Mineral development depends on the presence of an adequate mineral resource. Mineral resources are the product of unique, localized geological conditions – the mineral deposit must exist and be of adequate size and grade given current technology and commodity price to produce and transport the mineral in a cost-effective manner. Finding an adequate mineral deposit typically requires a large amount of focused exploration effort. Historically, the ratio of mineral discoveries to the establishment of a producing mine in Yukon is about 240:1 (Grant Abbott, Yukon Geological Survey, personal communication, 2006). Our current understanding of the geology and mineral potential of North Yukon Planning Region suggests it hosts relatively lower mineral potential than other areas of Yukon. Given this, the Yukon Geological Survey currently considers the ratio of discovery to establishment to be substantially higher at about 500:1. The level of mineral exploration must increase dramatically if any potential mineral deposits are to be located, assessed and brought into production.

Infrastructure

Beyond the Dempster Highway, road or rail transportation infrastructure is not currently present. Such transportation infrastructure would likely be required to transport potential mineral commodities to market. This is especially true given the nature of the potential mineral deposit types expected to occur in the region. As discussed by Bradshaw (2005), important mineral deposit types considered relevant to the geology of the region include the Mississipi Valley Type (MVT), Sedimentary Associated Deposits (SEDEX) and iron deposit models. These types of mineral deposits typically host ‘large volume, low value’ commodities (e.g., lead, zinc, iron). Transportation costs for a remote location like North Yukon would potentially be prohibitive for such commodities, even with additional road infrastructure. Current rail and port access transportation concepts for Yukon do not anticipate a rail line running through or in close proximity to the North Yukon Planning Region in the coming decades (ALCAN RaiLink Inc. 2007 – see Section 4.1.7.3). It is fully recognized that mineral exploration does not depend on all season road infrastructure.

Metal Prices and Technology

As described by Gartner Lee Ltd. (2006), once a mineral resource is established, the successful development of a mine relies primarily on three factors – infrastructure, metal prices and technology. Transportation and power infrastructure have been discussed above. Metal prices and technology are not factors that can be controlled locally – they rely on global market trends and many other factors. Mining technology changes and improves over time, allowing for the development of deposits that were historically sub-economic. Metal prices and technology are not currently considered to be the major barriers affecting future mineral exploration activity in North Yukon Planning Region.

All of these factors – mineral resources, infrastructure, and metal prices and technology – must converge to bring a potential mineral deposit into production. Given the existing situation in North Yukon Planning Region, the potential for a producing mine to be operating within the next 10-15 years is very remote.

4.1.3.3.3 Location of Future Potential Activities

Regardless of the timing of such activities, based on the results of the North Yukon mineral potential assessment reported by Bradshaw (2005), future mineral exploration activities will most likely focus on two general areas: 1) the Ogilvie Mountains in the vicinity of Ni’iinlii’njik (Fishing Branch) SMA, and 2) the Southern Richardson

Mountains. Areas around the community of Old Crow may also be of interest, but this area is very remote.

It is unlikely that coal would be pursued for large-scale production anywhere in the region. The possibility of coal deposits occurring in close proximity to Old Crow may represent a potential future energy source for the community. As the presence of coal deposits within the region are not yet confirmed, coal bed methane potential cannot be assessed.

4.1.3.4 Discussion

4.1.3.4.1 North Yukon Mineral Potential Mapping – Uses and Considerations

The mineral potential of a region describes the probability for the existence of undiscovered mineral deposits. Mineral potential mapping does not describe the economic feasibility of a mine actually being developed. The North Yukon Planning Region mineral potential map is based on the current state of knowledge of mineral deposits, and is dependent upon the availability and quality of geoscience data and mineral exploration history. The North Yukon mineral potential map should be re-evaluated when there is a significant advance in the geology and mineral deposit types.

Specific considerations regarding the current mineral and coal and iron potential maps (Appendix 1 – Maps 44 and 45) for North Yukon Planning Region include the following:

- The 1:250,000 scale Yukon Digital Geology compilation (Gordey and Makepeace 2003) was used as the base geological map for the assessment area. The digital geology compilation is composed almost entirely from 1:250,000 scale geology maps produced by the Geological Survey of Canada during Operation Porcupine from 1961-63. Geological maps of the North Yukon assessment area are considered adequate at the 1:250,000 scale.

- Regional stream geochemistry is an important input to the mineral assessment process. For the North Yukon mineral assessment, 39 mineral elements were examined. At the time of this assessment, regional stream geochemistry information (Héon 2003) was unavailable for approximately half of the North Yukon Planning Region (Figure 4.1.3.4(a)). It is notable that the western portion of the planning region lacked geochemistry data. In 2006 new stream geochemistry surveys were completed for remaining portions of the planning region, including the western area.

- Yukon MINFILE occurrences (Deklerk and Traynor 2004) describe the location of documented mineral occurrences, and contain information on the deposit model classification, mineralization and alteration, and the most significant sampling results. Mineral occurrence records (MINFILE, Deklerk and Traynor

2004) are an important 'driver' of the mineral assessment procedure described by Bradshaw (2005), as they represent the 'field check' for the assessment geologists. Due to the very limited amount of exploration that has occurred in the planning region, only 35 MINFILE (Deklerk and Traynor 2004) locations are within or immediately adjacent to the planning region boundary. Bradshaw (2005 - *Appendix One*) lists the MINFILE records within the North Yukon regional mineral assessment area. In contrast, the Peel Watershed Planning Region contains 219 mineral occurrence records (Gartner Lee Ltd. 2006).

- The potential for non-metallic (e.g., gemstones) or industrial minerals (e.g., jade and asbestos) was not evaluated as part of the North Yukon regional mineral assessment. The potential for placer deposits was also not evaluated. The assessment procedure used for coal and iron was less rigorous than that performed for other metallic minerals.

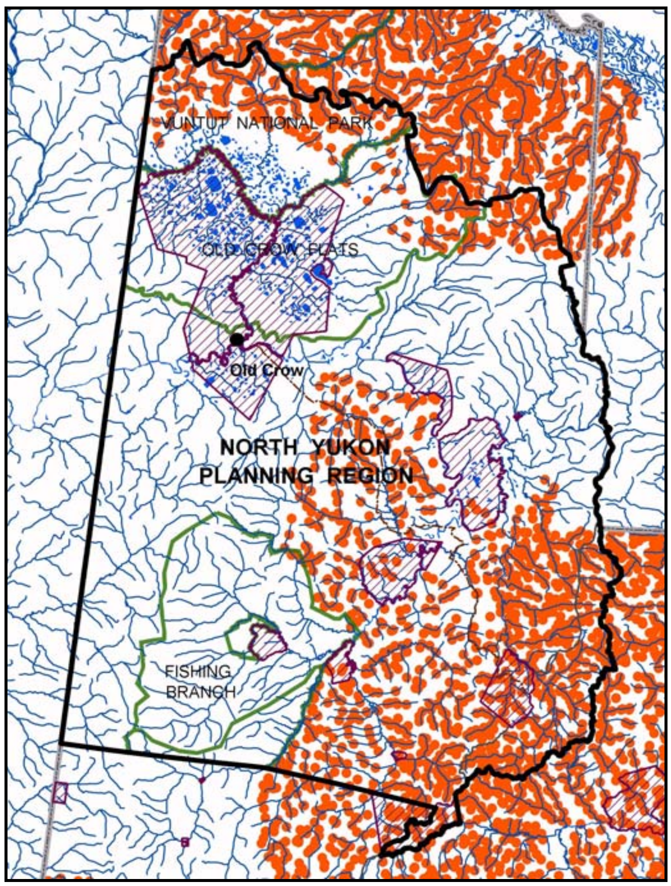

Figure 4.1.3.4(a). Regional stream geochemistry sample locations (red dots) utilized for North Yukon mineral resource assessment. At the time of this mineral assessment, stream geochemistry was not available for approximately 50% of the region, with the notable absence in the western and northeastern portions of the assessment area. Source: Héon (2003).

4.1.3.4.2 Land Withdrawals

Approximately 32% of the North Yukon Planning Region is under Protected Area status. Lands north of the Porcupine River, representing an additional 12% of the region, are affected by the North Yukon Interim Land Withdrawal (Appendix 1, Map 2 and Section 2.4). With these current land designations, 42% of the region is not available for potential mineral exploration and staking activity. Based on the existing mineral potential assessment and mapping (Appendix 1, Map 44), the North Yukon Interim Land Withdrawal affects prospective mineral resource potential in the following areas:

- Old Crow Range – Porcupine River (Mineral Assessment Tracts 51 and 52)
- Driftwood River (Mineral Assessment Tract 73)

The North Yukon Interim Land Withdrawal affects potential coal and iron resources in the following areas:

- Northern Richardson Mountains-Upper Driftwood-Bell River
- Community of Old Crow-Porcupine River

Mineral assessment tracts 13, 6 and 8 have been noted as of particular interest for high mineral potential (Section 4.1.3.2.2), and are not currently affected by either Protected or interim land withdrawal designations. As stated in Section 4.1.3.3.3, it is unlikely that coal would be exploited as a major economic commodity anywhere in the region.

4.1.3.4.3 Deposit Types and Future Mineral Scenarios

Considering the geology and known mineral occurrences in the North Yukon Planning Region, the mineral potential mapping reported by Bradshaw (2005) considered Mississipi Valley Type (MVT), Sedimentary Associated Deposits (SEDEX), and Wernecke Breccia deposit types to be some of the most important potential deposit mineral deposits in the region. The majority of high-ranking mineral tracks were based on this consideration (Table 4.1.3.2.2(a)). Some areas were also considered prospective for iron resources. The ALTO deposit near Fishing Branch, a SEDEX type deposit, contains an estimated 45 million tonnes low-grade ore reserve (MINFILE 116K 005; Deklerk and Traynor 2004).

As discussed in Section 4.1.3.3.2, the MVT and SEDEX deposit types typically host ‘large volume, low value’ commodities such as lead, zinc and iron. Transportation costs associated with such mineral commodities in a remote location like North Yukon would potentially be prohibitive, and would likely depend on rail transportation. Given this situation, an MVT or SEDEX lead, zinc or iron mineral resource that could potentially be brought into production at some point in the future would require a very significant mineral deposit with access to necessary rail transportation infrastructure.

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4.1.4 Aggregate Resources (Sand, Gravel, and Crushed Rock)

This section summarizes aggregate (sand, gravel, and crushed rock) reserves and resource potential, existing sources of aggregate material, future potential aggregate requirements, and potential socio-economic and ecological considerations regarding aggregate extraction and use[1].

Aggregate resources are critical for the development of transportation, municipal and industrial infrastructure in northern areas with permafrost. Gravel mining is a major activity associated with these land uses. The location and amount of aggregate materials in the region is currently not well identified. Gaining a better understanding of granular resources and industrial needs for such resources should be viewed as a regional priority.

Key Findings

- See Appendix 1, Map 49 for locations of current aggregate quarries
- Aggregate (sand, gravel and crushed rock) is a critical resource needed to support the development of transportation, municipal and industrial infrastructure in northern permafrost landscapes
- Suitable sources of aggregate are considered to be relatively scarce in the region. Based on existing information, major sources of potential aggregate are: 1) high terraces above rivers, 2) exposed ridges and bedrock, and 3) dry river/creek beds
- Existing gravel pits service the needs for Dempster Highway corridor maintenance and the community of Old Crow. With the exception of these areas, granular resources are not well identified.
- Obtaining adequate supplies of aggregate to support potential future development may require significant areas of land to be disturbed
- Identifying suitable sources of aggregate and understanding gravel requirements of potential industrial land use activities in advance of development should be viewed as a regional priority

Background

Aggregate (sand, gravel and crushed rock) is a critical resource required to support the development of transportation, municipal and industrial infrastructure in northern permafrost landscapes. The North Yukon Planning Region is underlain by continuous or discontinuous permafrost (see Section 2.6.1.5), and gravel or crushed rock is required for all-season road and building pad construction.

[1] Note: aggregate is also known as granular material

Outside of the Dempster Highway and Old Crow area – locations where there is a current demand for gravel – potential sources of aggregate resources are not well documented. While potential sources are not well documented, suitable aggregate materials required for infrastructure use in the region are generally considered to be scarce. The region remained unglaciated during the last ice ages, and large gravel deposits typically associated with melting glaciers and flowing water are generally absent. Most accessible deposits are found within modern river valleys, either as active floodplain deposits or on terraces adjacent to rivers. Where bedrock geology permits, crushed rock is also an option to produce aggregate, but can be a costly alternative.

Gravel requirements for the entire planning region are currently estimated at 50,000 m^3 per year[2]. The region has 28 gravel permits covering an area of approximately 380 ha (see Appendix One, Map 49). Approximately half of the total permit areas are actively quarried for gravel resources. The average gravel permit size is 13 ha. Twenty-seven of the 28 gravel pits service the Dempster Highway and are located within 1 km of the road corridor.

In 2004, the community of Old Crow developed an aggregate quarry on Crow Mountain to service community needs; this is the only active quarry outside of the Dempster highway. The Crow Mountain quarry deposit at Old Crow recently produced approximately 150,000 m^3 of aggregate materials for river bank stabilization, airport re-surfacing and various road and building pad requirements. Approximately 30,000 m^3 of processed aggregate has been stockpiled for future use.

Identifying aggregate resources, and understanding gravel requirements for activities prior to future potential land uses occurring should be viewed as a regional priority. The demand for such materials can be substantial. Estimated aggregate requirements for different industrial and transportation features are listed in Table 4.1.4(a). An important assumption behind these gravel requirements is that a depth of 1.5-2.0 metres of aggregate is <u>generally required</u> to provide adequate cover and insulation to prevent permafrost degradation.

[2] Based on a requirement of 40,000m^3/year for Dempster Highway annual surfacing and maintenance (~100m^3/km) and ongoing upgrades, with remainder for annual Old Crow use

Table 4.1.4(a). Typical aggregate resource requirements for construction of different infrastructure feature types in continuous permafrost environments, such as the North Yukon region.

Feature Type	Typical Aggregate Resource Requirement	Source
Major Road (e.g. Dempster Highway)	20,000 m^3 / km	Yukon Government, Transportation and Engineering Branch
Minor (Access) Road (e.g. Crow Mountain Quarry)	10,000 m^3 / km	Yukon Government, Transportation and Engineering Branch
2.5 ha oil or gas well pad	50,000 m^3 / pad	Based on assumption of required ~2m gravel pad
Major Natural Gas Pipeline (buried)	7,500 m^3 / km	Mahnic and Fujino (1993) – Granular Resource Requirements for Proposed Mackenzie Valley Pipelines

An overview of aggregate resource reserves and resource potential is provided below.

Available Information

Given the current low levels of land use, a comprehensive aggregate resource assessment has not been conducted for the region. Norris and Hughes (1997) provide general comment on the location and distribution of major granular resources of northern Yukon.

Information is available for the Dempster Highway corridor and Old Crow area. Aggregate resource assessments have been completed for the Dempster highway (e.g. EBA, 1990a and b). For the highway corridor, the mapping of Thomas and Rampton (1982a, b, c) provides a reference to identify potential aggregate materials. Duk-Rodkin and Hughes (1992) provide regional surficial geology mapping for a broad area including Eagle Plain and the southern Richardson Mountains. Old Crow recently completed a major granular resource planning (e.g. Visa Tek Ltd., 2001) and production exercise.

4.1.4.1 Dempster Highway and Area Aggregate Resources

The high terraces along the major rivers in the Dempster highway area, primarily the Eagle, Bell, Whitestone, and Porcupine rivers, are a source of potential aggregate resources. Many of these rivers deposited sediments and gravels as large amounts of glacial melt water flowed from melting ice sheets or ice-dammed lakes in adjacent areas of the Peel Watershed and Ogilvie Mountains (see Section 2.6.1.2). Over time, as the rivers down cut through the sediments, these deposits formed high terraces above the active river channels.

Figure 4.1.4.1(a) shows an example of a high terrace on the Eagle River, close to where the river crosses the Dempster highway (source: Map 10 – Moose Lake, Thomas and Rampton 1982b). These terraces are present along portions of the Eagle, Bell, Whitestone and Ogilvie Rivers (Thomas and Rampton 1982a, b, c). Figure 4.1.4.1(b) shows an aerial photograph of the terrace identified in Figure 4.1.4.1(a).

Figure 4.1.4.1(c) is a typical gravel deposit found at a specific location along the terraces in the Eagle River area. The gravel deposits here are generally found with various other materials and are expected to be relatively shallow (1-2 m depth of gravel). Most terraces have not been investigated due to the remoteness of the locations. Potential estimates of aggregate associated with the deposits are currently unavailable.

Near the Dempster highway, crushed aggregate has been used extensively for road surfacing material on the highway. Figure 4.1.4.1(d) shows the location of a potential crushed aggregate source along an exposed hill crest in central Eagle Plains. Similar materials have been quarried along the length of the highway as it passes through the Eagle Plain region (Figure 4.1.41(e)).

Another potentially large source of aggregate material is from tributaries that flow occasionally into the major rivers (see Section 2.6.1.4). Figure 4.1.4.1(f) shows an example of such an area in a tributary of the Eagle River.

Direct extraction of aggregate from the active channels of major rivers is not considered to be an acceptable or viable option at present, given the practical constraints of doing so and the potential impacts such activities would have on fish and/or wildlife habitat.

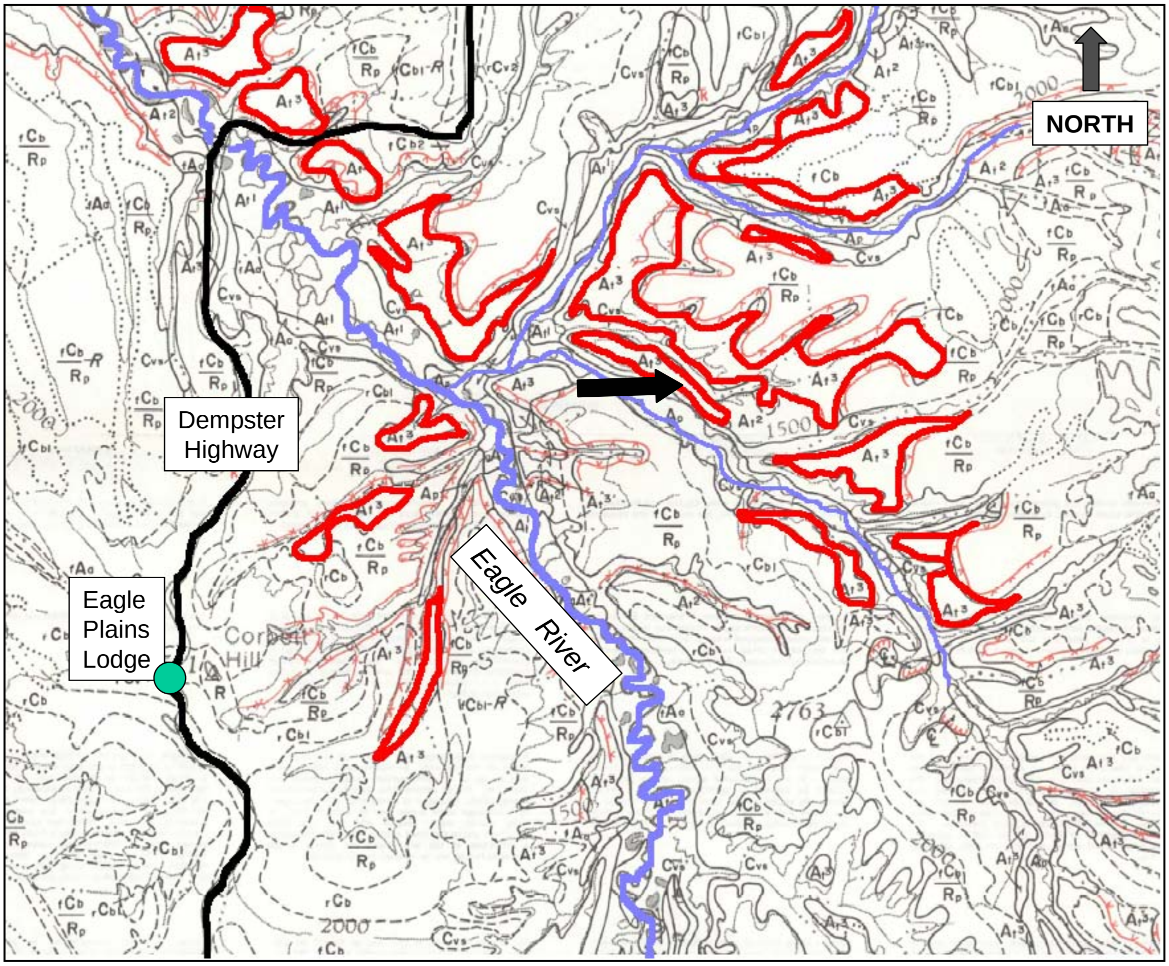

Figure 4.1.4.1(a). Location of major terraces (At3 - red areas) in vicinity of Eagle River and Dempster Highway crossing. Adapted from: Map 10, Moose Lake. Thomas and Rampton (1982b). Photo location of Figure 4.1.4.1(b) shown with arrow.

Figure 4.1.4.1(b). Potential sources of aggregate on high terraces of a tributary to the Eagle River near the Dempster Highway. Active floodplain gravel deposits are visible in the foreground. Photo: Jeff Bond, YGS.

Figure 4.1.4.1(c). Example of gravel deposit and other materials found on a high terrace in the vicinity of Eagle River and the Dempster Highway. Photo: Jeff Bond, YGS.

Figure 4.1.4.1(d). Potential aggregate sources on exposed hill tops in Eagle Plains, with Dempster Highway visible in background. Photo: Jeff Bond, YGS.

Figure 4.1.4.1(e). Active hill-top aggregate quarry along the Dempster Highway in Eagle Plains. Photo: Charlie Roots, YGS.

Figure 4.1.4.1(f). Potential aggregate source in dry creek bed of tributary to Eagle River. Photo: Jeff Bond, YGS.

4.1.4.2 Old Crow Area Aggregate Resources

The importance of aggregate resources to infrastructure maintenance and development in the community of Old Crow is highlighted by the recent aggregate planning, quarry development, riverbank stabilization and runway resurfacing projects that have occurred here (e.g. Visa Tek Ltd. 2001). The lack of available gravel resources was identified as one of the most important issues affecting community development in the Old Crow Capital Plan (Vuntut Gwitchin First Nation, 2003).

Aggregate sources available to the community of Old Crow generally come from the Porcupine River (Figure 4.1.4.2(a)) or as crushed aggregate from Crow Mountain (Figure 4.1.4.2(b)). For many years, Old Crow used available in-stream gravel sources from the Porcupine River. Depletion of the accessible gravel bar and concerns over fisheries management required the development of the Crow Mountain quarry and access road (Figures 4.1.4.2(c) and 4.1.4.2(d)).

Figure 4.1.4.2(a). Porcupine River at low summer flow showing exposed gravel deposits, downstream from Old Crow. Photo: John Meikle, Yukon Environment.

Figure 4.1.4.2(b). Crow Mountain gravel quarry, providing aggregate materials primarily for community of Old Crow infrastructure maintenance and river bank stabilization. Photo: Shawn Francis, NYPC.

Figure 4.1.4.2(c). Crow Mountain gravel quarry access road, with Porcupine River and Bluefish Wetlands in background. Photo: Shawn Francis, NYPC.

Exposed beaches and beach ridges along the wetlands near Old Crow offer a limited and remote aggregate resource. The beach materials range from sand to very coarse boulder gravel. A spit that extends westward from the north end of Mount Schaeffer is known to contain a very large source of good quality gravel (Norris and Hughes 1997). However, most of the known beach ridge locations are too far from Old Crow to be used economically. Current supplies of aggregate at the Crow Mountain quarry at Old Crow are sufficient to meet community needs of residents at present and for the near-term future.

4.1.4.3 Future Aggregate Requirements

Possible future industrial resource exploration and development activities may require large sources of aggregate materials for various infrastructure needs. Granular resource requirements are tied directly to the level and type of future infrastructure in the region. Sections 4.1.2 (oil and gas), 4.1.3 (minerals) and 4.1.7.3 (transportation) discuss potential development scenarios for the region. Gravel extraction would likely occur from sources close to these projects.

Future transportation or industrial requirements for aggregate would be in addition to existing requirements for the Community of Old Crow, regular Dempster Highway maintenance, or any future major Dempster Highway upgrades. Based on future land use scenario modeling for North Yukon Planning Region (North Yukon Planning Commission, 2007) and the average infrastructure gravel requirements reported in Table 4.1.4 above, an estimated 600-800,000 m^3/year of gravel may be required to support the region's future potential aggregate needs. A major assumption in this estimate is that the Eagle Plains natural gas scenario as described in Section 4.1.2.5 occurs; the majority of estimated future gravel volumes would be required to support the development of well pads and all-season access roads for natural gas development.

Annual surface impacts from gravel mines to support this volume of gravel extraction are estimated to be 700 ha of active gravel quarries (early in the natural gas scenario), with an average of 500 ha active gravel quarries for the next 30-50 years. This amount of active surface disturbance would decrease over time after major infrastructure requirements of the natural gas development were completed (well pads, access roads, etc.) and potential reclamation activities occurred.

In the Eagle Plains area where possible future natural gas development is anticipated to be focused, the high terrace sources of potential aggregate are large in area, but are anticipated to be of relatively shallow depth (1-2 metres). Obtaining large volumes of gravel from these sources may therefore disturb large areas of land.

4.1.4.4 Socio-economic Considerations

Aggregate is generally required 'close to source' as it is cost prohibitive to transport large volumes of aggregate long distances. It is difficult to plan for granular resources as they are generally used opportunistically where required. The location of accessible granular resources will influence the location of future transportation and industrial infrastructure, and potential impacts to the land and other resources. Gaining a better understanding of the location and amount of gravel resources in the region would assist in understanding potential land use impacts and infrastructure planning.

Subsistence and recreational use/harvesting of fish and wildlife resources are typical activities occurring along rivers and river valleys where aggregate may be located. Extraction of aggregate in these areas has the potential to impact the pursuit and enjoyment of these activities. The visual quality of river valleys may also be reduced, potentially impacting the aesthetic value of river-based wilderness tourism. Details on potential cumulative effects of aggregate development on subsistence use/harvest activity and tourism and recreation values are discussed in Section 4.4.

4.1.4.5 Ecological Considerations

Extraction of aggregate from active river floodplains may result in direct habitat loss and stream siltation that can be harmful to fish, birds, and animals. Rivers/streams and their adjacent valleys represent some of the most sensitive and important ecological environments within the region (see Section 4.3.3 below).

Exploitation of gravel from terraces that are clearly above the active flood plain is generally preferable to exploitation of floodplain gravel, from an ecological standpoint. Details on potential effects of aggregate development on ecological resources in the region are discussed in Section 4.4.2.

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4.1.5 Forest Resources

Forest resources are the trees and understory vegetation such as shrubs, herbs, mosses and lichens that comprise the forest vegetation community. Forests provide habitat for a diversity of animals, assist in the regulation of water, store and regulate atmospheric carbon, and provide resources for direct human use. Vuntut Gwtichin traditional knowledge of forest and plant resources is extensive. First Nations of the North Yukon Planning Region have utilized a large number of tree and plant species for food and medicinal purposes for hundreds, if not thousands of years (Sherry and VGFN 1999).

This section describes available information, the forest resource, and the current and future requirements for forest products in the North Yukon Planning Region.

Key Findings

- The planning region contains six of the eight major tree species native to Yukon
- Due to permafrost conditions, cold climate and active fire regimes, the region has no or very limited commercial forestry potential
- Tall stature, large diameter trees are generally confined to alluvial environments along major river and stream bottoms, creating a resource of very limited extent
- Old Crow may be considered the most forest dependent community in Yukon; 600 cords of fuel wood is harvested annually, supplying 30% of Old Crow's energy requirements
- Most forest harvesting occurs within 20-30 km of the community of Old Crow in the Porcupine River corridor
- Appendix 1, Maps 46 and 47 provide an overview of tree height and forest site potential around the Old Crow area
- Forest resources are a local community management issue. At this time, a detailed forest management plan is not required for the entire planning region
- David Lord Creek and lower Driftwood River produce some of the best quality and largest timber in the vicinity of Old Crow

Background

Forest resources are a local community management issue for Old Crow. The community has a need for local forest products, specifically fuel wood and building materials. As Old Crow has grown and the requirement for forest products – primarily fuel wood – has increased, community members have had to travel farther away from Old Crow to obtain fuel wood and building logs. There is also concern that some areas have been over-harvested, and that the issue of 'forest ownership' surrounding cabins and camps is causing difficulties to access local forest resources.

Forest harvesting around the community of Old Crow is not currently regulated or coordinated. A forest management plan for the Old Crow area is anticipated to be developed at a future date. Outside of the Old Crow area, there are no immediate forest harvesting issues. A detailed forest management plan for the entire North Yukon Planning Region is not currently required.

The North Yukon Planning Region is within Forest Management Unit Y13, Porcupine River. Chapter 17 of the Vuntut Gwitchin First Nation Final Agreement provides guidance for forest resource and fire management in the planning region. The Vuntut Gwitchin First Nation Final Agreement provides for Vuntut Gwitchin citizens to cut wood on Settlement Land and on Crown Land for traditional and non-commercial purposes.

Methods

Through community workshops held in 2004 and 2005, and with input of the Vuntut Gwitchin Natural Resources Department, North Yukon Renewable Resources Council and Yukon Forest Management Branch, general forest harvesting locations in the vicinity of Old Crow were identified and mapped. Knowledge of locations with high quality timber was recorded. Estimates of community fuel wood requirements were also developed.

In 2004, the Yukon Forest Management Branch completed 1:50,000 scale forest inventory mapping for the lower and middle portions of the Porcupine River around Old Crow (Figure 4.1.5). The forest inventory identifies: 1) different types of forest stands by tree species, 2) tree heights, 3) estimated age, 4) land position, and 5) site productivity. This information is important to identify where potential fuel wood and sawlogs are located today, gain a better understanding of how much wood is potentially available, and assist in the identification of areas that may contain harvestable trees in the future. The recent Yukon forest inventory mapping also includes information related to non-forested land cover, providing information on sparsely vegetated, vegetated non-forested, wetland and open water environments (Yukon Forest Management Branch 2003).

Older sources of 1:250,000 reconnaissance-level inventories are also available for the region, as well as a variety of remotely-sensed satellite imagery acquired over the past 20 years. The 1:50,000 scale forest (vegetation) inventory is currently the most detailed vegetation mapping for Old Crow and surrounding area. The North Yukon biophysical map was developed from satellite imagery but utilized the relatively detailed 1:50,000 scale forest (vegetation) inventory where coverage existed for the development of mapping concepts and accuracy assessment (see Section 2.6.2).

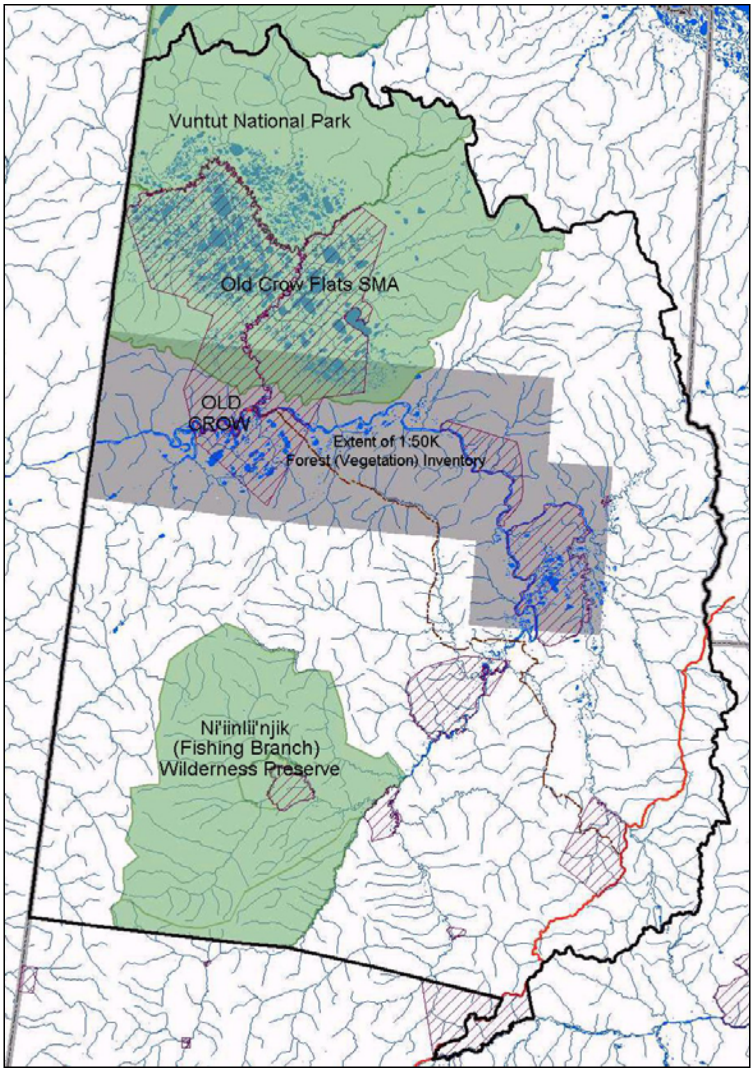

Figure 4.5.1. Extent of 1:50,000 scale forest (vegetation) inventory along lower and middle portions of Porcupine River in the vicinity of Old Crow. Extent of inventory mapping shown in grey. Source: Yukon Forest Management Branch.

4.1.5.1 Forestry Potential

Ecosystems of the North Yukon Planning Region are described in Section 2.6.2. With the exception of portions of Old Crow Basin, the western foothills of the Richardson Mountains, and high elevation mountains areas, the North Yukon Planning Region is predominantly a forested landscape. Six of the eight major tree species native to Yukon are found within the region, including black spruce (*Picea mariana*), white spruce (*Picea glauca*), tamarack (larch) (*Larix laricina*), paper birch (*Betula papyrifera*), balsam poplar (*Populus balsamifera*), and trembling aspen (*Populus tremuloides*). Black spruce is the dominant tree species due to the influence of cold permafrost soils, poor drainage and cold climate. A number of woody shrub species are found in the understory of North Yukon forests including dwarf birch, alder and a variety of willows. Shrub communities typically colonize recent burn areas, are prominent in wetlands and riparian environments, and may also cover broad areas of mid-high elevation mountain slopes.

As a result of the physical environment – permafrost soils, cold climate and active fire regimes – nowhere in the planning region is currently considered to have potential for commercial forestry. Under these conditions, the length of time required to produce merchantable trees for harvesting can be considerable. Riparian areas can support productive forest growth but are very limited in extent. Climate change may affect future tree growth rates but is also expected to result in increasing fire rates (see Section 2.6.3 for discussion of climate change).

Appendix 1, Maps 46 and 47 provide an overview of tree height and forest site potential as recorded by the 1:50,000 scale forest (vegetation) inventory mapping. The general area of community fuelwood and forest harvesting is also shown. As displayed on Map 46, areas with trees greater than 10m in height are generally confined to two positions on the landscape: 1) steep slopes, and 2) active riparian environments such as lower David Lord Creek. Due to permafrost conditions, gently-sloping terrain has poor drainage which limits tree growth potential. Steep slopes provide better soil drainage and therefore have the ability to produce larger trees. Aspect, the direction a slope faces, may also play an important role with steep south and west-facing slopes having deeper soil active layers resulting in warmer soil temperatures during the summer growing season.

Riparian environments such as David Lord Creek have deeper active soil layers (the top portion of the permafrost soil that thaws each year) immediately adjacent to the watercourse, producing warmer soil conditions with better drainage. Riparian forests are generally the most productive forests in the region, but are spatially very limited in extent. Outside of the major river corridors with extensive floodplains such as Porcupine, Bell and Eagle, productive riparian forests typically exist as a thin ‘ribbon of trees’ along active stream channels (Figure 4.1.5.1).

Appendix 1, Map 47 shows forest site potential for the Old Crow area. The majority of the forested landscape has a site index considered to be low or moderate. Site index is an estimate of site productivity for tree growth, and provides a common basis for comparing the relative productivity of different sites. Site index is the expected average tree height, measured in meters, at 100 years tree age. Stand volume curves, an estimate of cubic meters of wood per hectare of a given site index, have not been established for Old Crow as there is currently no commercial requirement to do so.

Figure 4.1.5.1. Riparian spruce forest on alluvial soils adjacent to small meandering stream in Eagle Plains. Photo: J. Meikle, Yukon Government.

4.1.5.2 Forest Product Demand

Fuel Wood Requirements

The Community of Old Crow may be considered the most forest-dependent community in Yukon. It is currently estimated that Old Crow consumes approximately 600 cords of fuel wood per year, with some variation depending on winter temperatures (approximately 10 cords per home x 60 homes). Fuel wood provides 30-35% of Old Crow's total energy requirements (Environmental Dynamics Inc. 2005). Approximately 25% of households in Old Crow have oil monitors, primarily Elders and other individuals who can afford the fuel costs associated with oil heating. All government buildings and the two local bed and breakfast accommodations utilize oil monitors or forced air oil furnaces for heating.

Future fuel wood consumption in Old Crow will depend on several factors with some of the most important being: 1) population growth, 2) trends in oil monitor use, 3) development of alternative energy sources such as hydroelectric or wind power, making electrical heating more economical, and 4) focused greenhouse gas reduction programs that influence oil and diesel use. Given the current situation and increasing trend towards oil monitor use, it is unlikely that the demand for fuel wood in Old Crow will increase significantly in the near future.

Building Material Requirements

Historically, spruce logs were used to construct all homes, community buildings, cabins and similar structures. Building logs are still utilized for cabins and a variety of special purposes such as reconstruction of the Rampart House Historic Site. A portable mill has also been used in the past to mill rough-cut lumber for local construction purposes.

For many reasons, the use of logs as primary building materials has decreased considerably from past times. With the exception of the new airport terminal, most new structures in Old Crow have been constructed with imported processed building materials. Rough-cut lumber produced from local forest resources has not been utilized in any new building construction. If these building material trends continue, there will not likely be a significant increase in demand for large diameter building or saw logs in the near future.

The Vuntut Gwitchin Government is investigating the cost of log versus typical construction, and the possibility for locally produced rough-cut lumber to supply at least a portion of required building materials. The outcome of these investigations may result in an increased demand for locally produced building materials.

4.1.5.3 Forest Harvesting

Tree Harvesting

Appendix 1, Maps 41, 46 and 47 show the general location of forest harvesting activities around Old Crow. Forest harvesting is not currently regulated or coordinated. It is generally not known how many trees are cut annually, or specifically where they are cut. The majority of harvesting is performed to supply the approximate 600 cords of annual fuel wood required by Old Crow. Most fuel wood and forest harvesting occurs within a 20-30 km radius of Old Crow, with the majority of effort focused on the Porcupine River corridor from Bluefish River upstream to the Driftwood River. Areas that are easily accessible by winter snowmobile travel often determine fuel wood harvesting locations, with timber quality being of secondary importance. Most forest harvesting occurs in winter within 1 km of the Porcupine River. Winter wood camps may stock pile logs for water transport in summer. In summer, areas beyond 30 km up river may be accessed by boat, harvested and the logs floated down to Old Crow; these locations may be as far upstream as Whitefish Wetlands.

There are currently no formal forest harvesting or silvacultural practices being used in the area. Small patch cuts are generally not utilized; a single resident or group of residents performs most forest harvesting in a selective manner, cutting only a single or few trees in any one location. Large machinery such as feller bunchers, skidders and trucks are not currently used. Snowmobiles and sleds provide winter log transportation; boats and rafts provide summer log transport. Forest harvesting remains a small scale, labour intensive activity.

David Lord Creek and the lower portion of Driftwood River are generally recognized as some of the most productive forest areas near Old Crow, and are the source for large diameter building logs when required. A winter wood camp is located at the mouth of David Lord Creek. David Lord Creek is identified as a Commercial Forest Reserve in the Vuntut Gwitchin First Nation Final Agreement (VGFN Section 17.4.2.10)

Wildfire Management Considerations

Wildfire plays an important role in determining the location of harvestable forests. In 1990, a large wildfire occurred to the immediate west of Old Crow, forcing an evacuation of the community. The burned area has yet to regenerate trees and is currently dominated by shrubs and herbs. Riparian sites are more productive and are generally affected by fire less frequently than upland sites, which tend to accentuate the tree height and diameter differences between the two areas. Planning region fire regimes are discussed in Section 2.6.2.5.

The Yukon Fire Management program, in consultation with First Nation governments, communities and stakeholders, has developed wildfire management zones for Yukon, identifying which areas of the territory require priority for the purpose of fire suppression. The purpose of prioritizing values is to balance fire suppression costs with ecological, social and economic risks, with communities receiving the highest level of wildfire protection. In some areas of Yukon, coordinated forest harvesting has been utilized to modify forest fuels and reduce fire risks to communities and infrastructure, while supplying required fuel wood. Such an approach has been contemplated in Old Crow by its recent FireSmart plan.

In North Yukon, the importance of the David Lord Creek and lower Driftwood River timber resource is recognized in Yukon wildland fire zonation maps, receiving the designation of strategic protection (Figure 4.5.1.3).

Traditional Forest and Plant Uses

First Nations have and continue to utilize a number of tree and plant species found in the planning region for a variety of food and medicinal purposes. Berry harvesting remains an important activity in the Old Crow area. Sherry and VGFN (1999) report the cultural uses of over 20 plant species found in the vicinity of Old Crow, including trees.

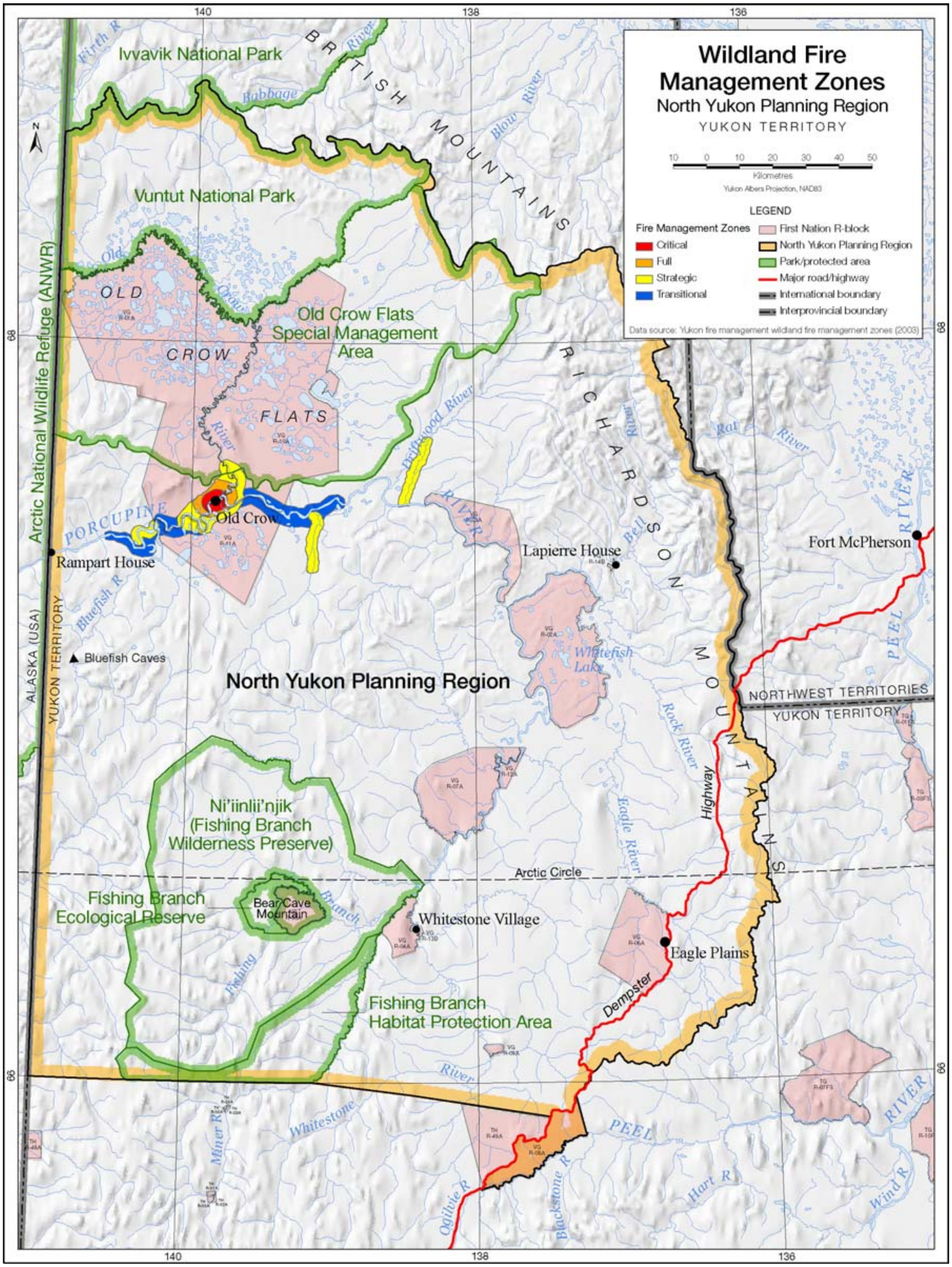

Figure 4.5.1.3. Wildland fire management zones for North Yukon Planning Region. Old Crow and surrounding areas, including priority timber resources of David Lord Creek and lower Driftwood River, are identified as priority fire suppression zones. Source: Yukon Fire Management (2003).

4.1.5.4 Socio-economic Considerations

Forest harvesting remains a non-mechanized, labour intensive activity that is considered by many residents to be central to contributing to a healthy, land-based lifestyle. Winter wood camps and tree harvesting are also an important source of employment and wage income for some Old Crow residents.

In Old Crow, a cord of wood costs $300.00 delivered. Similar to most goods and services in the region, this is substantially more than in southern Yukon.

Cabin owners along the Porcupine River have a sense of ‘ownership’ of the forest resource around their cabin site. Uncoordinated forest harvesting occurring in close proximity to personal cabins has the potential to create conflict with the cabin owner, and has been identified as creating potential barriers to accessing local forest resources in the vicinity of Old Crow.

Regional socio-economic considerations are discussed fully in Section 4.4.

4.1.5.5 Ecological Considerations

The majority of forest harvesting occurs in riparian forest environments, a biologically important landscape type of limited extent in Northern Yukon. Forest harvesting in these communities has the potential to cause habitat-related impacts on forest bird species and furbearers, but the current scale and methods of harvesting likely mitigates any potentially significant habitat-related impacts.

From the perspective of greenhouse gas emissions, burning fuel wood to create energy is considered to be a ‘carbon neutral’ activity, and may therefore be a preferable energy alternative to fossil fuels (Environmental Dynamics Inc. 2005). While forest resources may provide a renewable, carbon neutral energy source, the long regeneration time of northern Taiga forests must be fully considered. Large-scale energy production from forest biomass would not likely be sustainable in Old Crow.

Regional ecological considerations are discussed fully in Section 4.4.

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4.1.6 Renewable Energy

Renewable energy is a cornerstone of a sustainable society. The term ‘renewable energy’ refers to the generation of heat and electricity from natural resources that are not depleted over time. Examples of renewable energy sources include hydro (energy from flowing water), wind, solar (energy from the sun), geothermal (heat from steam or hot groundwater), earth (heating or cooling using below ground ambient temperatures), and trees or other forms of biomass that can fully regenerate after some of the resources are used. By contrast, non-renewable energy sources, such as oil, natural gas, coal and other fossil fuels, are finite and are depleted in the production of heat, electricity and motion.

This section provides an overview of current and future energy requirements, and potential future renewable energy sources within the North Yukon Planning Region.

Key Findings

- There has been limited assessment of renewable energy sources and options in northern Yukon.
- All electricity generation is currently produced by diesel power generation. The community of Old Crow and Eagle Plains Lodge both run diesel power plants.
- The community of Old Crow utilizes heating fuel oil, wood and electricity for its heating requirements.
- Due to the northern climate the stream flow characteristics, hydroelectric potential of the region is considered low, at least for large and medium-scale hydroelectric developments.
- Wind energy has been investigated for the community of Old Crow, but is not considered technically feasible at this time.
- Given the long periods of reduced winter daylight, the use of solar energy is only feasible in the summer months.
- Old Crow utilizes biomass (i.e. wood) for winter heating; large increases in fuelwood harvesting rates may not be sustainable.
- Future energy production will likely utilize some renewable energy options but will not fully replace diesel power generation in the near future. Increasingly efficient use of existing energy sources is an important energy strategy.

Available Information

A variety of reports and documents are available describing current energy use and renewable energy options for the region but generally, there has been limited assessment of renewable energy options. Hydroelectic and wind energy have received the most attention. The Northern Canada Power Commission conducted reconnaissance-level surveys of potential hydroelectric sites in the 1960s and 70s (e.g. North Canada Power Commission, 1974; Monenco Consultants, 1983). The most comprehensive source of information regarding energy use for the community is an energy baseline study completed in 2005 (Environmental Dynamics Inc., 2005). General information sources such as Natural Resources Canada and Yukon Government (e.g. http://www.emr.gov.yk.ca/energy/hydro.html) websites, and Yukon Energy Corporation publications (e.g., Yukon Energy Corporation, 2001) provide relevant background information.

4.1.6.1 Current Energy Consumption

Old Crow recently completed a community energy baseline audit (Environmental Dynamics Inc. 2005). It determined that the entire community used an estimated 33,687 Gigajoules[1] of energy at a cost of $1,076,00. About 65% of the energy generated was from fossil fuels. The remaining 35% was generated from tree biomass, used primary for heating during winter months. As a result of the high cost of air transportation, the price of fuel is about twice that paid by Whitehorse consumers.

All electrical energy production in the planning region is currently met by fossil fuels, specifically by diesel power generation. Old Crow and the Eagle Plains Lodge both have diesel-powered electricity generation plants. Heating fuel oil provides a large portion of Old Crow's winter heating requirements. About 40% of Old Crow residences have oil monitors, and fuel oil is used to heat all government buildings, the school and the new airport terminal.

4.1.6.2 Renewable Energy Potential

4.1.6.2.1 Hydroelectric Power

Hydroelectric power generation converts the energy of moving water into electrical power. To generate electricity, hydroelectric facilities must have adequate river flow and/or a sufficient height for the water to fall. The best locations are typically waterfalls, rapids, canyons, deep valleys or river bends. Rivers with large volumes of slow moving water may also have enough inertia to create power. There are two general types of hydroelectric facilities: 1) dam and reservoir projects (developments that use storage), and 2) run-of-river projects (developments that use no or minimal storage). These two types of developments can vary in scale from micro-hydro (less than 0.5 megawatt) to large scale (greater than 100 megawatt).

Dam and reservoir projects use structures to store water for use during periods of low flow. Natural river flows vary significantly from season to season, with the highest flows typically occurring in spring, or early summer. Lowest flows occur in late-winter, a pattern that is accentuated in northern regions. During peak flow periods, surplus water can be stored in a reservoir that is part of the hydroelectric facility. The water in the

[1] 1 Gigajoule of energy is enough to run a typical television, 24 hours per day for 40 days (Environmental Dynamics Inc. 2005).

reservoir can then be used to generate power during the low flow winter period. In Yukon, the low flow period also corresponds with the period of highest demand.

Run-of-river facilities use low dams to provide limited storage of water - at most daily pondage. They do not regulate river flow. Run-of-river facilities produce minimal reservoir flooding and cause few alterations to the natural river. Because run-of-river facilities have limited storage, water must be used immediately or the electrical generation potential is lost. In river systems with large differences in seasonal river flow, run-of-river facilities may not be able to provide reliable power year-round.

Most renewable energy assessment in Yukon historically focused on mid to large-scale hydroelectric sources[2]. While more than 100 potential hydro sites have been identified in Yukon, hydroelectric power has only been developed at a few locations. The Whitehorse Rapids, Fish Lake (Whitehorse), Aishihik Lake and Mayo hydroelectric facilities produce a total of 76 Megawatts (MW) of power. Fraser Lake, on the Canada-US customs office on South Klondike Highway, and some privately-owned micro hydro sites, produce additional power for local use. Historically, the largest single factor influencing electrical demand in the Yukon has been the mining industry. When operational, the Faro mine consumed 40% of Yukon's total electrical production.

Existing Assessments

Through the Northern Canada Power Commission, the larger rivers of North Yukon were assessed in the 1960s using a variety of means for hydroelectic potential. Two potential large-scale (greater than 100 megawatt) hydro sites were identified through preliminary reconnaissance in the planning region. Both sites are located on the Porcupine River; one at Salmon Cache Canyon and other at the Ramparts (Porcupine Canyon) (Figure 4.1.6.1). Other potential sites were identified on the nearby Ogilvie River and the Peel River, with Aberdeen Canyon receiving attention. In NWT, Fish Creek, flowing east from Summit Lake to the Mackenzie River, was also identified. Beyond this preliminary reconnaissance, none of these sites received further study.

In Alaska, a major hydro development that would have affected the Porcupine River received considerable attention in the 1960s and 70s. The Rampart Project in central Alaska would have impounded the Yukon River, creating a 28,000 km^2 lake (http://www.alaskool.org/resources/regional/yukon_reg_profile/geothermal.htm; U.S. Alaska Power Administration, 1974). This reservoir would have flooded land almost to the Yukon border, and inundated low-lying communities such as Ft. Yukon. The hydro development was estimated to have an installed capacity of nearly 500 megawatts of power, but was determined to not be economic at that time. Given the large social and environmental impacts of this project, it has not received additional attention.

[2] Note: With a power generation capacity of 24-40 MW, the existing Whitehorse Rapids facility is considered a mid-size hydro plant. Large-scale hydro facilities typically generate more than 100 MW of power. The Mayo facility is a small-scale project, producing 5 MW of power.

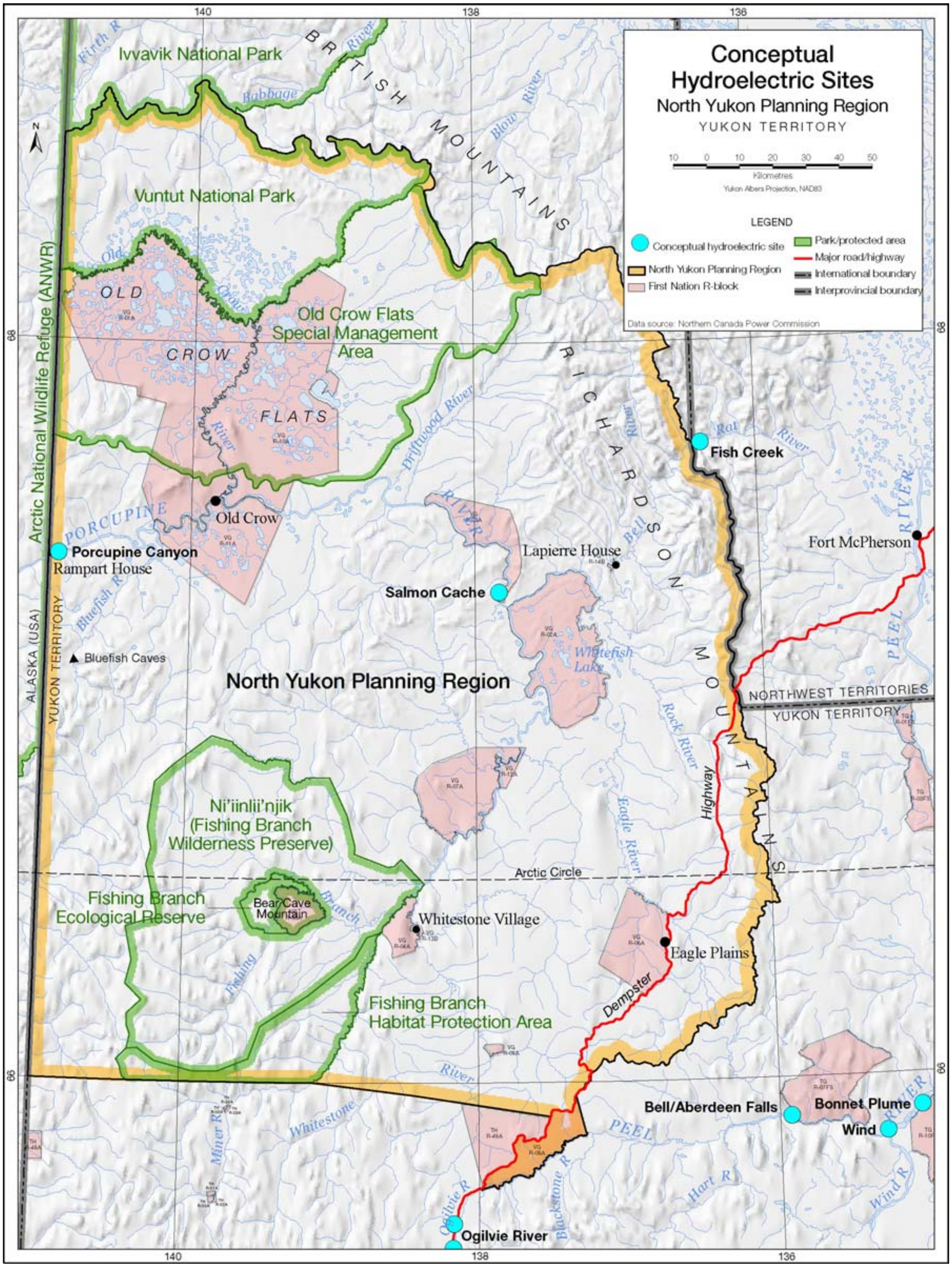

Figure 4.1.6.1. Conceptual large-scale hydroelectric sites within and adjacent to North Yukon Planning Region. Northern Canada Power Commission identified all sites through preliminary reconnaissance efforts in 1960s.

There has been no assessment of micro or small hydro sites (less than 20 megawatts), or run-of-river potential in northern Yukon. This smaller-scale hydro production would be more suitable for the existing and probable energy demands in the region, and the natural stream flow characteristics.

Factors Influencing Future Hydroelectic Development in Northern Yukon

The planning region is considered to have low potential for large-scale hydroelectric development. The Porcupine River watershed encompasses about 57,000 km^2 of drainage area with a unit discharge of 5.9 m^3 water per second per 1,000 km^2 drainage area. This is considerably less than other Yukon drainage basins. Climate and hydrology are major barriers, with subdued terrain and a lack of natural storage being contributing factors. The climate and permafrost characteristics of the region produce a hydrologic system with very limited natural storage, and extreme variation in water flow between summer and winter. Winter stream flow decreases dramatically; many small and moderate sized-streams frequently experience zero flow. These low stream flows occur when the demand for power is the highest, creating a difficult situation.

Hydroelectric development can be costly. Hydro plants can have capital costs from three to ten times greater than diesel plants. Larger-scale projects may require 20-50 year periods of return on capital investments. Long-term (10-year) feasibility studies and detailed water monitoring are typically required to determine cost effectiveness and stream flow characteristics. Distance to areas of major electrical demand is an important consideration with hydro development. Potential environmental and social impacts of hydroelectric development also require careful consideration.

A detailed discussion of factors and considerations influencing hydro potential in Yukon is provided at: http://www.emr.gov.yk.ca/energy/hydro.html.

4.1.6.2.2 Wind Energy

Wind energy converts kinetic energy (energy of motion) that is present in the wind into more useful forms of energy such as electricity or mechanical energy. Wind energy is a pollution-free, infinitely sustainable form of energy that holds great promise for future energy production in some parts of the world.

Wind energy is typically harnessed by a windmill or a wind turbine. With a wind turbine, power and energy output increases dramatically as wind speed increases. The most cost-effective wind turbines are therefore located in the windiest areas. Wind speed is affected by local terrain and increases with height above the ground, so wind turbines are usually mounted on tall towers to maximize wind velocities.

Existing Assessments

In North Yukon Planning Region, one wind power assessment has been conducted at Old Crow. A wind-monitoring program jointly funded by the Government of Yukon, Vuntut Development Corporation and DIAND confirmed that Crow Mountain receives enough wind to operate a moderate-sized wind turbine. However, similar to the Haekle Hill wind turbines operated by Yukon Energy in Whitehorse, severe problems with rime ice could regularly make the turbine inoperable during winter. As technology improves, a wind turbine on Crow Mountain may become technically and economical feasible.

Factors Influencing Wind Energy Use in North Yukon

Assuming suitably windy locations exist, the two most important factors influencing wind energy use in northern Yukon are the extreme winter climate and cost. Rime ice development on wind turbines is a challenging technical issue in extreme northern climates and has the ability to reduce the efficiency of or cease operation of wind turbines. While a moderate-sized wind turbine has the potential to provide almost half of Old Crow's current electricity needs, the capital investment to develop the resource can be substantial.

4.1.6.2.3 Solar Energy

Energy from the sun travels to the earth in the form of electromagnetic radiation. Solar energy can be used directly for heating or cooling, or through the use of solar electric panels and photovoltaic cells, can be converted to electricity. Available solar energy is expressed in units of energy per time per unit area, such as watts per square metre (W/m^2). At any particular time, the available solar energy is primarily dependent upon how high the sun is in the sky (declination) and current cloud conditions. On a monthly or annual basis, the amount of solar energy available also depends upon geographic location, with latitude and aspect both being important.

Existing Assessments

There have been no formal assessments of solar energy potential for Old Crow. The amount of annual available daylight ranges from near continuous (24 hour) on the summer equinox to negligible (0 hours) on the winter solstice. The solar energy available to Yukon averages only 60% of southernmost Canada (Wahl 2004), with North Yukon being even less.

Factors Influencing Solar Energy Use in North Yukon

As described above, the amount of available solar energy is affected greatly by the location on Earth. At high latitudes, the intensity of solar energy (amount of energy per m^2 of earth surface) is much reduced compared to southern Canada; the solar energy available to Yukon averages only 60% of southernmost Canada (Wahl 2004), with North

Yukon being even less. The majority of the North Yukon Planning Region occurs above the Arctic Circle (66.33^{o}N) and displays dramatic seasonality in climate and daylight. In mid-winter, the region receives very limited daylight, with at least two weeks without the sun rising above the horizon, making the use of direct solar energy not possible.

However, in the summer months solar energy may represent a practical renewable energy option for site-specific requirements, such as a camp or a specific building. In Old Crow the sun remains continuously above the horizon for two weeks around the summer equinox. Further, a large proportion of summer days in Old Crow have limited cloud cover and the subdued topography represents a nearly unbroken horizon.

Storage of solar energy for periods when direct sunlight is not available may be problematic. Storage of solar energy for large-scale utilization by batteries or other technology is an important consideration with for solar energy. Developing reliable solar energy systems for use during a relatively short period of the year could be costly.

4.1.6.2.4 Geothermal and Earth Energy

The earth's crust contains a large amount of energy, in the form of heat. Geothermal energy uses steam or hot water in the earth's crust to power turbines or to heat buildings or water. If geothermal sources are present, geothermal facilities can be installed to capture steam as it escapes from cracks or holes in underground rocks. Geothermal energy requires a source temperature of more than 100°C to drive a generating turbine but substantially less to provide efficient heating.

Earth energy uses temperatures found in the earth or below water (lakes or rivers) to cool or heat air and water for buildings. For example, a heat pump can extract heat from underneath the ground to heat a building. In the summer, the pump can be reversed to provide air conditioning by moving hot air out of the building and down into the ground.

Existing Assessments

No detailed assessment of geothermal or earth energy sources has been conducted. Available well log temperature profiles have been summarized by Taylor and Judge (1974). Technical engineering reports documenting permafrost conditions for Old Crow include Stanley Associates (1979) and EBA (1982).

Factors Influencing Use of Geothermal and Earth Energy

Geothermal energy requires appropriate geologic conditions in proximity to the location where energy is required. At this time, no indications of geothermal heat sources have been documented in the region. While geothermal assessments have not been conducted for the Old Crow area, local knowledge suggests that no geothermal sources (hot springs) are present in the vicinity of Old Crow.

The use of earth energy as an energy source in North Yukon is most influenced by permafrost conditions. The depth of permafrost under Old Crow is 63m thick, and is 89m thick in central Eagle Plains (Burn 2004). Below the permafrost base, ground temperatures increase substantially with increasing depth. At the North Cathedral B-62 drill site in central Eagle Plains, above 0^oC temperatures occur at 100m depth, with a ground temperature of $+13^oC$ recorded at 350m (Taylor and Judge 1974). Access to these relatively warm ground temperatures for utilization as a heat source would present technical challenges. Permafrost could be utilized as an efficient refrigeration system in summer months for storage of food stocks.

4.1.6.2.5 Energy from Biomass

Bioenergy is produced by the release of stored chemical energy contained in fuels made from biomass. Biomass is a product of solar energy that has been stored by the photosynthetic activity of plants. The plants remove CO_2 from the atmosphere and combine it with water to produce biomass. Biomass can come from many sources, with the most common being wood from trees, or from waste products generated from agricultural, forest, food and municipal activities.

Existing Assessments

There have been no formal assessments of producing energy from biomass in North Yukon. However, Old Crow is highly dependent on tree biomass to meet a large portion of its heating requirements. As described in Section 4.1.5 (Forest Resources), 30-35% of Old Crow's residential heating needs are supplied by burning wood. Old Crow residents burn approximately 600 cords of spruce logs annually, the majority in the winter period.

Factors Influencing Energy from Biomass

Given the small-scale nature of forest harvesting and methods utilized, use of wood for energy production is currently considered to be a 'carbon neutral' renewable energy source for Old Crow (Environmental Dynamics Inc. 2005). However, given the size of Old Crow and the relatively limited extent of forest resources in close proximity to the community, it may not be possible to utilize tree biomass for all winter residential and commercial building heating purposes. A large increase in wood burning for the purpose of winter heating may lead to unsustainable tree harvest rates in the vicinity of Old Crow. Efficient, centralized wood burning stoves or boilers with a community distribution system may be feasible, but would be capital intensive.

Beyond forest products, there are few other readily available sources of biomass for Old Crow to utilize for heating purposes. Incineration of municipal biowaste and the capture of heat may be an option, but also requires consideration of potential air quality-related health risks. If quantities were sufficient, local production of dimensional lumber or building logs may generate enough wood waste products to be utilized in a high efficiency wood boiler. Again, harvest rates would need to be carefully considered.

4.1.6.3 Future Energy Demand and Renewable Energy Options

Future energy requirements in North Yukon Planning Region will be driven by three major trends: 1) Old Crow population trends, 2) energy efficiency of Old Crow municipal infrastructure and 3) the level and type of economic development activities and associated workforce requirements.

If current trends continue, in the next 5-20 years Old Crow population growth is anticipated to be modest (less than 1%). Future renewable energy trends for Old Crow will likely be to gradually develop small-scale renewable energy sources to offset the current reliance on diesel electricity generation. Wind, small-scale run-of-river hydro, site-specific seasonal solar, and moderate increases in tree biomass fuel may provide such options. While such a trend would reduce greenhouse gas emissions and diversify its future energy sources, it is unlikely that diesel generation would be replaced completely by renewable energy in the coming years. The largest impediments to this energy transition will be research and capital investment. A number of detailed and potentially long-term feasibility studies may be required.

In the short-term, increasing the energy efficiency of Old Crow municipal infrastructure may represent the simplest and most cost effective means of decreasing the current level of non-renewable energy consumption. Most homes in Old Crow are not energy efficient. New homes, government administration, airport and visitor reception buildings have been and are being designed with energy conservation measures.

Potentially increasing levels of oil and gas exploration and development could require and utilize some forms of renewable energy, with wind, solar and micro-hydro potentially providing at least partial power requirements for work camps, compression facilities and well sites. Renewable energy would not likely replace on-site generation using diesel or produced gas and oil. Future potential mineral production would benefit from a source of reliable, clean hydropower. It is possible that if a significant mineral deposit were brought into production, a small hydro facility (less than 20 megawatts) could be developed concurrently. Given the remoteness of the North Yukon, the relatively low local energy demands, and the overall limited hydro potential, the possibility for large (greater than 100 megawatt) or medium (20-100 megawatt) scale hydro facilities being constructed in the region is unlikely.

4.1.6.4 Socio-Economic Considerations

Energy costs in Old Crow are very high. Renewable energy sources have the potential to reduce the cost of energy for Old Crow consumers. However, establishing these renewable energy sources can require large upfront capital investments. For a small community like Old Crow, such sources would likely require significant government funding. Homeowner financial investments in energy efficiency appliances, construction and lighting can contribute to energy conservation and reduced energy costs, but the cost savings may not be dramatic and may take several years to be realized.

Discussing and exploring renewable energy options also provides an important focus for community sustainability planning. It is important for people to make connections between their own pattern and level of energy use, where their energy and fuels come from, and the potential geo-political impacts of our actions.

The development and use of renewable energy has many benefits, but some forms or types of renewable energy developments may not be sustainable indefinitely. Large-scale dam and reservoir hydroelectric projects have the potential to create large social and ecological impacts, including direct displacement of communities and loss of traditional use areas.

4.1.6.5 Ecological Considerations

Given the current reliance on diesel power for electrical generation, greenhouse gas reduction would be a major benefit of increased renewable energy sources. In 2005, Old Crow energy use resulted in 4,390 tonnes of eCO_2 (equivalent carbon dioxide), with about 35% (1,547 tonnes eCO_2) being carbon neutral emissions resulting from the burning of firewood. This amount resulted in Old Crow citizens each producing 9.2 tonnes of carbon dioxide emissions (excluding plane travel), while the yearly Canadian average was 5 tonnes (Environmental Dynamics Inc., 2005).

Increased use of fuelwood by the community of Old Crow may result in unsustainable harvest rates, but this could be mitigated through the use of increasingly efficient burning and distribution methods.

While hydroelectric power is a renewable energy source, large and mid-size dam and reservoir projects can and have significant ecological impacts. Flooding of reservoir areas, constrained fish migration, altered stream flow, impacts on wetlands and low-lying areas, and changed river ice conditions may all result. Many of these impacts have direct or indirect effects on traditional economic activities.

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4.1.7 Traditional Economy

The Old Crow traditional economy should be fully recognized as an economic consideration in any regional economic assessment. Subsistence harvesting and traditional economic activities play an important role in the maintenance of Vuntut Gwitchin culture and community well being, and help to off-set the high cost of food items. The regional economy can be considered a ‘mixed-economy’ where both traditional subsistence harvesting and wage-based activities co-exist. Similar to other First Nation communities in the North American Arctic, residents of Old Crow actively seek participation in a cash economy as a means of supporting subsistence activities (Berman and Kofinas 2004).

This section describes the Old Crow traditional economy. It should be noted that residents of Ft. McPherson and Aklavik also practice subsistence harvesting in the Tetlit Gwich’in Secondary Use Area; those activities are not covered in detail in this report. The location of current First Nation use areas is discussed in Section 3.3.

Key Findings

- Old Crow participation rates in traditional economic activities and subsistence harvesting remains high
- Subsistence harvesting and traditional economic activities play an important role in the maintenance of Vuntut Gwitchin culture and community well being, but also serve to off-set the high cost of food items in Old Crow
- Hunting, fishing, gathering and trapping activities are actively pursued by Old Crow residents throughout the region
- Section 3.3 and Appendix 1, Map 41 provides a detailed description of the locations of Vuntut Gwitchin current use areas. Levels of use are highest in the vicinity of Old Crow, but areas as far as Bell River, Whitefish Wetlands and Whitestone Village are used occasionally
- Future Vuntut Gwitchin participation levels in traditional economic activities are anticipated to be similar to present if other economic opportunities are not available

Background

The regional economy can be considered a ‘mixed-economy where both traditional subsistence harvesting and wage-based activities co-exist. A large proportion of the economic activity in Old Crow is still focused on subsistence harvesting. Old Crow residents participate in traditional economic pursuits such as hunting, fishing and berry harvesting to provide staple food items, and to provide feed (e.g. Chum salmon) for dog teams. Trapping is still practiced as a supplementary economic activity when fur prices warrant. This high participation rate in the traditional economy is important for the maintenance of Vuntut Gwitchin culture and ties to the land, but also plays a major role in off-setting the high cost of food item purchases in Old Crow. A limited market-based economy within the community supplements traditional economic activities.

Methods

The focus for documenting and understanding the Old Crow traditional economy was Vuntut Gwitchin citizens residing in Old Crow. Subsistence harvesting and land use were recorded directly through Old Crow community workshops with the assistance of Vuntut Gwitchin Government Natural Resources and Heritage departments (fall 2004 to spring 2006), and the North Yukon Renewable Resources Council. NYPC members residing in Old Crow also contributed a large amount of knowledge regarding current use areas, patterns and trends. Previous academic and community based research conducted in Old Crow was also referenced, including the Arctic Borderland Ecological Knowledge Co-op. Experienced Old Crow land users also provided comment on land use and harvesting in the Tetlit Gwich'in Secondary Use Area of the Richardson Mountains – Dempster Highway Corridor.

4.1.7.1 Participation Rates in Traditional Economic Activities (Time on the Land)

While people generally do not spend as much time on the land as they did a generation ago, a large proportion of Old Crow residents still participate in traditional economic activities and spend time on the land. Tetlichi et al. (2004) report that 50% of community members participate in day or weekend trips multiple times per year. Approximately 25% of Old Crow residents participate in extended travelling and hunting trips up to one week in duration. An additional 25% report they spend from four to eight weeks, either on their own or through their jobs, on the land (jobs were related to parks management, wildlife management, and historic site restoration).

There is some debate as to the effect of participation in wage-based economy on hunting participation rates. While it is generally acknowledged that some form of wage-based work is required to finance hunting activities (i.e. fuel, equipment and transportation purchases), it must also be recognized that participating in wage-based work uses up potential hunting time (Kirkvliet and Nebesky 1997). Based on survey results of participating Old Crow land users, Berman and Kofinas (2004) found that having a full-time worker in the household reduced the likelihood of not hunting at all but reduced the likelihood of hunting often by an even greater amount. This suggests that Old Crow hunters with full time work may be more likely than unemployed or part-time employed hunters to go hunting once in a season, but less likely to hunt more often. This finding suggests that as the level of wage-based employment increases, traditional harvesting activities become less of a 'core activity'.

4.1.7.2 Hunting, Fishing and Plant Harvesting

Caribou and moose receive the majority of hunting effort. Old Crow residents harvest approximately 600 caribou annually, or approximately 2 animals per resident (Yukon First Nations Harvest Surveys 1988-94; Kofinas 1998, William Josie, VGFN Natural Resources Department, personal communication, August 2005). Caribou is the most frequently consumed wild food in Old Crow. The most recent survey results indicate that households serve caribou on average 240 times per year (Wein 1994). Caribou harvesting is not undertaken for sport or recreation, but as an activity central to Vuntut Gwitchin sense of self, the transmission of cultural traditions, and to the over-all well-being of the community (Berman and Kofinas 2004). Important caribou harvesting periods coincide with the annual fall and spring migration of the Porcupine Caribou Herd, but caribou may be hunted throughout the winter period when available or when long distance travel permits. Annual moose harvest rates are estimated to be approximately 10-20 animals (Robert Kaye, VGFN Natural Resources Department, personal communication, October 2006) with most moose hunting activity occurring in the fall along the middle Porcupine River. Waterfowl (ducks and geese), muskrat, ptarmigan and rabbits are also taken when available.

Fish harvesting utilizes both freshwater (e.g. char) and anadromous (King, Chum and Sockeye salmon) at various times of the year, with most fishing activity centred on the Porcupine River and its major tributaries. The summer and fall periods are the most important salmon harvesting times. King and Sockeye salmon is an important food item for Old Crow residents while Chum (dog) salmon is generally utilized as food for dog teams. The large number of historical fish traps located throughout the region provides insight into the importance and abundance of the fishery resource in northern Yukon (see Section 2.8 for a detailed discussion of fish and fish habitats).

Many Old Crow residents harvest cranberries, blueberries, mossberries and cloudberries in proximity to the community during late summer and early fall. Berries are used for a variety of cooking purposes. A detailed description of Vuntut Gwitchin plant names, species harvested, and uses is provided by Sherry and VGFN (1999).

4.1.7.3 Trapping

The Vuntut Gwitchin First Nation holds a single Group Trapping Concession (#401) that covers the majority of their traditional territory[1]. Within this group trapping concession, traditional family trapping areas are located throughout the planning region. In the early to mid-1900s, trapping was the most important economic activity in the planning region (see Section 3.2 for a detailed discussion of historical trapping activity). Today, Old Crow land users still participate in trapping activities but it is generally not considered a

[1] A small part of the planning region includes Inuvialuit Group Trapping Concession #403, in the Northern Richardson Mountains. A very small portion of Trapping Concession #387 occurs within southern portion of VGFN R-block R-08A, along the Oglivie River.

‘core’ economic activity. The fluctuating nature or fur prices and the high cost of equipment, transportation and fuel make trapping a marginal economic activity (Sherry and VGFN 1999).

When fur prices warrant, 10-20 Old Crow land users may be actively trapping during the winter months and doing so profitably. When fur prices are low, one to five individuals may be pursuing fur. In the winter of 2005, three individuals were trapping ‘full time’ while six to ten people trapped sporadically (Dennis Frost Sr., personal communication, August 2006). Marten, lynx, fox and wolf are the primary fur species.

VGFN and the North Yukon Renewable Resources Council actively encourage and support trapping activities through a Trappers Assistance Program with the goal to increase the overall Vuntut Gwitchin participation rate in trapping activities. Trapping remains an important cultural and traditional activity in Old Crow.

4.1.7.4 Clothing and Crafts

Hand sewn clothing and crafts produced from locally-harvested fur and skin maintain an important position in Vuntut Gwitchin culture. While most residents dress in contemporary purchased clothing, a large number of special or functional clothing items are still produced locally. Special function items include ceremonial vests and dresses while functional items include hats, mittens, boots, moccasins, and extreme winter weather skin pants and coats.

The majority of craft and clothing items are produced for local use and exchange. However, some clothing and craft items are produced for cash sale to Old Crow visitors. These sales occur primarily through ‘word of mouth’; the lack of a local sales outlet and distribution system for outside sales currently hampers this economic activity in Old Crow.

4.1.7.5 Assessing the Current ‘Value’ of Traditional Economic Activities

Attempting to establish a monetary value for traditional economic activities is difficult, and may not be a relevant approach. Berman et al. (2004) developed an agent-based model for Old Crow that explored the ‘mixed economy’ of the community in the context of potential economic and traditional harvesting futures under various development and climate change scenarios. In this exercise, the relative ‘value’ of subsistence harvesting was not converted to dollar figures, but instead measured in the context of number of animals harvested and corresponding median incomes. Such an approach appears to reflect a more reasonable alternative to assigning monetary value to harvesting activities. No further attempts have been made in this report to assess the economic value of traditional economic activities in Old Crow.

The cultural value of harvesting, and the spiritual connection between VGFN citizens and wildlife, cannot be converted to a monetary value. It is invaluable, and must be recognized as central to the continuation of VGFN culture.

4.1.7.6 Future Participation Rates in Traditional Economic Activities

It is difficult to say with certainty to what level future Old Crow residents will participate in traditional economic activities. Future participation rates may be influenced by many factors, with the most important likely being: 1) the type and level of wage-based economic opportunities available in Old Crow and the region, and 2) social choice. Future generations may not choose to participate in traditional economic activities, but future generations should have that option. Maintaining a suitable land base for such activities to occur, while ensuring that the land, water and wildlife populations remain healthy are appropriate ways to ensure future economic choices are available.
For the foreseeable future, Old Crow residents will likely continue to participate in wage-based economic activities while desiring to maintain subsistence harvesting activities and opportunities, and the resources upon which those activities depend.

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Yukon First Nations Harvest Surveys. 1988-94. Unpublished survey data available from G. Kofinas with permission from the Vuntut Gwitchin First Nation.

4.1.8 Transportation

Road access to and within the region is currently limited, and management of new and existing transportation corridors requires careful consideration. Road, air and water are all important modes of transportation in the North Yukon Planning Region. This section addresses existing and future road, surface and air transportation considerations. Water (river-based) transportation is an important consideration for community use and wilderness tourism; it is addressed under those relevant sections (Sections 3.3 and 4.2.1, respectively).

Key Findings

- The Dempster Highway is the only all-weather, maintained highway in the region, and is an important multi-use corridor
- Scheduled daily air service and semi-annual operation of a winter road provide adequate transportation and freight options for the community of Old Crow, at present
- A future potential Mackenzie Valley Highway Extension would have a very large impact on the level of freight and industrial traffic using the Dempster Highway
- The existing low level of transportation infrastructure is considered to be a barrier to future economic development
- Current conceptual road, rail and port transportation proposals are unlikely to occur within, or significantly affect, the region in the coming decades
- New all-season road infrastructure will not likely be constructed without a significant increase in the level of industrial land use activity. It is unlikely that new all-season access roads would be constructed in advance of such activity; they will respond to the location of industrial land uses

Background

There are few other regions in North America that remain as inaccessible as the North Yukon Planning Region. The Dempster Highway is the only all-weather, maintained highway, and only provides access to the southeastern portion of the region. While the current low level of transportation infrastructure is considered to be a barrier to future economic development, the un-roaded nature of the region assists in maintaining a high level of ecological integrity. Roads require careful management consideration. Perhaps more than any other factor, transportation networks and infrastructure have a major influence on the pattern of land use and economic development in remote northern jurisdictions. Roads also have the potential to create a large amount of social change and ecological impacts.

Potentially increasing levels of transportation infrastructure (i.e. roads) in the vicinity of Old Crow was anticipated to require special consideration by the VGFN Final

Agreement. Specific Provision 11.10.0 requires that a regional land use plan for the area provide a specific recommendation regarding an all-weather road to Old Crow.

Available Information

Available transportation information sources include Yukon Government records, Government of Northwest Territories transportation studies (e.g., GNWT 1999), conceptual transportation corridor studies (Access Consulting Group 2003), and recent rail and port feasibility assessments (ALCAN RaiLink Inc. 2007; KPMG LLP and Gartner Lee Limited 2007). Air passenger and freight levels are summarized in Inukshuk Planning and Development et al. (2000). Information on Old Crow resident travel patterns was obtained through community workshops with additional input from NYPC members.

4.1.8.1 Existing Transportation Infrastructure

Appendix 1, Maps 1-2 shows the location of existing road transportation infrastructure, the Dempster Highway and the Old Crow winter road. Known airstrips (condition uncertain) are shown on Map 49, Appendix 1.

4.1.8.1.1 Dempster Highway

The Dempster Highway links the Yukon and southern Canada to the Mackenzie delta communities of Ft. McPherson, Tsiigehtchic and Inuvik in NWT. Constructed in phases during the 1950s and 1960s, the approximate 736 km highway was not fully completed until 1979. The surfaced gravel highway traverses approximately 200 km of the southeast portion of the planning region, through Eagle Plains and skirting the foothills of the Richardson Mountains. Near the Ogilvie River, the highway is bordered by a Vuntut Gwitchin (VG R-08A) and a Tr'ondek Hwech'in land selection (TH R-49A).

The Dempster Highway provides an important corridor for many activities, including transportation, tourism, subsistence harvesting and communications. The highway is recognized as critical infrastructure for future regional economic development. A cooperative Yukon Government and northern Yukon First Nations (VGFN, THFN, and NNDFN) effort to develop an economic development plan for the Dempster Highway area is ongoing. In 2005, the highway was designated as a Northern and Remote Route under the National Highway System (Council of Ministers Responsible for Transportation and Highway Safety, 2005).

During the period 1993 – 2003, an average of 40 vehicles per day travelled the Dempster Highway (Figure 4.1.8.1). There is a strong seasonal pattern with summer (June – August) traffic averaging about 90 vehicles per day, and winter use dropping to about 35 vehicles per day. During summer, peak traffic levels of 150 – 200 vehicles per day occur occasionally. Should the Mackenzie Gas Project be constructed, the level of industrial traffic directly associated with the project utilizing the Dempster Highway is expected to be within the range of historical peak traffic volumes (Imperial Oil Resources Ventures Ltd, 2004). However, the project is anticpated to induce higher levels of industrial and passenger traffic use of the Dempster Highway than initially stated.

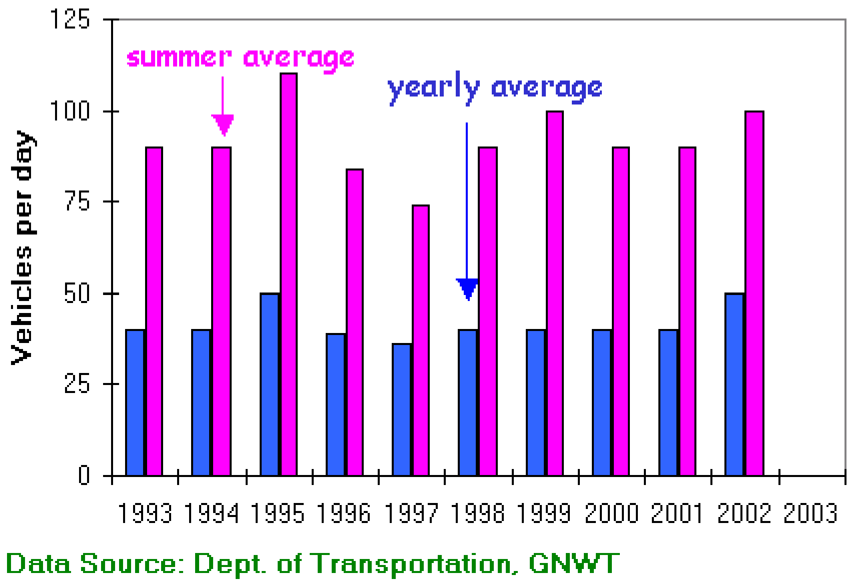

Figure 4.1.8.1. Dempster Highway traffic levels for period 1993 – 2003 as recorded near Yukon – NWT border.[1]

The Dempster Highway is managed under a special regime; it is the only highway in Yukon managed by specific regulations. The *Dempster Highway Development Area Regulations* apply within 8 km on each side of the road centre line, for a total corridor width of 16 km (Appendix 1, Map 2). The regulations are intended to provide for a higher level of environmental assessment and regulation of activities for new road access originating off of the highway within the 16 km corridor.

4.1.8.1.2 Old Crow Winter Road

The Old Crow winter road provides transportation between the Dempster Highway, near Eagle Plains Lodge, and the community of Old Crow. The winter road was first established in the 1970s on a series of historical seismic lines and exploration trails. The road is opened on an ‘as needed’ basis; historically this has been once every 3-5 years. The winter road provides an opportunity to transport large shipments of materials,

[1] Figure from http://www.taiga.net/coop/indics/demp.html. Data recorded at km 34, Dempster Highway, NWT (Counter ID# 8-34), as collected by the GNWT Department of Transportation. A similar pattern and level of traffic has been recorded for the southern portion of the Dempster Highway near Tombstone Territorial Park (km 65, Klondike Highway Camp)

equipment and vehicles to the community. Depending on conditions, the winter road has cost between $0.5-1.0 million to construct and maintain for a 2-4 week late winter operating period.

Given these high costs, the road is only constructed when economics permit. Semi-annual construction of the winter road is currently adequate and cost effective to transport occasionally required large commodities to Old Crow.

4.1.8.1.3 Air Transportation

Transportation of goods and people to and from Old Crow is facilitated by daily air service from Air North, a Yukon-based airline. The Vuntut Gwitchin Development Corporation has partial ownership of the airline. Daily air service to the community has only occurred in the past decade. Regular scheduled or chartered air service transports all freight to and from the community, including food supplies, general cargo, construction materials, and diesel, gasoline and heating fuel. In 1999, Air North carried approximately 268 tonnes of general freight, food supplies and building materials, and 412 tonnes of fuel (Inukshuk Planning and Development et al., 2000). High air freight transportation costs make the daily cost of living approximately double that of Whitehorse. A new airport terminal was recently constructed in Old Crow, and the runway was resurfaced. The other major serviceable airstrip in the region is the Parsons airfield near Eagle Plains Lodge. Parsons airfield is accessible from the Dempster Highway.

Air transportation plays a large role in oil and gas and mineral exploration (Figure 4.1.8.2). Some wilderness tourism activities also require air transportation services. A large number of temporary airstrips were constructed throughout the region in the 1950s – 1980s to support oil and gas and mineral exploration activities. The current condition of all airstrips is not known, but most are not considered to be unserviceable. Access Consulting Group (2003) provides a list of known airstrips in the region. These are also shown on Appendix 1, Map 49.

Figure 4.1.8.2. Orma Hill airstrip near Rusty Springs mineral claims west of Ni'iinlii'njik (Fishing Branch) Wilderness Preserve. Photo: G. Bradshaw, YGS.

4.1.8.2 Future Transportation Infrastructure

4.1.8.2.1 All-season Road to Old Crow

VGFN Final Agreement Specific Provision 11.10.0 requires that a regional land use plan for the area provide a specific recommendation regarding an all-weather road to Old Crow.

The possibility of an all-season road to Old Crow has received limited attention. At this time, no formal feasibility or engineering studies have been completed. Based on preliminary estimates prepared by Yukon Department of Transportation and Engineering, construction costs for a two lane gravel road would be approximately $400,000/km (W. Hidinger, Manager, YG Highways and Public Works, pers. comm., June 2005). Assuming a route similar to the existing Old Crow winter road, the all-season road would be approximately 200 km in length. Given these estimates, construction costs in the order of $80 million could be expected.

Given current levels of economic activity in the Old Crow area, and the projected low increases in population, it is unlikely that an all-season road would be economically feasible in the coming decade. Should all-season industrial access roads be constructed into the Eagle Plain oil and gas basin, construction of an all-season road between these access roads and Old Crow may become economically feasible.

4.1.8.2.2 All-season Access Roads

New all-season access roads would be required to support future potential oil and gas or mineral production. While new roads would be required, it is unlikely they would be constructed in advance of major resource discoveries or significant increases in the level of industrial activity. Given this situation, the location of future potential all-season access roads cannot be predicted with any certainty, as a future all-season access road network would respond to the location of natural resource discoveries.

Initial phases of energy sector or mineral exploration would not likely require or result in construction of new all season access roads. Winter surface access and air transportation would be used during the initial phases of mineral or hydrocarbon exploration. However, commodity production would require new all-season access roads. The potential Eagle Plains natural gas scenario developed by Fekete (2006) and described in this report (Section 4.1.2) concludes that 1,000 – 1,500 km of gravel access roads would be required to develop the expected Eagle Plain natural gas resource. Any mineral development in the Ogilvie Mountains would require a 100 – 300 km access road, connecting to the Dempster Highway.

A possible future access road network would expand outwards from the Dempster Highway in an incremental manner, and would follow the pace and location of resource production. Currently, the Eagle Plain oil and gas basin is considered to have the highest probability for construction of new all-season access roads. The natural gas scenario described in Section 4.1.2 suggests that a significant amount of new access road construction is unlikely to occur in the coming decade, but may develop rapidly after that time.

4.1.8.2.3 Air Transportation

The level of passenger and freight service to Old Crow is not expected to change significantly in the coming decade. The upgraded airport terminal and runway will serve the community's future air transportation requirements for many years.

If the level of industrial land use increases in northern Yukon, additional temporary and gravel airstrips would be required to service the oil and gas and mineral sectors. While it is not currently possible to determine how many airstrips would be constructed or their locations, a similar number of airstrips as constructed historically could be expected (see Appendix 1, Map 49). Similar to all-season access roads, the Eagle Plain oil and gas basin is considered to have the highest probability for construction of a large number of new airstrips.

4.1.8.2.4 Mackenzie Valley Highway Extension

With renewed interest in the Mackenzie Valley Pipeline, and the associated large capital investment it would create for the Mackenzie delta region of NWT, a long-standing proposal to construct an all-season highway along the Mackenzie River valley has been advanced in recent years. The proposed surfaced gravel road would run from Wrigley to the Dempster Highway near Inuvik (Government of Northwest Territories 1999). If the Mackenzie Valley Highway Extension were to be constructed, it would have a major influence on the type and level of Dempster Highway traffic use. The majority of freight and industrial traffic currently travelling from southern Canada to Inuvik along the Dempster Highway would be redirected to the Mackenzie Valley Highway, given the much shorter distance. However, with projected construction costs of over $500 million (1999 estimate – Government of Northwest Territories, 1999) the feasibility of the extension has yet to be demonstrated or financed. Given this situation, it will be many years (potentially decades) before such a highway becomes operational.

4.1.8.2.5 Major Road, Rail and Port Concepts

Conceptual Infrastructure Access Corridors

A variety of major road and port concepts have been described for northern Yukon. Access Consulting Group (2003) identified potential natural resource infrastructure corridors for the entire territory. Four corridors are included in the North Yukon Planning Region: 1) Kandik Resource Corridor, 2) Old Crow Resource Corridor, 3) Dempster Lateral Resource Corridor, and 4) North Yukon Coast Resource Corridor (Figure 4.1.8.3). The Dempster Lateral Pipeline concept has been in existence since the 1970s and was promoted as an alternative to the Mackenzie Valley Pipeline; it generally follows the Dempster Highway. The Old Crow resource corridor is envisioned to provide access to the central Eagle Plain oil and gas basin. The North Yukon Coast Resource Corridor is a long-standing concept to develop a road from the Dempster Highway, traveling north through the Richardson Mountains up the Bell River, to the Yukon North Slope. The road would provide access to King Point, a conceptual port location on the Beaufort Sea, and potential mineral resources. The Kandik resource corridor provides access to the Kandik oil and gas basin and potential mineral resources in the Ogilvie Mountains.

None of these infrastructure corridor concepts have received formal feasibility studies. With the exception of a central Eagle Plain route, all appear unlikely in the coming decades. As stated in Section 4.1.8.2.2 above (all-season access roads), major all-season access roads, which may also be considered ‘roads-to-resources’ such as those described by Access Consulting Group (2003), are not anticipated in advance of significant oil and gas or mineral discoveries. The existence of the North Yukon Interim Land Withdrawal, both within the planning region and on the Yukon North Slope in the Inuvialuit Settlement Region, currently precludes potential construction of a North Yukon Coast Resource Corridor.

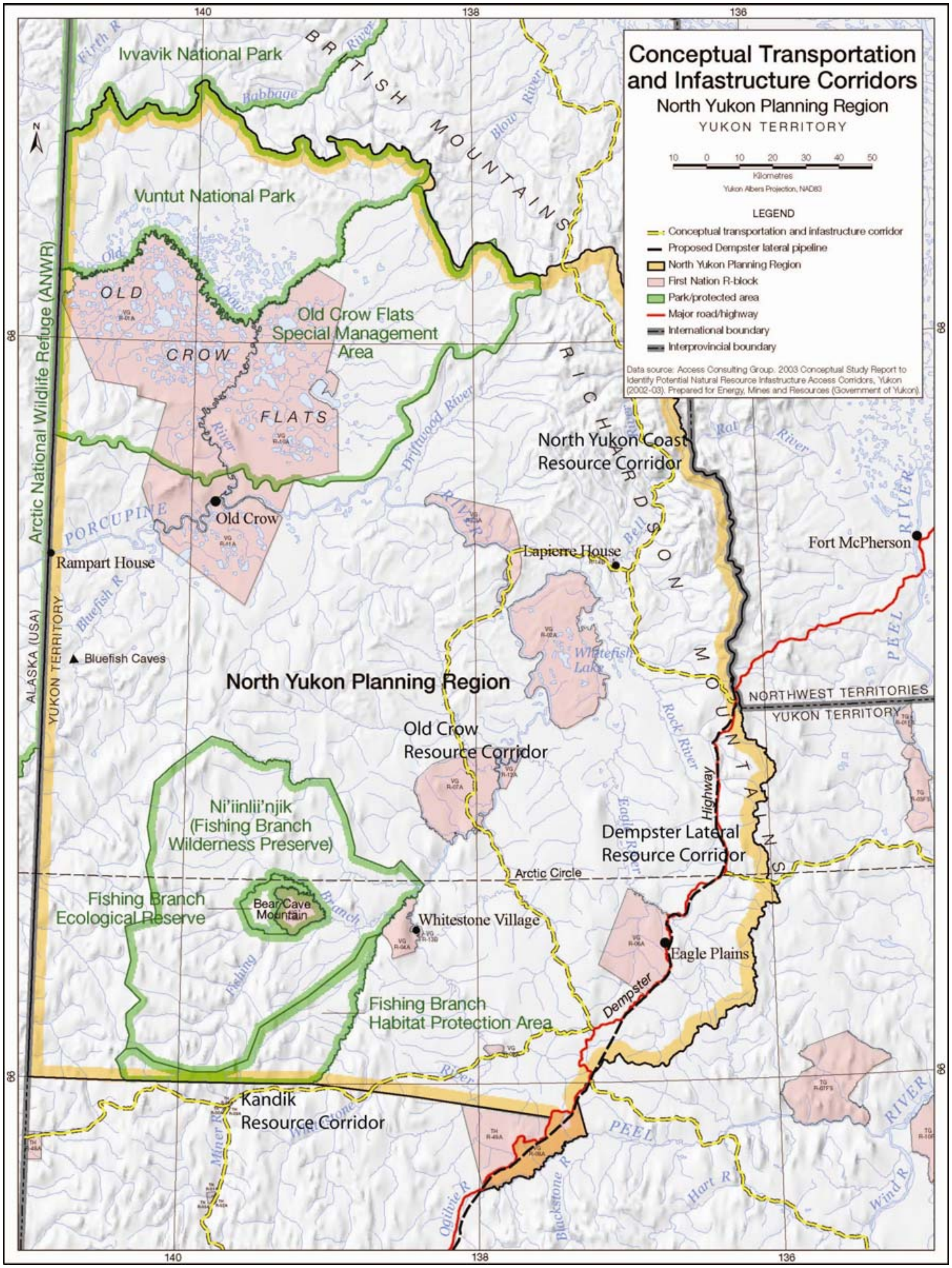

Figure 4.1.8.3. Conceptual transportation and infrastructure corridors in North Yukon Planning Region. Source: Access Consulting Group (2003).

Rail and Port Concepts

The recently completed Yukon-Alaska railroad study does not envision a potential rail line within the planning region (ALCAN RaiLink Inc., 2007). However, a rail line in the Dawson or Carmacks area may provide a positive influence for future resource development project economics, primarily through decreased bulk commodity transportation costs. The associated port assessment for the rail project (KPMG and Gartner Lee Limited, 2007) does not consider King Point to be a feasible port option for Yukon shipping in the coming decades.

4.1.8.3 Socio-economic Considerations

Perhaps more than any other land use features, new roads and access routes have the potential to transform the North Yukon Planning Region. Socio-economic change caused by a potential all-season access road to Old Crow would require special consideration, and is required by the VGFN Final Agreement. New roads and access routes may have both positive and negative socio-economic effects. Socio-economic considerations regarding new roads and surface access are discussed in Section 4.4.

4.1.8.4 Ecological Considerations

The potential ecological impacts and environmental risks of linear developments and transportation features have been reviewed extensively (e.g. Jalkotzy et al. 1999 and Salmo et al. 2004). Important ecological and land use considerations specific to the region are discussed in Section 4.4. Key ecological issues associated with construction and use of new roads and access routes include:

- Linear features, including access roads and seismic lines, contribute to direct loss and fragmentation of wildlife habitat
- Linear features, and peoples use of those features, may result in indirect impacts on wildlife, including avoidance of such features, increased harvest pressures, and/or increased levels of predation
- Where roads and access routes cross watercourses, stream crossings may impact fish through direct habitat disturbance, or indirectly through increasing harvesting pressures
- In permafrost landscapes, access road construction requires significant quantities of gravel. Winter ice roads may require significant volumes of water.
- Water and gravel withdrawals necessary for road building or maintenance may cause direct disturbance to fish and wildlife habitat
- Where all season roads and access routes become established, they tend to persist for long periods of time. It is difficult to regulate and manage use of these features, making full decommissioning and reclamation difficult

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4.1.9 Guiding and Outfitting

There are no guiding and outfitting activities occurring in the North Yukon Planning Region. VGFN view the communal use of wildlife and fish resources for subsistence purposes as culturally important, and not to be used for monetary gain. VGFN does not currently wish to participate in or have commercially guided sport hunting or fishing occur within their traditional territory.

Key Findings

- There are no guiding/outfitting concessions in the Planning Region (minor inclusions)
- VGFN does not wish to participate in or have commercially guided sport hunting or fishing occur within their traditional territory at this time.
- Guided sheep hunting in the Bell River area of Richardson Mountains may represent future guiding and outfitting opportunities, should they be considered acceptable at a future date.
- Caribou hunting along the Dempster Highway brings Yukon and NWT First Nation and non-aboriginal resident hunters to region, but this activity is not a guiding or outfitting activity.

Background

Guiding and outfitting is managed by the Yukon Government Department of Environment and regulated by the Yukon *Wildlife Act* and VGFN Final Agreement Chapter 16 (Fish and Wildlife).

Guiding and outfitting concessions are legally-recognized commercial hunting areas. There are twenty outfitting concessions in the Yukon. Each concession is owned and operated by an outfitter; no other outfitter may operate in the same area. There are no guiding and outfitting consessions in the planning region, with the exception of very small portions of Concession #1 (Reynolds Outfitting Ltd.) and Concession #2 (Blackstone Outfitters) located along the most southerly portion of the boundary. Both outfitting consessions are in Game Management Zone 2.

Game Management Zones are a way of creating land management units for the purpose of managing wildlife populations, specifically harvest management. The majority of the planning region is in Game Management Zone 1. A very small part of the planning region, in of the southwest corner near the Kandik River, is in Game Management Zone 2.

4.1.9.1 Current Situation

In some areas of Yukon, guiding and outfitting is an important economic activity. In the North Yukon Planning Region, commercial guiding and outfitting activities are not currently occurring. The small portions of outfitting concessions that do occur within the region are minor inclusions of large parcels to the south of the area, and do not receive a high level of use by the owners.

The harvesting of wildlife and fish resources for subsistence use plays an important role in Vuntut Gwitchin culture and economy. However, VGFN view the use of these resources as a communal and cultural activity; they are not to be used for monetary gain. Given this position, VGFN does not currently wish to participate in or have commercially guided sport hunting or fishing occur within their traditional territory.

4.1.9.2 Future Situation

VGFN's position on commercially-guided sport hunting and fishing activity will not likely change in the coming years; guiding and outfitting activity based on hunting and sport fishing is therefore not anticipated.

Non-consumptive guiding and outfitting tours may represent future business and employment opportunities for VGFN citizens and other residents of Yukon. A range of opportunities related to wildlife viewing and wilderness travel have been recognized as potential tourism opportunities by the North Yukon Tourism Strategy (see Section 4.2.1).

4.1.10 Economic Assessment: Conclusions

Section 4.1 provides an assessment of current economic activities and future economic potential. Appendix 1, Map 48 provides a generalized overview of important areas for future economic development consideration, with focus on oil and gas, tourism and recreation, and transportation[1]. Major conclusions are as follows:

Tourism and Recreation

- Outside of the Dempster Highway corridor, the level of tourism and recreation activity is currently low. Tourism has the potential to grow into a small-scale, carefully managed industry
- Old Crow residents do not desire mass tourism. The development of a North Yukon tourism industry must respect the values and desires of Old Crow residents
- While the region holds impressive natural and cultural features, North Yukon will likely appeal to a small and specialized market
- Future tourism products and experiences will be marketed around intact wilderness landscapes, wildlife and Vuntut Gwitchin culture. Old Crow community visits, river-based wilderness travel, wildlife viewing, learning vacations, and Dempster Highway-related activities are possible future tourism markets
- Specific areas of future tourism and recreation interest include the community of Old Crow, the major rivers, existing protected areas and historic sites, the Dempster Highway, and the Richardson Mountains, particularly along the Dempster Highway in the vicinity of Rock River, and Summit Lake-Bell River

Oil and Gas Resources

- The North Yukon Planning Region, specifically the Eagle Plain oil and gas basin, contains a significant portion of Yukon's total estimated natural gas and oil potential
- Given its proximity to the Dempster Highway, proven reserves and relatively high level of historical exploration, Eagle Plain is currently the area of highest industry interest for exploration and development. Eagle Plain contains 17 oil and gas land parcels, covering approximately 5,000 km^2 (9%) of the planning region. All existing oil and gas permits and significant discovery licenses within the planning region are located in Eagle Plain. The general area of current oil and gas permits, in the southern portion of the Eagle Plain basin, is expected to experience the highest levels of future potential energy sector activity
- The expected recoverable natural gas resource is significant enough to make Eagle Plain an economically viable play. However, substantial challenges must be overcome. Key factors include the prior development of a natural gas pipeline in a

[1] Note: Mineral potential is not currently shown on Map 48 due to uncertain knowledge of resource.

neighbouring jurisdiction, and access to that pipeline. The Mackenzie Valley Pipeline is considered critical to the future development of the Eagle Plain natural gas resource. The most economical way to transport Eagle Plain natural gas would be through a North Yukon Gas Pipeline along the Dempster Highway, connecting to a future Mackenzie Valley Pipeline

- While highly uncertain, a plausible natural gas scenario does not see natural gas production occurring until at least 2025, preceded by a 10-15 year period of focused exploration and infrastructure development
- Development of the natural gas resource is expected to require a significant level of exploration and production infrastructure, and capital investment. Preliminary engineering estimates approximately 10,000 km of seismic lines, 700-900 total wells, 1,300 km of gathering pipelines, and 1,500 km of all-season access roads would be required
- The expected oil resource is not sufficient to support large-scale production. Small-scale oil production may proceed separately from, and prior to, natural gas production.

Mineral and Coal Resources

- Relative to other areas of Yukon, the North Yukon Planning Region is currently considered to host lower mineral and coal potential. Given the low levels of historical exploration, this conclusion is based on a limited understanding of potential mineral and coal resources
- Mineral and coal exploration interest and activity in North Yukon Planning Region have historically been low, but are increasing. The region currently contains about 480 active quartz mineral claims, covering an area of 11,000 ha. Most are located along the Dempster Highway in the vicinity of the Richardson Mountains
- Given the existing situation, the potential for a producing mine to be operating within the next 10-15 years is unlikely. Mine development will not likely be realized without additional transportation infrastructure.

Aggregate Resources (Gravel, Sand and Crushed Rock)

- Aggregate is a critical resource needed to support the development of transportation, municipal and industrial infrastructure in northern permafrost landscapes
- Suitable sources of aggregate are considered to be relatively scarce in the region. Based on existing information, much of the aggregate potential of the region is associated with rivers and river valleys
- Any future industrial land use activity will require large amounts of aggregate. Obtaining adequate supplies of aggregate to support potential large-scale industrial land uses may require significant areas of land to be disturbed

Forest Resources

- Due to permafrost conditions, cold climate and active fire regimes, the region has no or very limited commercial forestry potential
- Tall stature, large diameter trees are generally confined to major river and stream valleys, creating a resource of very limited extent
- Forest resources are a local community management issue. At this time, a detailed forest management plan is not required for the planning region

Renewable Energy

- About 65% of Old Crow's energy is produced from non-renewable sources
- All electrical generation is currently produced by diesel power generation, contributing to relatively large per capita contributions of greenhouse gases
- While there has been limited assessment of renewable energy sources in the region, current information suggests that cost effective renewable energy options may be limited
- Future energy production will likely utilize some renewable energy options but will not fully replace diesel power generation in the near future. Increasing the efficiency of existing energy sources will be an important energy conservation strategy for Old Crow

Traditional Economy

- Vuntut Gwitchin participation rates in traditional economic activities and subsistence harvesting remains high
- Subsistence harvesting and traditional economic activities play an important role in the maintenance of Vuntut Gwitchin culture and community well being, but also serve to off-set the high cost of food items in Old Crow
- Levels of subsistence use are highest in the vicinity of Old Crow, but areas as far as Bell River, Whitefish Wetlands and Whitestone Village are used occasionally

Transportation

- Scheduled daily air service and semi-annual operation of the Old Crow winter road provide adequate transportation and freight options for the community of Old Crow, at present
- The Dempster Highway is the only major all-season road in the planning region, and is of critical importance to the Mackenzie Delta communities in NWT. A future potential Mackenzie Valley Highway Extension would have a very large impact on the level of freight and industrial traffic using the Dempster Highway

- New roads and access routes require careful management consideration. More than any other land use features, new roads and access routes have the potential to transform the North Yukon Planning Region.
- Current conceptual road, rail and port transportation proposals are unlikely to occur within, or significantly affect, the region in the coming decades
- New all-season road infrastructure will not likely be constructed without a significant increase in the level of industrial land use activity. It is unlikely that new all-season access roads would be constructed in advance of such activity; they will respond to the location of industrial land uses

Guiding and Outfitting

- There are no guiding and outfitting concessions or activities occurring in the North Yukon Planning Region (minor inclusions of two concessions are located along the southern planning region boundary)
- VGFN does not wish to participate in or have commercially guided sport hunting or fishing occur within their traditional territory at this time

Summary

Given the current situation, the level of human-caused change in the region is expected be relatively low over the next 5-10 years. Increasing levels of oil and gas and mineral exploration activity may continue, but major activities and infrastructure development are not anticipated in the coming decade. Levels of wilderness and cultural tourism may increase, but growth is expected to be modest. Large-scale hydroelectric developments are unlikely. The existing road transportation network will not grow significantly in the absence of large increases in the level of industrial land use activity. The highest level of land use activity will continue to be focused along the Dempster Highway corridor, and adjacent areas. The area around Old Crow will continue to be the focus for VGFN traditional economic and cultural activities, with most activities occurring along the Porcupine River, Bluefish Wetlands and Old Crow Flats.

Of the land uses and economic sectors examined, potential future natural gas exploration and production-related activities have the greatest potential to cause landscape-level change in the coming decades. This activity would require associated land uses, most notably all-season road construction, aggregate (gravel) extraction and potential surface water withdrawals. Most, if not all energy sector activity is anticipated to be focused on the southern portion of the Eagle Plain oil and gas basin. Centered on the Chance Creek area, the highest level of activity would be south of Whitefish Wetlands, bounded by the Whitestone, Porcupine and Eagle rivers. Some level of exploration and possibly development could expand across the entire Eagle Plain oil and gas basin, if natural gas production were to occur. While Eagle Plain natural gas production may eventually be realized, its future remains highly uncertain, and is influenced by developments in adjacent jurisdictions, most notably the Mackenzie Valley Pipeline in NWT.

4.2 Existing Land Use Impacts

Historical and current land use activities in the North Yukon Planning Region were described in Sections 3 and 4.1. This section provides an assessment of existing land use impacts in the North Yukon Planning Region. This assessment is based on documented human-caused surface disturbances and infrastructure that can be mapped. Human-caused surface disturbances can be considered development ‘footprints’. Contaminated sites are also discussed. The assessment of existing land use impacts provides a general assessment of cumulative habitat impacts and ecological integrity.

4.2.1 Human-caused Surface Disturbances and Land Use Features

Land use activities have resulted in the creation of surface and vegetation disturbances ranging from small features that regenerate quickly to relatively permanent features such as the Dempster Highway. Most areas of the region contain very few documented human-caused caused surface disturbances. Some areas have experienced relatively high levels of surface disturbance impacts. New human development footprints will be cumulative with historical levels. Understanding and documenting the status of these features is therefore important. Establishing a baseline condition for current levels of land use impacts is an important consideration for regional land use planning and future land use monitoring.

Key Findings

- Appendix 1, Map 49 shows the location of documented human-caused surface disturbances in the North Yukon Planning Region.
- Currently, 8,125 ha of surface disturbance and 8,140 km of linear features are estimated within the region. Non-permanent historical and current linear features (seismic, trails, tote roads, etc.) account for the majority of surface disturbance impacts
- A minimum of 20% of historical non-permanent linear features are in a state that can be considered reclaimed, a conservative regional average that varies by landscape type and fire history.
- The highest cumulative habitat impacts have occurred within the central Eagle Plain oil and gas basin, in the Chance Creek, Whitestone and Johnson Creek Ecodistricts.
- The status of human-caused surface disturbance and linear density indicators should currently be viewed as estimates that represent the ‘best available data’
- Based on this analysis, nowhere in the region appears to have experienced critical levels of cumulative habitat-related impacts, nor has ecological integrity been compromised

4.2.1.1 Definitions

The following definitions are central to a discussion of human-caused surface disturbance and disturbance impacts.

Human-caused Surface Disturbance

Human-caused surface disturbance is a general term used to describe the physical disruption of soil or hydrology, or the clearing of trees and woody vegetation. The amount of surface disturbance provides a measure of direct habitat-related impacts. Human-caused surface disturbance may also be considered the direct human '**footprint**' on a landscape that results from land use activities.

The amount of human-caused surface disturbance can be measured as a discrete area (e.g., ha or km^2), or as the proportion of a defined unit of analysis (e.g., % of an Ecodistrict or other land management unit).

Some land use footprints are relatively permanent, such as highways or municipal infrastructure. Other land use footprints are temporary in nature, and may exist on the landscape for short periods of time. Examples of non-permanent footprints may include low impact seismic lines or winter trails.

Linear Features

Linear features are roads, trails, seismic lines, power transmission lines, and similar features; they are a type of human-caused surface disturbance that facilitates access into previously inaccessible areas.

The amount of linear features can be measured as a discrete length (e.g., km of features), or expressed as the total length of all linear features per unit of analysis (e.g., km of features / km^2 of land area). The latter method, known as **linear density**, is the most relevant measure for land and resource management as it describes both the amount and spatial distribution of linear features within a given area.

Linear density provides a measure of **landscape fragmentation**, and may therefore also be used as an index of **core habitat** area. Landscape fragmentation is the disruption of large contiguous areas of habitat into smaller, less contiguous areas of habitat. Core habitat refers to the area of a landscape that remains intact and unaffected by physical human disturbances.

Functional Disturbances

Not all human-caused surface disturbances or land use activities result in functional disturbance. Functional disturbances are human-caused physical land use disturbances that result in significant disruption of soil or hydrology, or that require the cutting of trees and woody vegetation. Some land use activities result in very limited or no direct surface-disturbance impacts. Initial helicopter-supported mineral exploration, no-trace wilderness camping, and snowmobile travel across frozen ground would be examples. Other activities such as gravel extraction or all-season road construction result in the creation of long-term functional disturbances. In northern permafrost landscapes, industrial land use activities that do not result in functional disturbances include the following:

- creation of new linear features (seismic lines, trails, survey lines, etc.) in forested areas less than 1.5m in width (these features do not contribute significantly to increased access, and generally revegetate quickly)
- winter land use activities that occur on frozen waterbodies
- winter land use activities that occur in non-forested landscapes where the clearing of woody-vegetation is not required, and where activities do not result in soil or hydrology disruption
- winter activities that utilize existing un-reclaimed human-caused disturbances

Reducing the amount of functional disturbance created by land use activities is an effective strategy to minimize potential habitat-related impacts. Minimizing the size and intensity of surface disturbances is a common strategy used to achieve the goal of functional disturbance reduction.

Reclamation / Revegetation

Reclamation is the process of applying focused or deliberate actions to restore a disturbed area to an undisturbed or desired condition, or to a former productive capacity. Reclamation activities generally attempt to restore disturbed lands resulting from localized human land use impacts, including gravel pits, mine sites, roads or contaminated soils.

Revegetation is the process where natural plant succession reclaims or restores a disturbed site without human intervention. Linear features such as seismic lines, which may be many kilometres in length and occur in remote areas, return to an undisturbed condition through the process of revegetation.

The point or condition when a disturbed site can be considered to exist in an ‘undisturbed condition’ is an important consideration for human-caused surface disturbances. By example, forest management has established free-to-grow standards for forest harvest blocks. When trees are a certain height and density, the harvest block is no longer considered a disturbance; it is considered to be a young, regenerating forest.

Some definitions of reclaimed relate to the visual removal of the feature. However, in northern environments, human footprints may remain readily visible for many decades due to differences between regenerating and mature vegetation conditions. Establishing a definition for reclaimed should consider the major impacts caused by the human-caused disturbance, and the management goals for the area. In the North Yukon Planning Region, the following definition for ‘**reclaimed**’ is suggested:

> *"a linear feature or other human-caused surface disturbance that in its current state, does not facilitate increased access or travel. In forested areas, a feature can be considered reclaimed when it contains woody vegetation (trees and shrubs) approximately 1.5m in height"*

A key consideration for this definition is related to access and ungulate management. In some studies, human-caused footprints, especially linear features, facilitate increased access (hunting) and predator movement/success (mortality). Both factors can contribute to increased mortality of caribou and moose, two of the focal species for the region. Considering the future anticipated land uses in northern Yukon, creating increased opportunities for motorized access and predator movement as a result of linear feature creation will likely be a larger management issue than direct habitat loss.

The rate and process of reclamation / revegetation is variable and may be influenced by a number of factors including intensity of the surface disturbance, size of the feature, intensity of feature use (access legacy), landscape type and natural disturbance history. Different types of surface-disturbances may have characteristic rates and processes of reclamation / regeneration on different landscape types.

4.2.1.2 Concepts

A significant consequence of most land use activity is the creation of surface disturbance and linear features. A growing body of research suggests that the total amount of human-caused surface disturbance and density of linear features is related to overall ecological integrity of natural systems (Duinker, 2000; Dyer et al., 2001; Environment Directorate, Northern Affairs Program, 2002; Cameron et al., 2005). As the total amount of surface disturbance and linear feature density increases, so do the risks to wildlife and fish populations, and overall ecological integrity (Figure 4.2.1.1).

Depending on the nature of the surface disturbance, temporary or permanent habitat loss will result. Increases in linear density may result in decreased core habitat area for focal wildlife species, a shift to introduced species such as white-tailed deer and coyote, restricted movement for migratory animals, increased human-caused mortality, and increased predation rates. A decreasing occurrence and abundance of many mammals, including caribou, has been correlated with increasing road density (Carroll et al., 2001; Forman et al., 2003).

Given their potentially significant ecological consequences, **human-caused surface disturbance and linear features may be considered relevant and practical indictors of cumulative effects, and overall ecological integrity.**

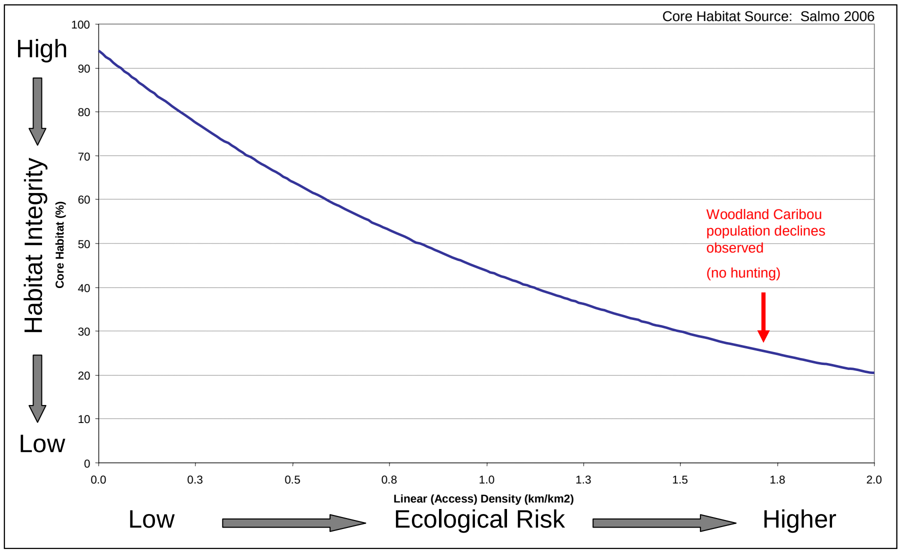


Figure 4.2.1.1. General relationship between linear density (km/km^2), habitat integrity, and ecological risk, as determined from research in boreal forested landscapes. Figure adapted from Environment Canada, Northern Division (2006).

4.2.1.3 North Yukon Planning Region Feature Types

Historical and current land use activities have resulted in the creation of different land use features and human-caused surface disturbances. Table 4.2.1.1 categorizes the major land use feature types in the North Yukon Planning Region. A variety of information sources were utilized to identify and map land use features and human-caused surface disturbances; these are referenced in Table 4.2.1.1. Figure 4.2.1.2 provides a visual reference for some of those features.

Settlements, traditional camps, all-season roads, airstrips and a variety of non-permanent linear feature types are present in the region; linear features are the most conspicuous and numerous. For the purpose of analysis and reporting, ‘Seismic Lines’ and ‘Trails’ may be considered similar feature types; they are both non-permanent linear features associated with historical resource exploration and transportation activities.

Table 4.2.1.1. North Yukon Planning Region land use feature types.

Feature Type	Width (m) *	Description	Data Source
Linear Features			
Major Road	60	Dempster Highway	Transportation features from 1:50,000 scale National Topographic Database
Access Road	10	All-season gravel access roads (Crow Mountain gravel quarry road, communication tower roads, etc.)	Transportation features from 1:50,000 scale National Topographic Database
Winter Road	10	Old Crow Winter Road. This is considered to be a ‘permanent’ feature, as it is maintained and receives periodic use.	Transportation features from 1:50,000 scale National Topographic Database
Seismic Line	8	Features classified as seismic lines in the Yukon Government Oil and Gas Management Branch Seismic Line database. Prior to 1990, historical seismic lines were on average 8m in width. Future seismic lines are anticipated to be 5m or less in width.	Yukon Government Oil and Gas Management Branch Seismic Line database (feature type). Seismic Lines are represented spatially by transportation features of 1:50,000 scale National Topographic Database (see Methods, 4.2.1.4.1, for details).
Trail	8	Unclassified linear features as recorded in the transportation layer of 1:50,000 scale National Topographic Database. Most ‘Trails’ are considered to be historical seismic lines and associated winter tote roads.	Transportation features from 1:50,000 scale National Topographic Database (see Methods, 4.2.1.4.1, for details)
Community Use Trail	3	Old Crow community use trails as identified through land use workshops. Some trails utilize historical Seismic Lines and Trails.	Community trail mapping and transportation features from 1:50,000 scale National Topographic Database (see Methods, 4.2.1.4.1, for details)

* Width (m). Average linear feature width, in metres. Linear feature widths have been averaged based on consultation with sector experts. For other features, ‘actual’ refers to the mapped extent of the feature.

Table 4.2.1.1 (cont'd)**.** North Yukon Planning Region land use feature types.

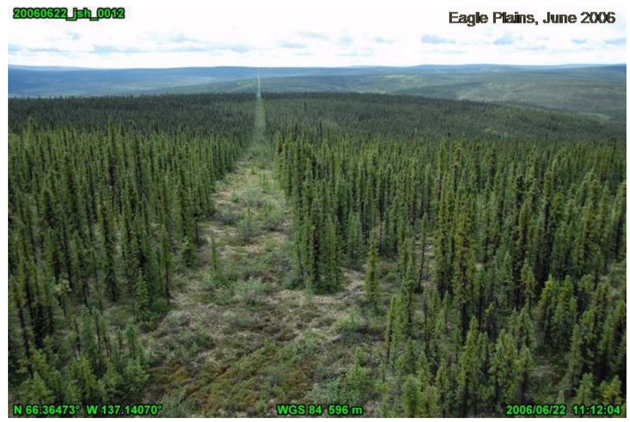
Feature Type	Width (m) *	Description	Data Source
Other Features			
Settlement	Actual	The community of Old Crow, including the air strip. This feature type also includes communication towers, such as those located along the Dempster Highway.	Community Boundary, YESAB. Assumed scale 1:50,000.
Traditional Camp	50 x 50	First Nation traditional camps and cabins.	VGFN S-sites and community mapping. Assumed scale 1:50,000.
Tourism/Visitor Facility	Actual	Eagle Plains Lodge, Rock River campground and Historic Sites	Land Dispositions (Yukon Government Lands Branch) modified for actual disturbed area. Assumed scale 1:50,000.
Airstrip	60 x 1000	Rough airstrips, used primarily for resource exploration or tourism purposes.	1:250,000 scale transportation features from National Topographic Database.
Well Site	100 x 100	Oil and gas well sites/pads. All well sites in the region are currently abandoned and in various stages of revegetation.	Yukon Government Oil and Gas Branch well site database. Assumed scale 1:250,000.
Gravel Pit **	Estimated and Actual	Gravel extraction locations where active quarrying is or has occurred. The total gravel lease area is not included in the definition of gravel pit.	Land Dispositions (Yukon Government Lands Branch) modified for actual disturbed area. Assumed scale 1:50,000.
Mine/Mineral Exploration Site	Actual	Rusty Springs property. In 2005-2006, when footprint data was initially compiled, this was the only major mineral exploration-related surface disturbance.	Active Quartz Claims (Yukon Government Mineral Branch) modified for actual disturbed area, based on input of exploration geologists.

* Width (m). Average linear feature width, in metres. Linear feature widths have been averaged based on consultation with sector experts. For other features, 'actual' refers to the mapped extent of the feature.
** Gravel Pit. Half of the total area of gravel quarry leases is estimated to be active gravel pits. Crow Mountain Quarry is actual footprint.


(a) Major Road


(b) Access Road


(c) Winter Road



(d) Seismic Line


(e) Airstrip


(f) Traditional Camp

Figure 4.2.1.2. North Yukon Planning Region feature type examples. Photos: a) C. Roots, YGS; b) S. Francis, NYPC; c,d,f) J. Hawkings, CWS; e) G. Bradshaw, YGS.

4.2.1.4 Historical and Current Levels of Human-caused Surface Disturbance

Establishing 'how much' of the North Yukon Planning Region has been affected by human-caused surface disturbances, and the current state of those disturbances, is an important consideration in the assessment of cumulative effects and ecological integrity. Setting a baseline condition for these indicators is also required to establish benchmarks against which future comparisons can be made. In consideration of the available sources of information, the amount and status of human-caused surface disturbance and linear features should currently be viewed as estimates that represent the 'best available data'.

4.2.1.4.1 Methods

<u>Mapping and Data Capture</u>

- **Seismic Lines and Trails**
  An assessment of available linear feature data highlighted potential issues with the Yukon Government Oil and Gas Management Branch seismic line database. The most recent petroleum assessment for Eagle Plain (Osadetz et al. 2005) reports that historical oil and gas exploration in Eagle Plain resulted in the creation of 9,952 km of seismic lines. In contrast, the Yukon Government Oil and Gas Management Branch seismic line database records a total of 3,249 km of seismic lines throughout the region, including the Kandik and Old Crow basins.

  Two background resources, North Yukon Planning Commission (2005) and Francis et al. (2006), highlight the issues associated with Yukon Government seismic line database, and the methods used to improve the representation of those linear features. Briefly, 1:50,000 scale transportation features from the National Topographic Database was used to spatially represent all linear features. The Yukon Government seismic line database was used to inform the classification of seismic lines, with all other unclassified linear features considered to be 'Trails'. Some linear features visible on satellite imagery and aerial photographs were not represented in either database; missing features were estimated at 10-20% of the total linear features.

- **Old Crow Winter Road**
  The route of the Old Crow Winter Road follows a number of historical seismic lines and winter trails. To avoid duplication, the historical seismic lines and trails were reclassified to reflect their status as part of the Old Crow Winter Road.

- **Community Use Trail**
  The northern portion of the planning region contains a network of Community Use Trails. Some trails utilize historical seismic lines and winter roads, and the Old Crow winter road. Based on community mapping workshops and input from the VGFN Natural Resources and Heritage Departments, a community trail network was created. Community Use Trails are shown on Map 3 of the Draft

North Yukon Regional Land Use Plan. In situations where community trails utilize historical industrial features, they are considered to be Community Use Trails.

Spatial Representation of Feature Types

Areal features (i.e, polygons) were created for all linear features and sites through the use of buffers in ArcGIS. The dimensions of each feature type are listed in Table 4.2.1.1. As an example, Seismic Lines were buffered by 4 m on either side of the linear feature to create an 8 m wide polygon. The intersection of each Seismic Line (i.e., the location where two seismic lines cross each other) was merged into the feature layer, to avoid duplication. This procedure was repeated for all other linear feature types.

Areal features were also created for all feature types represented spatially in their host databases by a point location. Rectangular features were constructed for airstrips based on the dimensions noted in Table 4.2.1.1. Square features were constructed for well pads, communication towers and similar feature types based on noted dimensions.

The spatial extent of existing polygonal features (e.g., Old Crow community boundary, Crow Mountain gravel quarry) were used without modification.

Estimating Historical Levels of Human-caused Surface Disturbance

The non-overlapping area and length of all mapped linear features was summarized in ArcGIS, as was the area of all other feature types. The reference year for historical surface disturbance estimation was considered to be 1980, the year immediately following completion of the Dempster Highway.

Estimating Current Levels of Human-caused Surface Disturbance

A key question for establishing disturbance estimates is the current status of historical features. Many non-permanent linear features were created in the 1960s, more than 40 years ago. During this period, a proportion of the linear features and other disturbances have revegetated to the point where can be considered reclaimed, based on the definition suggested in Section 4.2.1.1, above. Developing a reasonable estimate for the amount of reclaimed features was accomplished in the following manner.

- **Low-Level Oblique Aerial Photography**
  In summers of 2005 and 2006, a large amount of low level, oblique aerial photography was acquired by the Yukon Government Oil and Gas Management Branch and Environment Canada, Canadian Wildlife Service in the Eagle Plains area (Figure 4.2.1.3). This photography permitted a visual assessment of the current revegetation status of historical features in the most impacted portion of the planning region.

- **Preliminary Field Studies**
  In summers of 2006 and 2007, field studies coordinated through the Yukon Oil and Gas Management Branch were conducted in Eagle Plains to examine revegetation rates and trajectories of historical linear features. Preliminary field observations aided this assessment.

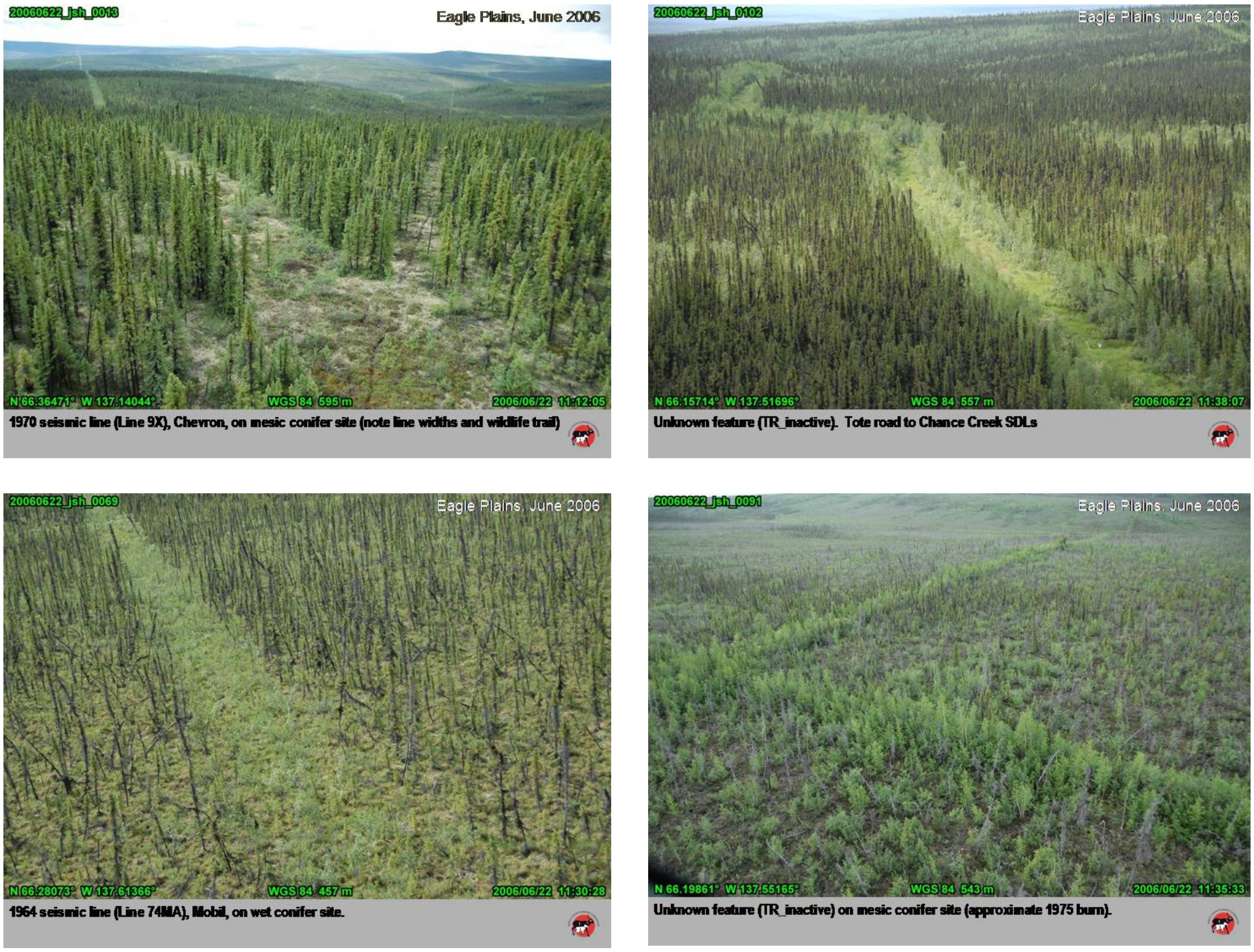


Figure 4.2.1.3. Examples of available low-level oblique aerial photography for Eagle Plains linear features (June 2006). A GPS photo link allows historical seismic lines to be identified, when possible. All photos: J. Hawkings, CWS.

Given the available sources of field-based information, NYPC estimated that, on average, a minimum of 20% of the historical non-permanent linear features represented in existing databases are in a state that can be considered reclaimed[1]. The actual amount of non-permanent linear features that exist in a revegetated state is likely higher than 20%. However, it should be recognized that as many as 10-20% of features visible on the landscape are missing from available linear feature databases. An average 20% revegetation rule therefore attempts to account for these missing features.

To provide a more accurate estimate of current levels of human-caused surface disturbance, a 20% reduction was applied to area and length of all non-permanent features. This estimate attempts to account for natural re-vegetation, and is considered to be a conservative regional average that varies by landscape type and fire history.

4.2.1.4.2 Results

Historical Levels of Human-caused Surface Disturbance

Estimated historical levels of built features and human-caused surface disturbances are reported in Table 4.2.1.2. The status of surface disturbance and linear density indicators, reported by Ecodistrict, is shown in Table 4.2.1.3. The location of all mapped feature types and human-caused surface disturbances, not accounting for potential regeneration, is shown in Appendix 1, Map 49. Community Use Trails, a special class of linear features, are shown on Map 3 of the Draft North Yukon Regional Land Use Plan.

Most linear features and disturbances were created in a 20-year period between 1960 and 1980. The Dempster Highway and the community of Old Crow are the only permanent features of significance. The majority of human-caused surface disturbances are Seismic Lines and Trails – for the purposes of reporting and analysis, they can both be considered non-permanent linear features associated with historical resource exploration and transportation activities.

In the year 1980, immediately following completion of the Dempster Highway, NYPC estimates that the region contained approximately 9,500 ha of human-caused surface disturbance (0.17% of region by area). The Demspter Highway accounts for 12% (1,180 ha) of the total footprint, and is the only major source of 'permanent' feature types. The community of Old Crow contributes 2% of the total footprint. Seismic lines and trails, both non-permanent linear features, comprise 75% (7,150 ha) of the total human-caused surface disturbance.

In 1980, approximately 9,900 km of linear features are estimated within the region (0.18 km/km^2 of region by area), with the Dempster Highway accounting for 200 km of this total. Almost all linear features (93% or 9,200 km) are historical seismic lines, tote roads and winter trails used to support historical resource exploration and drilling activities in the Eagle Plain oil and gas basin.

[1] Reclaimed: based on the suggested definition of 1.5 m shrub growth in forested landscape types.

Ecodistricts with the highest levels of disturbance are Chance Creek (0.62% surface disturbance, 0.66 km/km^2 linear density), Whitestone (0.55% surface disturbance, 0.56 km/km^2 linear density) and Johnson Creek (0.46% surface disturbance, 0.56 km/km^2 linear density). They are located within the Eagle Plain oil and gas basin, and experienced the highest levels of historical oil and gas exploration in the planning region.

Table 4.2.1.2. Historical and current levels of land use features and surface disturbances in North Yukon Planning Region. Historical reference year is 1980. 'Current' reflects current estimate of non-permanent linear feature revegetation status, as described in 4.2.1.4.1, above.

Feature Type	Historical		Current	
	Area (ha)	Length * (km)	Area (ha)	Length * (km)
Linear Features				
Major Road (Dempster Highway)	1,178	196	1,178	196
Access Road	5	5	11	11
Winter Road (Old Crow winter road)	266	266	266	266
Seismic Line (features recorded in YG seismic line database)	2,589	3,237	2,071	2,590
Trail (unclassified linear features recorded in 1:50K NTDB)	4,563	5,703	3,650	4,562
Community Use Trail	155	515	154	515
Linear Feature Totals	**8,756**	**9,922**	**7,330**	**8,140**
Other Features				
Settlement (includes communication towers)	210	--	210	--
Tourism Facility	188	--	188	--
Airstrip	162	--	162	--
Well Sites (abandoned)	28	--	28	--
Traditional Camp	12	--	12	--
Gravel Pit (active quarrying)	191	--	191	--
Mine/Mineral Exploration Site (Rusty Springs)	4	--	4	--
Other Feature Totals	**795**	--	**795**	--
Planning Region Total	**9,551**	**9,922**	**8,125**	**8,140**

* Length only reported for linear features. Other features have perimeter but this is not considered in calculation of linear feature density.

Table 4.2.1.3. Historical and current levels of surface disturbance (S.D.) and linear density (L.D.) indicators reported by Ecodistrict in North Yukon Planning Region. 'Historical Estimate' reference year is 1980. 'Current Estimate' reflects estimated re-vegetation status of non-permanent linear features, as described in 4.2.1.4.1, above.

Ecodistrict	Area (ha)	Area (% NYPR)	Indicator	Indicator Status Historical Estimate		Indicator Status Current Estimate	
				Amount	Metric	Amount	Metric
Barn Range	18,799	0.3	S.D.	0.0 ha	0.00 %	0.0 ha	0.00 %
			L.D.	0.0 km	0.00 km/km^2	0.0 km	0.00 km/km^2
Bell River	318,810	5.7	S.D.	81.4 ha	0.03 %	65.1 ha	0.02 %
			L.D.	53.6 km	0.02 km/km^2	42.9 km	0.01 km/km^2
Bluefish Wetlands	149,440	2.7	S.D.	326.8 ha	0.22 %	261.4 ha	0.17 %
			L.D.	181.4 km	0.12 km/km^2	145.1 km	0.10 km/km^2
British Mountains	6,615	0.1	S.D.	0.0 ha	0.00 %	0.0 ha	0.00 %
			L.D.	0.0 km	0.00 km/km^2	0.0 km	0.00 km/km^2
Canyon Creek	65,885	1.2	S.D.	13.8 ha	0.02 %	11.0 ha	0.02 %
			L.D.	0.0 km	0.00 km/km^2	0.0 km	0.00 km/km^2
Chance Creek	641,090	11.5	S.D.	4,003.0 ha	0.62 %	3,202.4 ha	0.50 %
			L.D.	4,217.0 km	0.66 km/km^2	3,373.6 km	0.53 km/km^2
David Lord Range	251,620	4.5	S.D.	154.8 ha	0.06 %	123.8 ha	0.05 %
			L.D.	190.8 km	0.08 km/km^2	152.7 km	0.06 km/km^2
Driftwood River	551,530	9.9	S.D.	307.0 ha	0.06 %	245.6 ha	0.04 %
			L.D.	397.3 km	0.07 km/km^2	317.8 km	0.06 km/km^2
Fishing Branch River	345,260	6.2	S.D.	328.7 ha	0.10 %	262.9 ha	0.08 %
			L.D.	402.1 km	0.12 km/km^2	321.7 km	0.09 km/km^2
Johnson Creek	220,110	4.0	S.D.	1,014.5 ha	0.46 %	811.6 ha	0.37 %
			L.D.	1,239.2 km	0.56 km/km^2	991.4 km	0.45 km/km^2
Kandik River	373,550	6.7	S.D.	117.3 ha	0.03 %	93.8 ha	0.03 %
			L.D.	120.4 km	0.03 km/km^2	96.4 km	0.03 km/km^2
Keele Range	392,260	7.1	S.D.	182.4 ha	0.05 %	145.9 ha	0.04 %
			L.D.	64.3 km	0.02 km/km^2	51.5 km	0.01 km/km^2
Lord Creek	260,410	4.7	S.D.	231.9 ha	0.09 %	185.5 ha	0.07 %
			L.D.	363.3 km	0.14 km/km^2	290.7 km	0.11 km/km^2
Nahoni Range	156,401	2.8	S.D.	32.3 ha	0.02 %	25.9 ha	0.02 %
			L.D.	37.8 km	0.02 km/km^2	30.2 km	0.02 km/km^2

Table 4.2.1.3 (cont'd). Historical and current levels of surface disturbance (S.D.) and linear density (L.D.) indicators reported by Ecodistrict in North Yukon Planning Region. 'Historical Estimate' reference year is 1980. 'Current Estimate' reflects estimated re-vegetation status of non-permanent linear features, as described in 4.2.1.4.1, above.

Ecodistrict	**Area** (ha)	**Area** (% NYPR)	**Indicator**	**Indicator Status Historical Estimate**		**Indicator Status Current Estimate**	
				Amount	Metric	Amount	Metric
Old Crow Flats Wetlands	512,720	9.2	S.D.	102.4 ha	0.02 %	81.9 ha	0.02 %
			L.D.	190.0 km	0.04 km/km^2	152.0 km	0.03 km/km^2
Old Crow Range	207,920	3.7	S.D.	30.6 ha	0.01 %	24.5 ha	0.01 %
			L.D.	41.7 km	0.02 km/km^2	33.3 km	0.02 km/km^2
Richardson Foothills West	403,920	7.3	S.D.	1,054.9 ha	0.26 %	843.9 ha	0.21 %
			L.D.	641.7 km	0.16 km/km^2	513.4 km	0.13 km/km^2
Richardson Mountains North	71,716	1.3	S.D.	0.0 ha	0.00 %	0.0 ha	0.00 %
			L.D.	0.0 km	0.00 km/km^2	0.0 km	0.00 km/km^2
Richardson Mountains South	7,485	0.1	S.D.	0.0 ha	0.00 %	0.0 ha	0.00 %
			L.D.	0.0 km	0.00 km/km^2	0.0 km	0.00 km/km^2
Tatonduk Mountains	2,437	0.0	S.D.	6.2 ha	0.26 %	5.0 ha	0.20 %
			L.D.	7.8 km	0.32 km/km^2	6.2 km	0.26 km/km^2
Timber Creek	246,650	4.4	S.D.	47.8 ha	0.02 %	38.2 ha	0.02 %
			L.D.	72.6 km	0.03 km/km^2	58.0 km	0.02 km/km^2
Upper Peel River	6,876	0.1	S.D.	9.7 ha	0.14 %	7.8 ha	0.11 %
			L.D.	9.6 km	0.14 km/km^2	7.6 km	0.11 km/km^2
Whitefish Wetlands	200,440	3.6	S.D.	710.5 ha	0.35 %	568.4 ha	0.28 %
			L.D.	882.6 km	0.44 km/km^2	706.1 km	0.35 km/km^2
Whitestone River	144,740	2.6	S.D.	799.7 ha	0.55 %	639.8 ha	0.44 %
			L.D.	815.5 km	0.56 km/km^2	652.4 km	0.45 km/km^2
Total	**5,556,684**	**100.0**					

Current Levels of Human-caused Surface Disturbance

Since 1980, the level of industrial land use activity in the North Yukon Planning Region has been very low. Few new surface-disturbances have been created and at least 20% of the non-permanent historical linear features (i.e. seismic lines and winter trails) have re-vegetated to the point where they can be considered reclaimed.

Accounting for the estimated amount of re-vegetated linear features, the current level of surface disturbance within the region is now approximately 8,125 ha (0.15% of region by area), an amount less than in 1980. The area affected by permanent features such as the community of Old Crow and the Dempster Highway has remained largely unchanged since 1980. All-season access roads have increased slightly. Large areas of the region have no documented human-caused surface disturbances.

Currently NYPC estimates 8,140 km of linear features in the region, resulting in a regional linear density of 0.15 km/km^2. As with historical estimates, Seismic Lines and Trails are the largest sources of footprint (70% of total surface disturbance area and 88% of total linear feature length). Chance Creek, Whitestone and Johnson Creek Ecodistricts remain the most impacted areas, but have also experienced the highest levels of recovery compared with 1980 conditions (Table 4.2.1.3).

Current surface disturbance and linear density levels, averaged across the entire Eagle Plains oil and gas area of interest (Appendix 1, Map 48) are estimated to be 0.41% and 0.44 km/km^2, respectively.

4.2.1.4.3 Discussion

At this time, given current sources of information, it is not possible to categorically state the current level of surface disturbance in the North Yukon Planning Region. The amount and status of human-caused surface disturbance and linear features should currently be viewed as estimates that represent the 'best available data'. The estimates provided in this assessment should be viewed as conservative, but reasonable for regional applications. It is possible and expected that higher levels of linear feature re-vegetation have occurred in some areas. The estimates provided in this assessment provide a reasonable baseline that can be refined through ongoing and future research.

The most recent oil and gas resource assessment of the Eagle Plain basin reports 9,552 km of seismic lines were shot in the Eagle Plain basin over a thirty year period, beginning in about 1955 (see Figure 19 from Osadetz et al. 2005). In contrast, the Yukon Government Oil and Gas Management Branch seismic line database records a total of 3,240 km of seismic lines throughout the region, including the Kandik and Old Crow basins. The source for this large discrepancy is uncertain. However, based on our assessment of linear features, the amount of seismic cited by Osadetz et al. (2005) appears much more accurate and better reflects the level of visible surface impacts in the North Yukon Planning Region.

The length of time required for natural re-vegetation processes to reclaim historical disturbances is variable, and may be affected by a number of factors including the method used to create the feature (intensity of the disturbance), the size of the feature, the subsequent level of use (access legacy), landscape type, and fire history. Accounting for all of these factors at a regional level may not be possible. However, some general patterns are apparent:

- The method and timing of seismic line construction is important. Use of heavy equipment represents higher risks to long-term soil and hydrology damage than smaller equipment and hand cutting
- If the timing of construction and use is poor, wetland environments are very slow to recover
- Tussock tundra vegetation can sustain long-term impacts from improper winter use of heavy equipment
- Fire acts to reclaim historical linear features on well-drained forested sites
- The rate and pattern of seismic line vegetation recovery on well-drained forested sites appears to be similar to post-fire regeneration

Ecodistrict size (or the unit of analysis) influences the reporting of surface disturbance and linear density metrics (Table 4.2.1.3). The indictors, reported in % and km/km^2, respectively, are proportional to the area of analysis. As an example, the area of the Tatonduk Mountains Ecodistrict within the planning region is very small (2,437 ha). Proportional to this small Ecodistrict area, 6.2 ha of recorded surface disturbance is 0.26%, nearly as high as other much larger Ecodistricts that experienced substantial historical land use activity (e.g., Whitefish Wetlands). The size of the unit of analysis should therefore be considered in the interpretation of surface disturbance and linear density metrics. Reporting these metrics for very small geographic areas is not recommended, as relatively small increases in land use impacts result in large increases to indicator levels, particularly linear density. Correspondingly, very large units of analysis, such as the North Yukon Planning Region, tend to ‘dilute’ the effect of high levels of localized disturbances.

4.2.1.5 Assessment of Levels of Disturbance

The previous discussion described the types and estimated levels of human-caused surface disturbance within the planning region. While estimates of the historical and current levels of human-caused surface disturbance have been provided, a second major question now requires consideration. What effect has historical land use activity and resultant surface disturbance had on regional wildlife and fish habitats and populations, and other ecological or heritage values?

Historical land use activities in the North Yukon Planning Region resulted in the creation of thousands of kilometres of linear features and related surface impacts. The Eagle Plain oil and gas basin contains the highest levels of historical habitat impacts. A proportion of historical linear features, particularly winter trails that received poorly-timed multiple use, have been heavily disturbed and will take many decades to recover. A much larger proportion of these features have revegetated to an undisturbed state, a process that will continue with time.

Very few of these historical seismic lines and winter trails receive current human-use. Outside of the Dempster Highway corridor and the village of Old Crow, there are no significant permanent human features. The levels of surface disturbance and industrial land use activity are currently lower today than in the period 1950-1980. Large areas of the region have no surface disturbance impacts.

Understanding the effect of human-caused surface disturbance on habitat quality and potentially wildlife populations is complex, and is not concise. Not only must the potential direct and indirect effects of human footprints and activities be considered, but natural agents of change such as fire, climate and predation must also be factored.

Caribou, the most important ecological resource in the planning region, are known to be influenced to varying degrees by human features and activities. The current population status of the Porcupine Caribou Herd is a major concern for residents of the region and other communities. Current literature suggests that linear densities between 1-2 km/km^2 represent habitat-related risks to boreal caribou populations (Environment Directorate 2002; Environment Canada, Northern Division 2006). Data for barren ground caribou is not currently available, but several studies indicate relationships between level of use and linear density (e.g., Cameron et al. 2005). Assuming boreal caribou data is relevant for this area, at present, based on the surface disturbance and linear density indicators reported in Table 4.2.1.3, **nowhere in the region appears to have experienced critical levels of cumulative habitat-related impacts. The current levels and types of human-caused surface disturbances, while visible, are not compromising the ecological integrity of the region.**

4.2.1.6 Socio-economic Considerations

Construction of linear features changes traditional travel patterns and historical travel routes. Large-scale landscape conversion may result in loss of traditional use or important cultural areas. Surface disturbance impacts may affect other land use sectors, where visual quality and wilderness landscapes are desired. Potential socio-economic considerations relating to land use and surface disturbance impacts are discussed in Section 4.4.2.

4.2.1.7 Ecological Considerations

The ecological consequences of increasing surface disturbance and linear density may be significant. Generally, as the total amount of surface disturbance and linear feature density increases, so do the risks to wildlife and fish populations, and overall ecological integrity. Potential impacts of human features and surface disturbances on ecological values and resources are discussed in Section 4.4.2.

Managing the cumulative nature of surface disturbance and linear feature impacts should be a key consideration in regional land use planning. New land use surface disturbance impacts will be cumulative with historical levels. The cumulative impacts of linear features require special consideration. Given the future anticipated land uses in the planning region, managing the creation and use of new linear features of all types will be a more complex and significant management issue than direct habitat loss.

The long-term cumulative impacts of human-caused landscape disturbances cannot be effectively assessed and managed on a project-by-project basis through the YESAA assessment process. Exploring and understanding the possible effects of future land use activity and human-caused surface disturbance on ecological resources is better suited to regional land use planning, where a long-term, comprehensive view of multiple land uses can be examined. The North Yukon Planning Region Land Use Scenarios Report (North Yukon Planning Commission 2007) explores the ecological, social and economic outcomes of future land use activity and surface impacts through the use of the ALCES® landscape computer simulation model.

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4.2.2 Contaminated Sites

This section provides a brief assessment of contaminated sites in the North Yukon Planning Region. As defined by YESAA, contaminated sites are areas of land in which the soil, including and groundwater lying beneath it, or the water, including the sediment and bed lying below it, contains a contaminant the amount, concentration or level of which is equal to or greater than that prescribed by the Yukon *Contaminated Sites Regulations*.

Key Findings

- Appendix 1, Map 50, shows the location of known contaminated sites, sites that require further assessment and sites that have been assessed for potential contamination
- Based on this information, one site, Bonnet Lake, requires remediation. An additional 6 sites require further assessment
- All other documented sites have been remediated, or have been determined to not require remediation
- Most sites shown on Appendix 1, Map 50 appear to consist of empty fuel drums and assorted refuse resulting from historical resource exploration activities
- While contaminated sites remain a concern for the community of Old Crow and local land users, the number and nature of the identified sites do not appear to be a major threat to regional ecological integrity, or the health of wildlife and fish populations

Background

Over the past years, Old Crow residents have expressed concern regarding potential contaminated sites that resulted from historical industrial land use activities. In response to these concerns, various efforts have occurred over the past decade to identify and remediate identified sites. The most recent effort involved the removal of a large number of fuel drums from Whitefish Wetlands in summer 2006.

4.2.2.1 Contaminated Site Assessment

A number of potential contaminated sites have been identified in the North Yukon Planning Region (Appendix 1, Map 50). Based on existing information, one site requires remediation (Bonnet Lake, at headwaters of Johnson Creek in ‘Area East’ of Old Crow Flats SMA) and 6 require assessment. All other documented sites have been remediated or have been determined to not require remediation. Most documented sites appear to consist of empty fuel drums and assorted refuse resulting from historical resource exploration activities.

Based on the currently available information, the number and nature of the identified sites do not appear to be a significant threat to regional ecological integrity, or the health of wildlife and fish populations.

Reference

Department of Indian and Northern Affairs. 2003? Yukon contaminated sites database. 1:250,000 scale locations of contaminated site investigations.

4.2.3 Existing Land Use Impacts: Conclusions

Based on the estimated levels and types of historical and current land use impacts reported in this section, at present, nowhere in the region appears to have experienced or be experiencing critical levels of cumulative habitat-related impacts. The current levels and types of human-caused surface disturbances, while visible, are not compromising the ecological integrity of the region. Large areas of the planning region have no recorded surface impacts and the level of use of existing non-permanent linear features by humans is low. There is a lower level of functional habitat disturbance today than existed in 1980.

Given their potentially significant ecological consequences, managing cumulative surface disturbance and linear feature impacts should be a key consideration in regional land use planning. The long-term cumulative nature of human-caused surface disturbances cannot be effectively assessed and managed on a project-by-project basis through the YESAA assessment process. In the North Yukon Regional Land Use Plan, linear features should receive special management consideration; the creation and use of new linear features is anticipated to be a more complex and significant management issue than direct habitat loss.

4.3 Conservation Assessment

This section summarizes the historical and current status of various conservation assessments, proposals and notations of conservation interest within the region. Current identified ecological, heritage, and cultural areas of importance from the Commission's consideration of traditional, local, and scientific sources of knowledge are discussed.

The combined summary includes a description and discussion of identified important areas for wildlife resources, with emphasis on the Porcupine caribou herd, moose, marten, sheep, and wildlife key areas. Water resources (lakes, wetlands, river and streams and their adjacent valleys) are also identified and discussed, owing to their importance in sustaining a variety of species in the region (i.e., waterbirds, fish and furbearers). Cultural and heritage areas of importance to First Nations and other residents are highlighted.

4.3.1 Previous Conservation Notations of Interest

Key Findings

- Proposals to establish conservation areas date back to at least the 1960s. See Appendix 1, Map 51 for previous notations of conservation interest
- A variety of goals, objectives, and selection criteria have been used to identify and propose areas of previous conservation interest
- Some of the areas identified through prior conservation assessments are now partly or wholly contained within existing Protected Areas and VGFN land selections
- The southern and northern areas of the Richardson Mountains and Whitefish Wetlands have been consistently identified through previous conservation assessments. None of these areas have a formal conservation area designation at this time.

Background

Previous efforts to formally identify and notate conservation areas of interest in the region date back to at least the 1960s. In 1964, the International Biological Program (IBP) was initiated with the participations of 58 countries, including Canada (as cited in Department of Indian Affairs and Northern Development, 1989, p. 1). The program goal was to identify, protect, and manage areas of importance to science. Two northern Canada panels were tasked with locating and describing representative examples of natural arctic and subarctic ecosystems in cooperation with various stakeholders, and recommending appropriate protection and management measures. Within the planning region, the following sites were recommended for interim protection: Old Crow Basin, Summit Lake, Rat River, and Bell River (Department of Indian Affairs and Northern

Development, 1989). Fishing Branch River was recommended as available for mining, with a management regime to be determined.

In November 1972, a provisional park reserve notation of interest was issued by Yukon Parks Branch for a proposed Arctic Circle Territorial Park (Reference #116I08-0000-00001). The park boundary was not derived from a formal assessment of the region's biological or aesthetic values per se; rather it was centred on where the Dempster Highway crosses the Arctic Circle. The notation of interest was cancelled in 2003 (A. Jones, Yukon Department of Environment, pers. comm.).

In 1976, the Berger Inquiry recommended the establishment of a wilderness park in the northern Yukon to protect the ecology and traditional way of life of residents (as cited by Yukon Department of Environment and Vuntut Gwitchin Government, 2006, p.1). In 1980, an Order-in- Council (OIC) withdrawal was established for northern Yukon pending resolution of the establishment of Ivvavik National Park and the Inuvialuit land claim agreement. The North Yukon Interim Land Withdrawal is still in place as of September 2007 (Yukon Department of Energy, Mines and Resources, 2003, 2005, OIC #s 2003/143 and 2005/53). The interim withdrawal area applies to all lands north of the Porcupine River and west of the Bell River.

In 1982, the Old Crow Flats were designated by Canada as an important wetland under the Ramsar Convention, an international designation of the United Nations (Gillespie et al. 1991). Old Crow Flats is the only Ramsar site in the Yukon (Ramsar Convention Secretariat, 2006). In 1983, three environmentally significant areas in northern Yukon were recommended by researchers at the University of Waterloo as priorities for wildlife and ecosystem protection (Theberge and Nelson, 1983). These areas were Bear Cave Mountain (Fishing Branch), Dempster Highway corridor, and the Whitefish Wetlands.

In 1989, the Rock River – western Richardson Mountains foothills area was identified as an important heritage resource area and was recommended for some level of regional protection (Yukon Department of Tourism and Regional Planning and Yukon Department of Renewable Resources, 1989). The area contains a high density of known archaeological sites, and many suspected sites that had been discussed during First Nation oral history projects, but that had not yet been located.

In 1993, the Yukon Parks system plan prepared by Department of Renewable Resources, Parks and Outdoor Recreation Branch, identified four areas of interest in the region: Summit Lake – Bell River, Whitefish Wetlands, Eagle Plains, and upper Canyon creek (Yukon Department of Renewable Resources, 1993). The areas were selected based on a variety of criteria designed to capture representative physical and biological features, maintain viable animal populations, and minimize resource conflicts (see Table 4 *in* Yukon Department of Renewable Resources, 1993 for additional detail).

In May 1993, the Vuntut Gwitchin First Nation settled their final land claim agreement. Three areas were identified for Special Management Area designation under Chapter 10, Schedules A-C, based on their heritage, cultural, and ecological importance: 1) Vuntut

National Park, Fishing Branch Ecological Reserve, and Old Crow Flats (Department of Indian Affairs and Northern Develoment, 1993). Many other R-blocks and site-specific land selections were made on the basis of their heritage and cultural significance to VGFN. These are discussed under Section 4.3.5.

In 1996, the Peel River Watershed Advisory Committee provided recommendations on potential Special Management Areas (SMA) or protected areas within the Peel Watershed (Peel River Watershed Advisory Committee, 1996). The Committee was formed under the terms of the Na-cho Nyak Dun Final Agreement and the Gwich'in Comprehensive Land Claim Agreement to provide advice on natural resource management issues within the Peel River watershed. Based on sources of traditional and scientific knowledge, over 30 experts provided input on areas of interest during workshops held between March 19-21, 1996 in Mayo, Yukon. For the North Yukon planning region, the Richardson Mountains and critical caribou habitats were identified as primary areas of interest.

In 1997, the Gwich'in Land Use Planning Board in the NWT identified the following five areas within the North Yukon planning region as important areas for cultural and ecological values: Rat River watershed, Stoney Creek (small area on Yukon side), Rock River area, Canyon Creek Range, and Little Bell – Summit Lake area. The areas were identified during local knowledge workshops held in the NWT to support the land use plan within the Gwich'in Settlement Region. These recommendations also drew upon earlier work of the Mackenzie Delta Beaufort Sea Land Use Planning Commission (1990). All of the Yukon areas are within the Gwich'in Secondary Use Area. All areas in the NWT and Yukon were proposed as protected area options, but the Yukon specific areas of interest were beyond the scope of the Gwich'in plan. Details of the selection process and methodology are reported in the Gwich'in Land Use Plan and supporting documents (Gwich'in Land Use Planning Board, 1997, 2003).

In 2002, the Yukon Government's Protected Areas Strategy (YPAS) identified Eagle Plains ecoregion as a candidate area of interest (Yukon Government, 2002). The goal of the strategy was to ensure that each of the Yukon's ecoregions had adequate protected area representation. At that time, Eagle Plains was not represented in a protected area. Following extensive research and assessment of the ecoregions natural, cultural/heritage, and economic values, a "minimum core area" for Eagle Plains was selected and recommended to satisfy the criteria of representativeness and ecological viability. Shortly after the proposal was put forward, the YPAS program was discontinued.

Under the various past conservation area proposals, a variety of goals, objectives and selection criteria were used to identify and notate areas of conservation interest. The selection criteria ranged from recreation and scenic quality, First Nation's values, community areas of interest, wilderness tourism values, biodiversity values, representative landscape/habitat features, maintenance of ecological integrity, and sustaining viable populations of fish and wildlife.

Discussion

Appendix 1, Map 51 shows notations of previous conservation interest in the planning region. The Gwich'in Land Use Planning Board (1997) identified areas are not shown. Some of the areas of past conservation interest are now contained within existing Parks, protected areas, Ecological Reserves & Preserves, Habitat Protection Areas (HPAs), and Vuntut Gwitchin land selections. Existing Parks and protected areas and status are discussed further in Section 2.4.1 and Section 4.3.2, below.

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4.3.2 Current Conservation Area Status

There are currently three Protected Areas within the region, Ni'iinlii'njik (Fishing Branch) Wilderness Preserve and Ecological Reserve, Vuntut National Park, and the core wetlands area of Old Crow Flats SMA (see Section 2.4.1 for further discussion). The protected area portion of Ni'iinlii'njik includes VGFN land selections VG R-05A and S-3A1. The core wetlands area of Old Crow Flats SMA was recommended for Protected Area status in August 2006 (Yukon Department of Environment and Vuntut Gwitchin Government, 2006). The core area of Old Crow Flats SMA includes VGFN land selections R-01A and R-10A, and a smaller portion of Yukon Government public lands. Protected Areas are permanently withdrawn from industrial development.

One area in the planning region has conservation management land status (i.e. Habitat Protection Area) that is not a protected area. The Fishing Branch HPA, part of the Ni'iinlii'njik Special Management Area, is managed to maintain cultural and ecological integrity, but is not withdrawn from resource exploration or development (Yukon Department of Environment and Vuntut Gwitchin Government, 2004a,b).

Interim conservation areas include the east and west areas of public land adjacent to Old Crow Flats SMA core wetlands; these areas are withdrawn from industrial land use activity for a period of 20-years. The intention of Yukon Government is to eventually establish these lands as a Habitat Protection Area (Yukon Department of Environment and Vuntut Gwitchin Government, 2006). The North Yukon Interim Land Withdrawal (Yukon Department of Energy, Mines and Resources, 2003, 2005, OIC #s 2003/143 and

2005/53) can also be considered an interim conservation area that is temporarily withdrawn from oil and gas and mineral disposition, but its future status is currently undetermined

As established under the VGFN Final Agreement, Chapter 13, Schedule B, Rampart House and Lapierre House are historic sites that are protected from disturbance under the *Yukon Historic Resources Act* (Historic Resources Act, R.S.Y. 2002, c. 109). A number of VGFN settlement lands were also selected with conservation management intent; these are discussed in Section 4.3.5, below.

References

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Yukon Department of Energy, Mines and Resources. 2005. Prohibition of entry on certain lands in North Yukon order. Yukon Order in Council #2005/53, April 2005. 4 pp.

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4.3.3 Important Ecological Areas Identified by NYPC and Plan Partners

Key Findings

- Traditional (local) and scientific knowledge confirmed the entire region is used by Porcupine caribou, moose, marten, birds, and a variety of other species
- Lakes, wetlands, river and streams, and river and stream valleys were consistently identified as important habitats for a variety of birds, animals, and fish species
- Wetland complexes and rivers of particular ecological significance include Old Crow Flats, Whitefish Wetlands, Cadzow Wetlands, Bluefish Wetlands, and the Porcupine, Eagle and Bell rivers.
- The Richardson Mountains was considered to be the most significant mountain area for many large mammals (Porcupine caribou, sheep, moose, bears, and

furbearers). A number of other mountains or mountain ranges also contain significant ecological values, but not in the concentrations present in the Richardson Mountains.

- The area around Old Crow, Old Crow Flats, Whitefish Wetlands, Cadzow Wetlands, Bluefish Wetlands, Fishing Branch, and Whitestone Village were consistently identified as important ecological areas by VGFN residents

Background

The ecological values assessment provides a combined summary of identified important areas for the region's focal species (Porcupine caribou, moose, and marten). The region's major lakes, wetlands, river and streams, and river and stream valleys are also important habitats for sustaining a variety of species; these species included waterbirds (ducks, swans, geese, and loons), Peregrine falcons, other bird species, and fish. Key mountain ranges and alpine habitats for sheep were also included. Sources of scientific and traditional (local) knowledge were both considered. The information sources are current to May 2006. The main findings are reported below.

4.3.3.1 Caribou Concentrated Use Areas

A priority of the regional land use plan is conservation of important areas for sustaining the Porcupine Caribou Herd. The herd occupies the entire region at various times of year. A recurring issue of concern expressed at community consultations was the conservation of the herd in light of potential oil and gas development and the uncertainty of climate change. Multi-jurisdictional issues of current concern included possible impacts to the herd from hydrocarbon development in the Arctic National Wildlife Refuge (ANWR) in Alaska, and the potential for population over-harvest. Caribou populations for some herds in the Northwest Territories have been declining, notably for the Cape Bathurst and Bluenose West herds. As a result of these declines, several communities and villages along the Yukon/NWT border have shifted harvest effort to the Porcupine herd, particularly along the Dempster Highway.

The determination of concentrated use and general calving areas of the herd from analyses of the telemetry data (described in Section 2.7.5.1.1) identified many significant areas within the region. These results showed good agreement with sources of traditional (local) knowledge of important caribou areas, and many complementary patterns in animal distribution were revealed. A comparison of these findings with the maps of suitable habitat and Department of Environment's Key Wildlife Areas database provided an adequate assessment to identify areas of conservation interest across the planning region. Concentrated use and general calving areas of the herd are shown in Appendix 1, Maps 20 and 52.

At present, approximately 60% of the herd's concentrated use areas and general calving areas are present in designated protected areas or interim withdrawn lands. Portions of Vuntut National Park and Old Crow Flats SMA protect approximately one third of the total concentrated seasonal caribou use areas in the planning region. Another one third of the herd's total concentrated use area within the planning region is in the North Yukon Interim Land Withdrawal. Outside of these protected and interim withdrawn lands, the entire southern Richardson Mountains and foothills and the Ahvee – Lone Mountains area south of Old Crow are the most significant locations of concentrated seasonal caribou use. These two areas represent the majority of the remaining concentrated use areas in the planning region. An additional consideration for caribou is the maintenance of migration routes between important areas and seasons. General migration patterns of the herd are discussed in Section 2.7.5.1.1, and shown in Appendix 1, Maps 21-23.

Additional details of the methods used to identify significant areas for caribou are provided in Sections 2.7.2.1.2, 2.7.5.1, and 2.7.3.2. A detailed assessment of Porcupine caribou conservation and land use planning is reported in Ryder et al. (Rangifer: *Accepted March 2007*) (available upon request from NYPC).

4.3.3.2 Wetlands, Lakes, Rivers and Streams, and River and Stream Valleys

Wetlands, lakes, rivers and streams, and river and stream valleys (i.e., riparian habitats) represent some of the most sensitive and important ecological environments within the region. Old Crow Flats is recognized as a wetland area of international importance (Gillespie et al. 1991). Wetlands, lakes, and rivers and streams provide goods and services for humans. Riparian areas are important for economic, cultural, aesthetic, scientific, and educational values (Dudgeon et al. 2006).

Much of the suitable habitat identified for two of the region's focal species (moose and marten) are contained within wetlands and riparian areas. Waterbird (ducks, swans, geese, and loons), Peregrine falcon, and fish habitats are located within or near wetlands, lakes, rivers and streams, and river and stream valleys. Of the bird species reported present in the region, most (109 of 149, or 71%) occupy these environments seasonally (Environment Canada, unpublished data, 2006).

Many species depend on these waterbodies and river/stream valley habitats for a variety of life functions, on a seasonal or annual basis. Wetland complexes and rivers of particular ecological significance include Old Crow Flats, Whitefish Wetlands, Cadzow Wetlands, Bluefish Wetlands, and the Porcupine River.

4.3.3.3 Sheep

Dall sheep occupy several mountain ranges and alpine habitats throughout the planning region. Although they were not identified as a focal species during the assessment of regional wildlife populations and habitats, sheep are a high profile species that have cultural and ecological significance to First Nations and other Yukon residents. Sheep traditionally use the same ranges repeatedly, and they are sensitive to noise and activity-related disturbances. The sheep Key Wildlife Areas assessment from Yukon Department of Environment and traditional (local) knowledge identified important sheep habitat throughout the Richardson Mountains. Other areas were identified in the Fishing Branch HPA, the Barn Mountains within Vuntut National Park, and Mount Rover in the Keele Range on the Alaska border. See Sections 2.7.2.1.2 and 2.7.3.2 for details.

Discussion

Important ecological areas identified at traditional (local) knowledge workshops in Old Crow generally included rivers and streams, their adjacent valleys, wetland areas, specific mountains and mountain ranges, areas in the vicinity of Old Crow, and the area around Whitestone Village. The Wildlife Key Areas database compiled by Yukon Department of Environment (Yukon Department of Environment, 2005) showed that the Richardson Mountain range is been an important area for caribou, moose, and sheep. The other sources of scientific information supported these findings and highlighted a few additional areas.

Major rivers and stream, and wetland complexes (Old Crow Flats, Whitefish Wetlands, Bluefish Wetlands, and Cadzow Wetlands) were consistently identified as important ecological areas, from all information sources. Traditional (local) knowledge sources highlighted Fishing Branch (Bear Cave Mountain) as an important ecological area. Fishing Branch Ecological Reserve was identified as a key area for bears and furbearers by Yukon Department of Environment. These findings provided much of the rationale for the establishment of the Fishing Branch Ecological Reserve (Yukon Department of Environment and Vuntut Gwitchin Government, 2004a,b).

References

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Gillespie, D.I., H. Boyd, and P. Logan. 1991. Wetlands for the world: Canada's Ramsar sites. Canadian Wildlife Service, Ottawa, Ontario. 40 pp.

Ryder, J.L., P. McNeil, J. Hamm, W.A. Nixon, D.E. Russell, and S.R. Francis. An integrated assessment of Porcupine caribou seasonal distribution, movements, and habitat preferences for regional land use planning in Northern Yukon Territory, Canada. Rangifer. *Accepted March 2007*.

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Yukon Department of Environment and Vuntut Gwitchin Government. 2004b. Ni'iinlii'Njik (Fishing Branch) Ecological Reserve and Settlement Land R-5A & S-3A1 Management Plan. Fishing Branch Local Planning Team. 42 pp.

Yukon Department of Environment. 2005. Yukon Wildlife Key Area Inventory. Digital database and software produced by NatureServe Yukon, Fish and Wildlife Branch, Department of Environment, Government of Yukon, Whitehorse. Yukon Government website. Accessed August 9, 2006. URL: http://environmentyukon.gov.yk.ca/geomatics/data/wildlife-key-area.html

4.3.4 Summary of Identified Important Ecological Areas

Key Findings

- Approximately 60% of the region has been identified as having high ecological values, based on NYPC's findings and interpretations (see Appendix 1, Maps 52 and 53)
- Identified ecologically important areas occur throughout the region, but Old Crow Flats and Basin, areas north of the Porcupine and Bell rivers (i.e., North Yukon Interim Land Withdrawal), Whitefish Wetlands and the Richardson Mountains contain the highest concentration of areas (see Table 4.3.4)
- Approximately 60% of the identified areas of high ecological value are contained within existing Protected Areas, the Fishing Branch HPA and the North Yukon Interim Land Withdrawal. At this time, the southern Richardson Mountains and Whitefish Wetlands have no formal conservation designations, and the future status of the North Yukon Interim Land Withdrawal is undetermined.

Background

The identified ecologically important areas represent the knowledge, interpretations, and synthesis of information gathered from traditional (local) and scientific sources of information of animal, bird, and fish distribution, and habitat use in the region. The emphasis of the assessment was on the region's focal species (caribou, moose, and marten), water resources (including wetlands), wildlife key areas, identified sheep areas, and important fish habitats. Information on these species and habitats was more complete than for others in the region, and they were of greatest interest to stakeholders. All identified areas for fish and wildlife were considered equally important in this assessment and summary.

Methods

The ecologically important areas maps represent the combined overlay of various biological and physical information sources noted above. A "detailed" map of ecologically important areas was compiled from the analyses and maps described in

Sections 2.6.2.4, 2.7, and 2.8 (Appendix 1, Map 52). A “generalized” map of ecologically important areas highlights locations where more than one species or value was found (Appendix 1, Map 53). For example, caribou concentrated use areas overlapped identified sheep areas in a few locations. These are shown on the generalized ecologically important areas map in a darker shade, to indicate that both species occupy the same location.

A table showing the area and percentage of the identified ecologically important areas found within each ecodistrict in the planning region was compiled from the following information: a) caribou concentrated use and calving areas, b) area of wetlands, lakes, rivers and streams, and their adjacent valleys (i.e., riparian habitats), and c) identified sheep areas. Where the ecological values for these overlapped, they were counted only once.

Discussion

Appendix 1, Maps 52 and 53 show the identified ecologically important areas. The maps are intended to provide an objective, defensible, and comprehensive overview of the distribution of ecological resources of interest to stakeholders. It should be noted that the ecological “significance” of an area shown on Map 53 is a relative term, indicating that multiple ecological values can be found at the same location. It is not intended to imply that one area is more significant than another. Table 4.3.4 summarizes the identified ecological values for each ecodistrict in the region, organized by rank, as shown in Maps 52 and 53.

Approximately 60% of the planning region area has been identified as having “high” relative ecological value in this assessment. Much of this identified area (58%) is contained within existing parks, protected areas, and areas with conservation management objectives. These areas include Vuntut National Park, Old Crow Flats SMA, and Ni’iinlii’Njik (Fishing Branch) Wilderness Preserve and Ecological Reserve. A large proportion of the values are also within the North Yukon Interim Land Withdrawal (north of the Porcupine and Bell rivers), an area with currently undetermined management objectives.

Table 4.3.4. Summary of identified ecological values (in hectares) for each planning region ecodistrict. The percentage of each ecodistrict occupied by the area of the ecological resource is also shown. The table is organized from highest to lowest percentage of each ecodistrict covered by the area of identified ecological values.

Ecodistrict	Area	Caribou area [1]		Waterbodies and River Valley area [2]		Sheep area [3]		Identified Ecological Values area [4]	
	ha	ha	%	ha	%	ha	%	ha	%
Barn Range	18,534	18,534	100%	39	0.21%	0	0%	18,534	100%
Richardson Mountains North	71,863	71,863	100%	3,322	5%	7	0.01%	71,863	100%
Canyon Creek	65,639	64,906	99%	834	1%	2,168	3%	65,236	99%
Old Crow Flats Wetlands	513,077	266,045	52%	508,097	99%	0	0%	511,375	99%
Bluefish Wetlands	148,944	77,773	52%	143,151	96%	0	0%	146,147	98%
Driftwood River	552,016	498,989	90%	83,691	15%	0	0%	510,698	93%
Richardson Foothills West	404,013	367,733	91%	67,288	17%	13	0.01%	376,981	93%
Whitefish Wetlands	199,604	72,215	36%	179,420	90%	0	0%	184,748	93%
Bell River	318,681	277,177	87%	37,046	12%	1,209	0.4%	285,269	90%
Old Crow Range	207,130	177,530	86%	20,331	10%	0	0%	181,988	88%
Richardson Mountains South	7,375	5,864	80%	1	<1%	28	0.4%	6,007	81%
Timber Creek	246,907	139,543	57%	11,739	5%	0	0%	170,992	69%
Upper Peel River	6,864	0	0%	3,537	52%	0	0%	3,537	52%
Keele Range	393,047	124,618	32%	54,236	14%	0	0%	168,867	43%
Lord Creek	260,818	58,783	23%	63,871	24%	0	0%	108,542	42%
Fishing Branch River	344,980	13,712	4%	98,342	29%	0	0%	111,749	32%
Whitestone River	145,355	30,423	21%	17,025	12%	0	0%	46,693	32%
Johnson Creek	220,434	36,037	16%	43,146	20%	0	0%	66,609	30%
Chance Creek	641,884	57,531	9%	121,103	19%	0	0%	161,004	25%
Nahoni Range	156,532	26,230	17%	10,816	7%	593	0.4%	37,124	24%
British Mountains	6,533	1,406	22%	0	0%	0	0%	1,406	22%
David Lord Range	251,225	35,133	14%	16,613	7%	0	0%	48,794	19%
Tatonduk Mountains	2,358	0	0%	330	14%	0	0%	330	14%
Kandik River	372,954	28,835	8%	10,339	3%	0	0%	39,175	11%
PLANNING REGION TOTALS:	**5,556,768**	**2,450,879**	**44%**	**1,494,318**	**27%**	**4,019**	**0.07%**	**3,323,668**	**60%**

1 Caribou areas include concentrated use areas obtained from satellite telemetry, all seasons, and general calving areas
2 Waterbodies and river valleys include lakes, wetlands, river/streams, and river/stream valleys obtained from a variety of map sources
3 Sheep areas include key areas (v.2005) from Yukon Department of Environment and sheep areas identified at November 2004 Old Crow wildlife workshop
4 Identified ecological values include the caribou, waterbodies and river/stream valleys, and sheep areas combined. Areas of overlap were counted only once

While care has been taken to compile a comprehensive and balanced assessment and overview of some important ecological values in the region, using a variety of information sources, it should be expected that not all ecologically important areas have been identified, especially site specific features. Many species and habitats have not been considered. The maps represent general patterns of wildlife distribution and habitat preferences for the species and habitats of primary interest to stakeholders. Due to issues of scale, the locations and boundaries for many of the region's lakes, wetlands, rivers and streams, and their adjacent valleys should be viewed as approximate, and should be recognized as a limitation to the description and summary of water resources.

Despite the limitations of the available information, the assessment of ecologically important areas currently provides the most comprehensive source of knowledge for determining and recommending regional conservation priorities for wildlife and fish populations, and their habitats. The conclusions are based on a thorough and reasonable assessment of scientific and traditional (local) knowledge of wildlife and fish resources.

4.3.5 Summary of Priority Heritage and Cultural Areas

Key Findings

- See Appendix 1, Maps 40 and 41 for reference to important heritage resource and cultural significant areas
- Identified heritage and cultural areas of conservation priority for First Nations and other residents included the vicinity of Old Crow, Old Crow Flats, Vuntut National Park, Whitefish Lake (wetlands), Cadzow Lake (wetlands), Bluefish Wetlands, Bluefish Cave, Driftwood River – Salmon Cache, Fishing Branch (Bear Cave Mountain), vicinity of Whitestone Village, Summit Lake – Bell River, Rock River – Richardson Mountains, and the region's major rivers (Porcupine, Eagle, and Bell)
- Many VGFN land selections reflect the First Nation's heritage, cultural and ecological conservation priorities. More than half of VGFN's land selection area is within existing protected areas.
- Identified site-specific areas of heritage conservation priority for VGFN residents were Rampart House, Lapierre House, Whitestone Village and Johnson Creek Village
- As required by the VGFN Final Agreement (Chapter 13, Schedule A), priority heritage routes and sites to be considered in the regional land use plan are listed in Table 4.3.5

Background

The identified heritage and cultural priorities represents a combined summary of written and oral information obtained from First Nations and other residents of the region and available literature, during the resource assessment phase of the North Yukon regional land use plan. The summary was based primarily on an assessment of identified heritage and cultural resources and values that are of greatest current conservation interest and concern for VGFN residents. Adjacent First Nation interests were also considered.

Methods

The methods used to identify and map heritage and cultural areas are discussed in Section 3.2 (Heritage Resources). Priority areas were identified from several sources of information, including discussions and mapping exercises with community residents, available literature, and North Yukon Planning Commission members. Additional information on priority cultural areas and heritage routes and sites was obtained from the VGFN Final Agreement Chapters 10 and 13 (Schedule A). A table summarizing these priority areas from Chapter 13, Schedule A is provided below. The Vuntut Gwitchin Government Heritage Department summarized oral history and historical land use information on behalf of the NYPC.

Discussion

Identified heritage and cultural areas of conservation priority for First Nations and other residents included the vicinity of Old Crow, Old Crow Flats, Vuntut National Park, Whitefish Lake (wetlands), Cadzow Lake (wetlands), Bluefish Wetlands, Bluefish Cave, Driftwood River – Salmon Cache, Fishing Branch (Bear Cave Mountain), vicinity of Whitestone Village, Summit Lake – Bell River, and Rock River – Richardson Mountains. The region's major rivers (Porcupine, Eagle, and Bell) are also important areas, particularly for river travel and subsistence harvesting. Appendix 1, Maps 40 and 41 show important heritage resources and culturally significant areas, and areas of current Vuntut Gwitchin land use.

Many VGFN land selections reflect the priority heritage, cultural and ecological conservation areas listed above. VGFN land selections VG R-01A and R-10A (Old Crow Flats), VG R-02A (Whitefish Wetlands), VG R-03A (Berry Creek), VG R-04A and R-13B (Whitestone River and Village), VG R-05A (Bear Cave Mountain), VG R-07A and R-12A (Johnson Creek and Village), VG R-09A (Whitestone River), VG R-11A (Bluefish Wetlands), and R-14B (Lapierre House) were selected for their cultural, wildlife, wetland, fishing, and timber harvest value to VGFN residents (William Josie, Vuntut Gwitchin Natural Resources Director, pers. comm., 2005).

VGFN also selected many site-specific areas of heritage and cultural value. Identified site-specific heritage areas for VGFN residents are Johnson Creek Village, Whitestone Village, Rampart House, and Lapierre House. Driftwood Village was also recognized. Additional heritage routes and sites that must be considered by the regional plan are discussed in the VGFN Final Agreement (Chapter 13, Schedule A). These are summarized in Table 4.3.5 (see Figure 3.2.3.4 for map of routes).

The Tetlit Gwich'in Secondary Use Area is an important heritage and cultural area for the Tetlit Gwich'in residents in Ft. McPherson and Aklavik. The Summit Lake – Bell River, LaChute River, Rock River, and Canyon Creek – southern Richardson Mountains are known to be of special significance. Similar to the entire Vuntut Gwitchin Traditional Territory, the Tetlit Gwich'in Secondary Use area contains a large number of historical routes and trails. Many of these routes and trails are shared between the Vuntut Gwitchin and Tetlit Gwich'in First Nations. Both groups have historical connections through the Tukudh Gwich'in, the previous Gwich'in cultural group living and traveling in the Dempster Highway area (see Section 3.1.3, Heritage Resources).

Table 4.3.5. Summary of heritage routes and sites for consideration in the North Yukon regional land use plan (See Chapter 13, Schedule A, of VGFN Final Agreement for details).

Number	Description	Location
1	Route	Old Crow to Whitestone Village
2	Route	Old Crow to Fort McPherson via Salmon Cache and Lapierre House
3	Route	Whitestone Village to Johnson Village
4	Route	Johnson Village to La Chute via Whitefish Lake
5	Route	Whitestone Village route connecting with the Old Crow – Fort McPherson route (route 2) at the western approach to the Northwest Territories border
6	Route	Whitestone Village route connecting with the Old Crow – Fort McPherson route (route 2) via Upper Stony Creek
7	Route	Old Crow to Rampart House
8	Route	Old Crow to Herschel Island
9	Route	Old Crow to Fish Hole Creek (Canoe River) fishing hole
10	Route	Old Crow to Johnson Village via White Snow Mountain
A	Site	Caribou fence on Thomas Creek at its headwaters
B	Site	Caribou fence on Thomas Creek at part way down to Crow Flats
C	Site	Caribou fence on Timber Creek
D	Site	Caribou fence on Black Fox Creek
E	Site	Fishing Hole on Fish Hole Creek (Canoe River)
F	Site	Fishing Hole on the Babbage River
G	Site	Fishing Hole on the Firth River

While care has been taken to compile a thorough and balanced assessment and overview of important heritage and cultural resources and values in the region, from a variety of information sources, it should be expected that not all sites or areas have been identified. Many smaller, site-specific areas are important to various community members, and may not be identified adequately here. S-sites are assumed to represent many of these site-specific interests. A large number of S-sites are individual cabins or camps. Maps 40 and 41 and this section represent a summary of general priority conservation areas based on current heritage and cultural interests in the region.

Despite the potential limitations, the assessment of heritage and cultural priority areas provides a relevant source of knowledge for determining and recommending regional conservation priorities for heritage and cultural resources. The identification of priority areas was based on the synthesis of various sources of written and oral knowledge of the current heritage and cultural values of conservation and traditional land use interest to Vuntut Gwitchin residents. Given the strong connection between land, wildlife values and Gwich'in culture, the priority heritage and cultural areas show good agreement with many of the identified important ecological areas discussed in Section 4.3.3 above. Between the two sources of information, a reasonable assessment of the planning region's important ecological and social/cultural conservation priorities was obtained. This knowledge can be used to recommend regional conservation priorities for ecological, heritage, and cultural resources in the North Yukon regional land use plan.

4.3.6 Conservation Assessment: Conclusions

The North Yukon Planning Region contains significant ecological, heritage and cultural values and resources. A large amount of the region, approximately 60%, is considered to have high ecological values, based on NYPC's findings and interpretations. Some heritage resources are of global significance. Major conclusions from the conservation assessment are as follows:

Wetlands, Lakes and Rivers

- Wetlands, lakes, rivers and streams, and river and stream valleys contain many of the ecological and heritage/cultural values
- Wetlands, open water and their adjacent areas represent the most biologically productive and sensitive environments in the planning region
- Four wetland complexes are of regional and territorial significance: Old Crow Flats, Whitefish, Bluefish and Cadzow. Old Crow Flats is recognized internationally

Porcupine Caribou Herd and other Mammals

- The Porcupine Caribou Herd utilizes the entire planning region seasonally, but over the past 30-years has utilized some areas of the region more intensively than others. Important Porcupine Caribou Herd use areas include the entire Richardson Mountains and foothills, Old Crow Flats and basin, Whitefish Wetlands, Ahvee, Lone and Sharp mountains, and Whitestone River. The central portion of Eagle Plain has been used less intensively than these habitats.
- In addition to the major wetland complexes, areas north of the Porcupine and Bell rivers (i.e., North Yukon Interim Land Withdrawal) and the Richardson Mountains and foothills contain the highest concentration of identified ecologically important areas
- The northern Richardson Mountains contains the highest diversity of large mammals in the region, and is of special significance for the Porcupine Caribou Herd

Heritage and Culture

- The North Yukon Planning Region contains some of the most significant archaeological resources in Yukon. Some are of global significance
- Given the strong relationship between Gwich'in traditional land use and ecological resources, many of the same areas identified as being ecologically important are also of high heritage and cultural significance
- Many VGFN land selections reflect the First Nation's heritage, cultural and ecological conservation priorities
- Old Crow Flats and basin, Whitefish, Bluefish and Cadzow wetlands, Bear Cave Mountain, Driftwood River, Berry Creek, the major rivers, and the entire Richardson Mountains and foothills contain the highest concentrations of heritage and cultural resources. Rampart House and Lapierre House are existing Historic Sites. Whitestone and Johnson Creek villages are also important heritage resources

Land Status

- 32% of the region has existing protected area status (Old Crow Flats SMA, Vuntut National Park, and Ni'iinlii'njik (Fishing Branch) Wilderness Preserve and Ecological Reserve)
- A large amount of the identified ecologically important areas and significant heritage and cultural resources and values are contained within existing protected areas, the Fishing Branch HPA and the North Yukon Interim Land Withdrawal

- At this time, the Richardson Mountains and foothills, other areas of Porcupine Caribou Herd concentrated use, and the three major wetland complexes outside of Old Crow Flats have no formal conservation designations
- The future status of the North Yukon Interim Land Withdrawal within the planning region is undetermined

4.4 Sustainable Development Considerations

The VGFN Final Agreement provides guidance for developing a regional land use plan in the VGFN Traditional Territory. An important guiding principle for the regional land use plan is to ensure that social, cultural, economic and environmental policies are applied to the management, protection and use of land, water and resources in an integrated and coordinated manner so as to promote and ensure *Sustainable Development* (VGFN Final Agreement 11.1.1.6).

As defined in the VGFN Final Agreement, *Sustainable Development* means "beneficial socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent". The VGFN Final Agreement clearly envisioned economic development activities occurring within the traditional territory. Consultations with Old Crow community members also indicate the need for economic development activities that benefit local residents. There is a general recognition that increasing levels of economic activity may be necessary to maintain the long-term viability of Old Crow.

While economic development is recognized as important and necessary, it is also acknowledged that increasing levels of economic activity will not come without trade-offs of impacts. Managing the significance of those impacts is the defining challenge. Providing opportunities for economic development activities while minimizing potential impacts on social and ecological resources is the major focus for the North Yukon regional land use plan.

This section highlights some key economic, social/cultural, and ecological considerations relating to the sustainable management of land and resources in the North Yukon Planning Region. Potential land use conflicts and impacts are also identified.

4.4.1 Socio-economic Considerations

A complete socio-economic assessment of future economic activity and potential impacts to social/cultural resources and values in the region is beyond the scope of this report. However, major social considerations are traditional economic activities are heritage and cultural resource conservation priorities. Important economic considerations are employment and workforce requirements, and resource royalties and revenues.

4.4.1.1 Traditional Economic Activities

The region currently has a 'mixed economy', where traditional economic activities such as hunting, trapping, fishing and gathering co-exist with wage-based employment. Wage employment is recognized as necessary and required but residents also desire to maintain subsistence lifestyles. Traditional economic activities are closely linked with the maintenance of Vuntut Gwitchin culture and Old Crow community well-being. The region's mixed economy may also be important to offset the 'booms and busts' of non-renewable resource development cycles. Subsistence harvesting also assists in mitigating the high cost of food purchases in Old Crow.

The land use plan should consider the effects of other land uses on subsistence harvesting activities, and make recommendations to minimize negative effects. The land use plan should also consider areas currently utilized to support traditional economic activities, and recommend measures to maintain those areas in a condition suitable for those activities to continue.

4.4.1.2 Heritage and Cultural Resources Conservation

Priority areas for heritage and cultural resource conservation are discussed in Sections 3.1 and 4.3. Important areas include the vicinity of Old Crow, Old Crow Flats and Vuntut National Park, the major wetland complexes outside of existing protected areas – Whitefish, Bluefish and Cadzow, Bluefish Cave, Driftwood River – Salmon Cache, Fishing Branch, vicinity of Whitestone Village, Bell River - Summit Lake, and Rock River – Richardson Mountains.

The region's major rivers, particularly the Porcupine, Eagle, and Bell, are important travel and harvesting corridors. Site specific heritage areas include Johnson Creek Village, Whitestone Village, Rampart House, and Lapierre House. Identified heritage routes and sites, as listed in the VGFN Final Agreement, Chapter 13, Schedule A, are also important cultural resources.

For areas outside of existing protected areas, the land use plan should recommend adequate conservation measures to protect and conserve the heritage and cultural values in these areas. Depending on the nature of the value, the conservation of heritage and cultural areas may be incompatible with industrial land uses.

4.4.1.3 Wage-Based Employment and Workforce Requirements

The tourism and recreation, oil and gas, mineral, and transportation sectors appear to represent the greatest future potential wage-based employment opportunities in the region. Old Crow municipal wage-based employment also includes pubic utilities, construction, health, social, education, transportation and tourism-related services.

Some land use sectors, particularly oil and gas and minerals, may require large workforces. Workforce requirements will vary depending on the location, scale and pace of activity, and may be of variable duration.

The land use plan should take steps to understand and consider wage-based employment opportunities and workforce requirements associated with future potential land uses. The land use plan should provide opportunities for those land uses to occur where they represent beneficial socio-economic change. Potential impacts of large workforce requirements (e.g., work camps) should also be considered and recommendations made to minimize their potential effects.

4.4.1.4 Resource Royalties and Revenues

Royalties are revenues paid to governments by resource producers for the right to produce a given product. VGFN holds nine Category A land parcels within the Eagle Plain oil and gas basin. Some of these parcels are within the ‘exploration and drilling fairway’ described by Fekete (2006) and described in this report (Section 4.1.2 and Appendix 1, Map 48). Tr’ondek Hwech’in First Nation also has a large Category A parcel (TH R-49A) within the Eagle Plain ‘drilling fairway’, to the immediate south of the region.

The current Yukon oil and gas royalty structure ranges from 5%-15% of the value of the commodity, depending on length of production and oil and gas prices. Mineral royalties vary depending on commodity type and other factors. Based on the natural gas scenario described by Fekete (2006) and discussed in this report (Section 4.1.2), resource royalties could represent contributions of several million dollars annually to First Nation governments, and much higher levels to the Yukon Government.

The land use plan should consider the effect of land use decisions on potential resource royalties and revenue levels for the affected First Nation and Yukon governments.

4.4.2 Land Use Impacts on Ecological, Heritage and Cultural Resources

Future land use activity has the potential to cause impacts to ecological, heritage and cultural resources. A specific goal from the VGFN Final Agreement, consistent with Sustainable Development, is that the management and Harvesting of Fish, Wildlife and their habitats shall be governed by the principle of Conservation (VGFNFA 16.3.2). Maintaining the integrity of wildlife and fish habitats, with emphasis on the Porcupine Caribou Herd, is a priority repeatedly expressed by Old Crow community residents. As discussed in Section 4.3.4, approximately 60% of the region is recognized as having “high” relative ecological values, based on the species and habitats assessed by the Commission and partners.

VGFN heritage, culture, traditional economy is closely linked. Significant heritage and cultural resources and areas are similar to the areas with high identified ecological values – major wetland complexes, caribou wintering areas and migration pathways, and river corridors.

Many of the identified ecological, heritage and cultural areas are contained within the three existing Parks and conservation areas - Vuntut National Park, Old Crow Flats SMA, and Ni'iinlii'njik (Fishing Branch) Wilderness Preserve, Ecological Reserve and HPA. The North Yukon Interim Land Withdrawal also contains a substantial proportion of these values, but its future status is undetermined. There are fewer areas with "high" ecological and cultural values in the central portion of the Eagle Plain oil and gas area of interest.

4.4.2.1 Considerations for Eagle Plain Oil and Gas Basin

Oil and gas-related activity in the Eagle Plain oil and gas basin has the highest potential to cause adverse landscape-level impacts in the region. The Eagle Plain oil and gas area of interest, in particular the 'drilling fairway' as described by (Fekete 2006), is a specific and well defined area of economic interest. The central Eagle Plains basin requires specific management recommendations in the land use plan.

Three general areas with high ecological and cultural values may be impacted by future oil and gas-related activity in the Eagle Plain oil and gas area of interest: 1) Whitefish Wetlands, 2) vicinity of Whitestone Village and River, and 3) major river corridors. The Porcupine Caribou Herd also utilizes the Eagle Plains area, with the highest use occurring in low snow years.

4.4.2.1.1 Whitefish Wetlands

Whitefish Wetlands complex has been consistently identified through traditional/local knowledge and scientific information as a priority area for conservation of ecological, heritage, and cultural resources and values (see Sections 4.3.3 and 4.3.5). The Whitefish Wetlands complex is one of four areas in the region identified as a significant wetland by the Yukon Wetlands Technical Committee (2005).

The central portion of the wetland is located in the northern portion of the Eagle Plains oil and gas basin; it also contains portions of the Porcupine, Eagle and Bell river valleys. It is the most ecologically sensitive area within the prospective "drilling fairway" described by Fekete (2006). The ice rich sediments underlying the Whitefish Wetlands complex are particularly susceptible to permafrost degradation resulting from surface disturbance. Whitefish wetlands received a substantial amount of historical seismic exploration and two exploration wells were drilled. VGFN land selection block VG R-02A covers the central portion of the wetland area.

4.4.2.1.2 Vicinity of Whitestone River and Village

The area around Whitestone Village, and the confluence of the Fishing Branch, Miner, and Whitestone rivers, has been consistently identified through traditional/local knowledge and scientific information as a priority area for conservation of ecological, heritage, and cultural resources and values (see Section 4.3.3 and 4.3.5 for discussion). This area is located in the southwestern portion of the Eagle Plains oil and gas basin.

4.4.2.1.3 Major River Corridors

Four major river corridors, the Porcupine, Eagle, Bell and Whitestone, occur within the Eagle Plain oil and gas basin. The river environments hold some of the most productive and biologically important habitats in the region. They are also important travel and subsistence harvesting corridors.

4.4.2.1.4 Porcupine Caribou Herd Areas

A discussion of significant Porcupine caribou habitats across the planning region is provided in Section 2.7.5.1. The entire region is occupied by the Porcupine herd at various times of year, particularly during the fall migration, rut, winter, and spring migration seasons. The range of dates for these seasons is approximately early August to end of May. Recommending appropriate measures to conserve significant use areas and habitats within the Porcupine caribou herd range, outside of those areas that are not already formally protected, is a key consideration for the regional land use plan. The recent decline of the herd has led to calls for enhanced conservation plans and measures from communities that rely on the herd for subsistence harvest. Governments, management boards, and other organizations are involved in these discussions.

At present, approximately 30% of the herd's concentrated use areas and general calving areas are present in designated protected areas. An additional 30% are contained within the North Yukon Interim land Withdrawal (see Sections 2.4.1 and 4.3.1). Most identified significant caribou use areas from this assessment are located outside the central portion of the Eagle Plain oil and gas basin. In particular, there appears to be limited direct overlap between significant caribou use areas and oil and gas exploration and development interests around Chance Creek. However, there is an expectation from stakeholders that adequate conservation measures will be established across the planning region in response to recent population concerns, and that these measures will be established in advance of increased land use activity.

While caribou can be present throughout Eagle Plains, the vicinity of Whitestone Village and Whitefish Wetlands have received significant levels of caribou use, as have areas long the Porcupine River. Caribou are present primarily during the rut and winter seasons, creating a difficult situation. The herd utilizes the range in the same period as when the highest levels of energy sector activity will occur, during the winter period. It may therefore not be realistic, or possible, to temporally separate oil and gas exploration activities from caribou use periods through the use of timing windows. Given this realization, that exploration and caribou use periods cannot be temporally separated, the maintenance of long-term habitat integrity should be an important consideration for the land use plan. This should also be a major consideration for industry and regulators when prescribing terms and conditions for oil and gas or other land use projects.

Caribou migration routes between significant areas and seasons also require important consideration. General migration corridors within and between the seasons occur within the Eagle Plain basin. Similar to the timing window issues described above, the presence of migrating caribou will require special attention by government and industry regarding when prescribing operating procedures. General migration patterns of the herd are discussed in Section 2.7.5.1.1, and shown in Appendix 1, Maps 21-23.

4.4.2.2 Road Access

With the exception of the Dempster Highway and community of Old Crow, the North Yukon Planning Region currently has no permanent road infrastructure. Additional winter and all-season road construction from any exploration or development activities provides an opportunity to access previously remote areas, with subsequent potential effects on the region's ecological, heritage and cultural resources. Impacts may include the direct loss of wildlife and fish habitat, indirect habitat effects, and damage or loss of undocumented heritage resources (e.g. archaeological sites).

The most significant and probable future road development consideration is associated with the Eagle Plain natural gas scenario. As estimated by Fekete (2006), approximately 1,200 - 1,500 km of all season access roads would be required over the 20-year production phase of the natural gas play, potentially opening the Eagle Plain basin to all season vehicle traffic. Significant requirements for all season road construction are not anticipated during initial natural gas exploration, as winter roads would be utilized until adequate reserves are determined. Given the permafrost conditions of the region, the winter season would be a focused period for oil and gas exploration and road construction. The Porcupine caribou herd is present in the oil and gas area of interest during the winter season. As described in Section 4.4.2.1.4, above, it is therefore inevitable that oil and gas-related activities would occur while the herd is on the winter range. Managing access and use of roads is a challenging issue associated with all natural resources industries, but particularly the oil and gas and forestry sectors.

Road construction creates opportunities for additional harvest of fish and wildlife populations. Access management strategies to reduce harvest-related effects associated with new road development will require careful consideration. Such management will play a key role in minimizing potential population and habitat impacts to caribou, moose, sheep, furbearers, fish, and other harvested species. Potential direct (i.e. mortality from collisions) and indirect (i.e. harvest opportunities) impacts of road construction on fish and wildlife are described by Jalkotzy et al. (1997), Trombulak and Frissell (2000), and Christie (2003). It should be noted that roads may also benefit wildlife by providing corridors for movement, particularly in deep snow years.

Road construction, access management and their related issues are crucial considerations for the land use plan. Given the substantial cumulative effects that can result, managing the creation and use of new linear features will likely be one of the most challenging issues for the land use plan and land managers. Negative impacts to existing social/cultural and ecological resources and values are likely consequences, should such activities remain unmanaged and uncontrolled. Minimizing the amount of all season road construction, and other linear access features, should be a priority for land managers.

4.4.2.3 Landscape Disturbance

Historical exploration and development activities in the region left a legacy of various disturbances to the landscape. Most of the impacts were associated with construction of the Dempster highway, and historical oil and gas-related exploration activities. The features included seismic lines, winter roads and trails, airstrips, and abandoned well sites. Many of the features are readily visible on the landscape today. A detailed discussion of existing impacts is provided in Section 4.2.

Any new industrial land use activity will create new surface disturbances, in addition to the existing impacts. Future potential oil and gas activities in the Eagle Plain region have the greatest potential to create the highest level of new surface disturbances. Some historical impacts have now regenerated to a point where they might not be considered human-caused disturbances. Also, some land use activities would likely utilize existing features. Understanding the cumulative nature of historical and future potential energy sector disturbances in Eagle Plains is therefore important, as the level of direct and indirect habitat impacts may range from relatively low to high depending on operating practices, natural and human reclamation rates and strategies, the geographic extent of activities, the size of the reserve being produced, and the pace at which exploration and production occurs.

Human-caused surface disturbance results in the direct loss and/or conversion of wildlife habitat. Given high enough levels, native wildlife species such as caribou may no longer be able to persist in a highly impacted area. While some sensitive species are not well adapted to habitat disturbance and alteration, other species such as moose often benefit from such activities, where young vegetation growth is promoted. Surface disturbance can also lead to permafrost degradation and changes to surface and sub-surface water flow between wetlands and waterways, with possible consequences for wetland-dependent organisms. Unintended impacts may also include loss or damage to archaeological sites or First Nations culturally significant areas. Other impacts include visual quality degradation of aesthetic values (i.e. visual quality), or the loss of the mental concept of ‘wilderness’.

Fragmentation is when large tracts of habitat become increasingly fragmented into smaller areas by human features or disturbances. Habitat fragmentation is a special concern for sensitive species such as caribou, some furbearers, and grizzly bear. High levels of habitat fragmentation may impact the viability of these wildlife populations to persist.

The land use plan should consider the effects of landscape disturbance, both surface disturbance and fragmentation, and recommend ways to manage future landscape disturbances. Future industrial land use activity in the region should minimizing habitat disturbance, conversion and fragmentation when ever possible.

4.4.2.4 Aggregate (gravel) Extraction

Aggregate (gravel) is a critical resource for the development of transportation and industrial infrastructure in northern permafrost landscapes. In the permafrost terrain of northern Yukon, large amounts of gravel will be required for the construction and maintenance of industrial infrastructure. Given the potential scale of future energy sector activity, the requirement for gravel may be particularly large for oil and gas-related industrial infrastructure (e.g. access roads, well pads, compressor stations and work camps). Future requirements would be in addition to existing gravel requirements to support the community of Old Crow, Dempster Highway regular maintenance, or any future major upgrades to the Dempster Highway.

In the North Yukon Planning Region, gravel is considered to be a non-renewable resource in limited supply. Obtaining adequate reserves to support future industrial land use activities may disturb large areas of land, and would be additional to the impacts of that land use. Potential terrestrial effects to ecological, heritage, and cultural resources are similar to those outlined in Section 4.4.2.3, above.

An additional consideration for aggregate is that many potential gravel sources in the region are located within river valleys, ecologically sensitive and biologically productive habitats. Gravel extraction in riparian areas may impact to aquatic habitats, particularly for fish species where habitat loss, water diversion and siltation are important considerations. Gavel pits and quarrying activities can also negatively impact the visual quality and enjoyment of other land uses such as river-based wilderness tourism, cultural activities, and subsistence harvesting.

4.4.2.5 Water Withdrawals

Water is an essential requirement for most industrial and transportation activities. Oil and gas exploration and development may require large amounts of water for a number of activities including exploration wells, drilling mud, work camps, and ice road construction. Conventional oil production typically requires about five barrels of water to produce one barrel of oil. Ongoing all season gravel road maintenance may require water for dust control or surface treatments.

Given the stream flow characteristics of the region, low summer and winter flow volumes may limit the amount of sustainable in-stream water available for industrial uses. Winter is considered to be a particularly critical period. Most oil and gas exploration activities would occur in winter, when maintenance of fish over-wintering areas is considered to be a critical issue for regional fish populations. Maintaining fish over-wintering areas is dependent on adequate water flow, depth and quality.

Fish over-winter locations are described above in Section 2.8.4. The main rivers containing critical fish over-wintering habitat are the Whitestone, Miner, Fishing Branch, Eagle, Bell, Porcupine, and Old Crow. Depending on the scale of activities and the amount of water required, increasing industrial-related water withdrawals from certain streams during the winter period may present large risks to regional fish populations. Water withdrawal operations can also impact the visual quality of river courses, lakes, and wetlands where the extraction operations are evident.

Maintenance of downstream water flow volumes has become a major management issue in the Alberta energy sector, where large volumes of water are required for oil sands production processes. Of note, the VGFN Final Agreement (14.8.1) states that Subject to the rights of Water users authorized in accordance with this chapter and Laws of General Application, a Yukon First Nation has the right to have Water which is on or flowing through or adjacent to its Settlement Land remain substantially unaltered as to quantity, quality and rate of flow, including seasonal rate of flow. This is a particularly important issue for the region’s major rivers.

4.4.2.6 Aquatic Habitat Disturbance

Rivers, streams and their adjacent valleys represent some of the most sensitive and biologically important environments within the region. As discussed above, gravel requirements for future development activities can be substantial, and often the sources come from floodplains, terraces and inactive river channels. Construction of the Dempster Highway in the 1970s relied heavily on gravel sources from active and inactive river channels. Similarly, many recent Yukon Government Department of Transportation gravel permit applications to provide gravel for ongoing Dempster Highway maintenance activities have focused on inactive river channels and terraces (see YESAB Project Applications for Rock Creek and Engineer Creek). Given the potentially limited gravel resources in Eagle Plains, a focus on gravel mining in inactive river channels will likely continue.

Understanding the impacts of such activities on fisheries values prior to gravel extraction activities should be viewed as a priority for land managers. Direct fish habitat disturbance may impact spawning and over-wintering areas, with resultant effects on fish populations other wetland-dependent organisms. Changes to the water dynamics and flows of rivers and active floodplains may result in altered water flow, habitat loss, and increases in stream siltation; all can have adverse effects on fish, birds, and other animals. Gravel extraction within or adjacent to high value wilderness tourism rivers can impact the visual quality of river courses where the extraction operations are occurring.

A second potential source of aquatic habitat disturbance resulting from industrial activity is stream crossings. Improperly planned and constructed stream crossings can have large negative impacts on streams and watersheds through either direct habitat disturbance or culvert failure/ blockage, creating temporary or permanent barriers to fish passage. In southern oil and gas regions, the number of access roads with improperly installed stream crossings has been found to be substantial, resulting in portions of entire watersheds being removed from productive fish habitat (Salmo et al. 2004).

Fish populations require access to both adequate summer and winter habitats, and must have the ability to migrate between the two seasonal habitats. Minimizing stream crossings, ensuring that required stream crossings are properly constructed and maintained, and minimizing the need for aquatic habitat disturbance and alteration during construction and maintenance activities are important fisheries and aquatic impact management considerations.

4.4.3 Climate Change Impacts on Ecological, Cultural and Heritage Resources

Within the region, climate change may have the greatest combined impacts on ecological and social/cultural systems, greater than any potential land use scenario. Climate change impacts will compound with land use impacts. Climate change effects have been evidenced by residents of the region for many years, and these and potential future effects should be considered in the land use plan. Climate change is discussed in Section 2.6.3.

Future climate at high latitudes is predicted to, in general, become warmer and drier. Of special significance to the region, a changing climate is expected to result in changed snowfall patterns and amounts, increased variability in weather and ice conditions, altered surface water flow, increasing permafrost active layer depths, increasing fire rates, and changed vegetation community composition and structure. Changes to vegetation communities will likely be most evident in high elevation and tundra environments; many of these have been identified as important habitats for large mammal species (sheep, caribou, moose, bears, and furbearers). Snow depth and hardness is a key factor influencing Porcupine Caribou Herd range use. Snow, water and ice conditions are also significant factors influencing people's ability to travel on the land.

Several studies have documented long-term declines in surface water in Arctic environments (see Section 2.7.5.4); water availability is an important consideration for fish populations. Should drier summers become standard for the Porcupine River region, less water will be available to re-charge groundwater reserves. This will decrease groundwater flows during critical winter periods, thereby reducing the availability and quality of fish over-wintering habitats. This further reinforces the importance of conserving the quality and quantity of winter water flows suitable to support fish over-wintering.

The magnitude of cumulative climate change effects are uncertain, but are expected to be large and significant. Shifts in fish and wildlife distributions to adapt to these changes are possible consequences of these climate-induced changes. Effects on social/cultural systems are already apparent. Many northern First Nations residents have expressed concern that the distribution and migration of wildlife and fish populations were once reasonably predictable, but these events are more uncertain now as the environment changes. This has important implications for the continuation of traditional economic and cultural activities.

4.4.4 Land Use Impacts on Other Sectors

Impacts from industrial land use activity can have both positive and negative effects on other land use sectors. For example, oil and gas development may negatively impact visual quality and experiences for wilderness tourists, but increasing road access can have positive impacts on mineral exploration and other tourism and recreation markets.

The greatest potential land use conflicts in the region are likely to occur between future oil and gas activities and wilderness/cultural tourism and subsistence use/harvesting in the vicinity of Eagle Plains, the Dempster Highway and major river corridors. A few possible effects are discussed below.

4.4.4.1 Oil and Gas Exploration and Development

The greatest potential development impacts and conflicts in the region are likely to be associated with large-scale oil and gas exploration and development projects, and the infrastructure requirements associated with this land use. The impacts could be realized on a 5-40 year time horizon from present, and would likely be focused on the Eagle Plains area. Exploration activities should be anticipated to occur over the entire basin, including Whitestone River, Johnson Creek, and possibly Whitefish Wetlands area.

Oil and gas activities need to be carefully managed to avoid negatively affecting the ecological and cultural values that support traditional economies and wilderness and cultural-based tourism opportunities. This is a particularly important consideration for wilderness tourism and subsistence activities along the Porcupine, Eagle, Bell and Whitestone rivers, and the Dempster highway corridor. Minimizing the extent, intensity, and duration of exploration activities and footprints will reduce potential impacts on these land uses.

Oil and gas infrastructure can provide beneficial opportunities for access to and exploration of mineral resources, where access can be co-managed and facilitated. Eagle Plain oil and gas basin is considered to have very low mineral potential, but new access routes may provide opportunities to explore potential resources located west and south of Fishing Branch. Oil and gas-related activities may also benefit community travel and subsistence use/harvesting. Some current community use winter trails around Old Crow and toward Eagle Plain basin utilize historical seismic lines and winter roads as travel routes. Opportunities for new tourism and recreation opportunities may occur as a result of access to new recreation areas and viewscapes, but generally there are undesirable impacts to wilderness tourism opportunities and experiences (e.g. Jalkotzy et al. 1997; Trombulak and Frissell 2000; Christie 2003).

A potential long-term transportation impact of oil and gas activity for Old Crow would be the possibility of having all-season road access located closer to the community. This would have some positive and negative implications. Such a situation might improve the economic feasibility of building an annual winter road to the community, as the distance to an all-season road in the oil and gas basin would be substantially reduced. However, this is a future consideration that is decades away from being realized.

4.4.4.2 Mineral Exploration and Development

Mineral resources in the region are poorly understood, and the future of the industry is highly uncertain. There is relatively low probability of a producing mine being established in the region in the near future. Mineral exploration and development activities are opportunistic events that generally have more site-specific issues and smaller scale impacts than the oil and gas sector.

As with oil and gas, mining-related impacts need to be carefully managed to avoid negatively affecting the ecological and cultural values that support traditional economies and wilderness and cultural-based tourism opportunities. Given the nature of mining activity and the relative volatility of mineral markets, predicting the location, pace and scale of mineral exploration and development activities over long periods of time is difficult. Generally, however, active mining operations negatively impact opportunities for wilderness and cultural tourism, and subsistence harvesting, where the interests overlap. Mine sites sited near rivers can impact the visual quality of the river corridor, and may affect the downstream water quality of rivers. Mine sites located along prominent human viewscapes, such as the front range of the southern Richardson Mountains and foothills, may also negatively impact wilderness and scenic tourism-related opportunities.

4.4.4.3 Transportation

Transportation infrastructure and activities generally have positive effects on other industrial sectors, where access to resources and markets is desired. Tourism and recreation opportunities may benefit from the transportation sector where easy and efficient access to ecological, heritage, and cultural resources is facilitated. This can also include access to new viewscapes and features, such as provided by the Dempster Highway. Subsistence use/harvesting opportunities also often benefit from road transportation, where access to wildlife and fish resources becomes easier.

Transportation may negative effect wilderness tourism and recreation and subsistence use/harvesting opportunities where large, intact landscapes and viewscapes are desired.

4.4.4.4 Tourism and Subsistence Use/Harvesting

Tourism opportunities in North Yukon generally use existing infrastructure and natural features. The focus of tourism activity is currently on wilderness tourism and the Dempster Highway corridor. Unmanaged tourism can have effects on ecological, heritage, and cultural resources, through disturbance or damage to physical resources.

Reduced opportunities for the pursuit and enjoyment of subsistence harvesting activities is also a possibility, since many of wilderness tourism activities occur on major rivers that are also used by local residents.

Generally, the site-specific and temporary nature of tourism activities, the relatively small ecological footprint of wilderness tourism operations, and the anticipated low levels of tourism activity would result in few direct impacts to other sectors in the region. Subsistence use/harvesting activities have few, if any, direct impacts to other sectors

However, it should be recognized that in areas where tourism and recreation and subsistence use/harvesting activities are prioritized, an indirect effect may be to alienate lands and resources from industrial land use activity.

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Section 5: Conclusions and Major Planning Issues

This resource assessment report provides a description and assessment of the ecological, heritage and cultural, and economic conditions and resources of the North Yukon Planning Region. Land status, biophysical setting, and fish and wildlife resources are described in Section 2. Section 3 contains a description of heritage and cultural resources, and current VGFN land use. Section 4 described current and future economic activity, existing land impacts and an assessment of conservation values. Topic summaries are provided in Sections 4.1.10, 4.2.3 and 4.3.6, respectively. Based on the compilation and analysis of information in this report, major conclusions and planning issues that should be considered by the North Yukon regional land use plan are listed below.

5.1 Conclusions

5.1.1 Land Use

- While changed from decades ago, VGFN culture, subsistence harvest, and traditional economy in the region remain strong – all are linked to healthy land, water, and ecosystems
- Tourism and recreation activity in the region is low, but has the potential to grow into a small-scale, carefully managed industry. Future tourism opportunities will depend on intact wilderness landscapes, wildlife and Vuntut Gwitchin culture
- Of the land uses examined, future potential oil and gas-related exploration and development activities in the Eagle Plains area have the greatest potential to cause landscape-level change in a significant portion of the region, and to result in cumulative land use impacts
- While the region is anticipated to hold substantial natural gas reserves, the future development of this resource is uncertain and is not expected for at least another decade. In addition to finding adequate reserves, three major conditions must be met prior to natural gas development at Eagle Plains: 1) a major pipeline must be built along Mackenzie Valley or Alaska highway, 2) capacity must exist in that pipeline to accept Eagle Plain natural gas, and 3) Eagle Plain natural gas must be accepted for delivery into that pipeline at reasonable toll rates
- The future of mineral exploration and development is highly uncertain. Based on current but limited information, mineral potential of the region is generally considered to be lower than other areas of Yukon
- Future industrial and transportation land uses may require substantial amounts of gravel and water; both are considered to be resources in limited supply. Obtaining

these resources to support other activities may result in significant additional impacts

- The greatest potential land use conflicts in the region are anticipated to occur between future oil and gas activities and wilderness/cultural tourism and subsistence use/harvesting in the vicinity of Eagle Plains, the Dempster Highway and major river corridors. The Dempster Highway viewscape in the southern Richardson Mountains and foothills requires special consideration
- At present, nowhere in the region appears to have experienced or be experiencing critical levels of cumulative habitat-related impacts. The current levels and types of human-caused surface disturbances, while visible, are not compromising the ecological integrity of the region
- Climate change is expected to be a major factor influencing future potential land use; climate change will affect both community and industrial land uses
- The cumulative effects of land uses are of great concern to residents of the region. The long-term, cumulative nature of multiple land uses, including historical land uses, is of greater concern to residents than any single development project or land use sector
- Sustainable Development cannot be achieved without managing cumulative effects. Meeting economic development objectives that do not undermine the social and ecological systems of the region (i.e., Sustainable Development) will require a land management regime capable of making pro-active and integrated land use decisions

5.1.2 Conservation

- The conservation of wildlife and fish habitats and populations is of great importance to residents of the region, with Porcupine caribou being of special concern
- Wetlands, lakes and river corridors are biologically productive areas that hold many of the region’s heritage, cultural, and ecological values. These areas should be managed with a high level of conservation, and require specific management recommendations
- In addition to the major wetland complexes, the southern and northern Richardson Mountains and foothills contain some of the highest concentrations of ecological, heritage, and cultural values in the region. Much of this area is within the Tetlit Gwich’in Secondary Use Area
- At this time, the Richardson Mountains and foothills, other areas of Porcupine Caribou Herd concentrated use, and the major wetland complexes outside of Old Crow Flats have no formal conservation designations
- A large amount of the identified ecologically important areas and significant heritage and cultural resources are contained within existing protected and

conservation areas, and the North Yukon Interim Land Withdrawal. The future status of the North Yukon Interim Land Withdrawal within the planning region is undetermined

- Three areas of conservation concern within Eagle Plain oil and gas basin require special management consideration in the regional land use plan: Whitefish Wetlands complex, vicinity of Whitestone Village, and major river corridors (Porcupine, Eagle, Bell and Whitestone rivers)
- A large body of scientific evidence suggests that climate change will induce significant changes to regional ecosystems, with uncertain results. These changes may be greater than changes created by land uses
- The uncertainty of climate change impacts, future land use scenarios, and potential land use impacts necessitates managing the region according to the precautionary principle, and in the spirit and intent of adaptive management
- Addressing regional conservation and development issues will require collaboration and sharing of resources between governments, land claim boards, and other groups

5.2 Major Planning Issues

Based on the findings of this report, the following planning issues should receive special consideration in the North Yukon regional land use plan. These issues and topics have the greatest potential to affect the social, ecological and economic conditions of the region.

5.2.1 Cumulative Effects Management

Cumulative effects are changes to the environment and/or society that result from a land use activity in combination with other past, present and future activities. While one activity may have only a small impact, the combined effect of a number of activities may have a significant impact. Understanding the cumulative nature of historical, current and future land uses, in combination with natural agents of change, is central to understanding and managing the potential cumulative effects of land use activity. *Sustainable Development* cannot be achieved without managing the cumulative effects of multiple land use activities.

The cumulative effect of multiple land use activities are a key concern for residents of Old Crow, and other land users of the region. The long-term, cumulative nature of multiple land uses is of greater concern to residents than any single development project. An assessment of development and exploration proposals on a project by project basis is not well suited to understanding potential cumulative effects. The current YESAB mandate to assess and recommend measures to mitigate potential cumulative effects in this manner is not sufficient to manage the long-term effects of multiple land use activities.

<u>Implications for land use plan:</u>

The land use plan should take steps to understand the pace, scale and location of future potential development activities, and consider and recommend measures to manage those cumulative effects. Of the land uses examined in Section 4.1, future potential oil and gas development in Eagle Plains has the greatest potential to cause adverse landscape-level cumulative effects.

5.2.1.1 Limits of Acceptable Change

Limits of acceptable change refers to a planning process that establishes the amount of change from a reference condition considered to be acceptable for a specified resource or indicator. It focuses on achieving a desired outcome for a pre-determined 'acceptable' condition. It also recognizes that a condition differing from 'pristine' or 'unaffected' may be acceptable. The limits of acceptable change approach has been used in a number of different planning exercises, but is considered to have particular relevance to the management of cumulative effects in Canada's North (e.g., Macleod Institute 2002).

Achieving the appropriate balance between conservation and development is central to any regional land use planning exercise. Limits of acceptable change is a useful concept for the North Yukon regional land use plan, and may be a pragmatic approach to managing cumulative effects.

<u>Implications for land use plan:</u>

The land use plan should take steps to establish limits of acceptable change for general indicators of land use activity, ecological integrity or other valued ecological or cultural resources. Such an approach is supported by the VGFN Final Agreement and its definition of *Sustainable Development*.

5.2.2 Potential Oil and Gas Development in Eagle Plains

Oil and gas land use activity has the potential to provide large economic benefits to the region and to Yukon as a whole. However, more than any other land use, it also has the potential to create landscape-level change in a significant portion of North Yukon Planning Region in the coming decades.

Oil and gas activity will create induced land uses. In addition to energy sector features such as well sites, pipelines and seismic lines, oil and gas activity in Eagle Plains will require construction of all season access roads, which may result in significant amounts of gravel extraction. Large amounts of water may also be required for ice road construction and production-related activities.

The economic, social/cultural and ecological changes that oil and gas development could introduce to the region would be significant. Understanding and mitigating the potential cumulative effect of oil and gas activity, and other land uses, on important ecological and cultural values should be a primary land use concern in the North Yukon Planning Region.

Within the Eagle Plain oil and gas area of interest (Appendix 1, Map 48), there are three areas where significant ecological, heritage and cultural values require special consideration and a higher level of conservation management: 1) Whitefish Wetlands complex, 2) vicinity of Whitestone Village and Whitestone river, and 3) the major river corridors (Porcupine, Eagle, Whitestone and lower Bell rivers). The Porcupine Caribou Herd utilizes Eagle Plain as winter range, with the highest levels of use occurring in low snow years. The Whitestone River and Whitefish wetlands areas have historically received the highest levels of use.

With the exception of the three areas identified above, at present there appears to be relatively limited overlap between concentrations of ecological and heritage/cultural resources and values and the Eagle Plain oil and gas area. This does not imply that there are no heritage or ecological resources and values in the Eagle Plains area, only that potential direct conflicts appear to be relatively few and these have the ability to be managed. This is a key consideration for the development of the North Yukon regional land use plan.

Implications for land use plan:

The land use plan should understand, consider and account for future potential oil and gas activity in Eagle Plains, and recommend ways to ensure adequate conservation measures are in place prior to large-scale development.

5.2.3 Land Management and Porcupine Caribou Herd

The Porcupine Caribou Herd is central to the well-being of Vuntut Gwitchin culture. The herd is suspected to be declining, and residents of Old Crow are concerned about immediate and long-term conservation of the herd. Vuntut Gwitchin culture, traditional values and subsistence economy are dependent on a healthy Porcupine Caribou Herd and continued access to and utilization of the herd.

Management of the Porcupine Caribou Herd is a shared responsibility between many governments, agencies, boards and committees, with the Porcupine Caribou Management Board being the principle group. The herd is a high profile barren-ground species that receives international attention and is managed under an international agreement with the United States. The uncertain status of the 1002 lands in the Arctic National Wildlife Refuge is a contributing factor to public interest in the herd.

Threats to the herd include habitat effects as a result of future industrial land uses such as large-scale oil and gas activity, habitat and energetic effects as a result of climate change, population effects due to over-harvesting, and the resulting cumulative effect of all factors. Harvesting issues are not the mandate of NYPC, but the land use plan can understand and recommend measures to minimize impacts on the herd's habitat.

Implications for land use plan:

To sustain the long-term health of the herd, the land use plan should ensure adequate conservation measures are established for important Porcupine Caribou Herd habitats throughout the North Yukon Planning Region, prior to large-scale industrial land uses occurring. Understanding the potential long-term cumulative nature of habitat impacts should also be a priority.

5.2.4 Wetlands, Lakes and Rivers

Wetlands, lakes, rivers and riparian environments are biologically productive areas that hold many of the heritage, cultural and ecological values of the region. Future land use activities have the potential to impact these values.

Wetlands, lakes and riparian areas are important habitats for many species, including fish, marten and moose. Vuntut, or *Van Tat*, means 'people who dwell among of the lakes.' The VGFN has a strong cultural and traditional economic connection to the lakes, wetlands and rivers of the region. This connection is expressed through VGFN land selections: 80% of their lands encompass major wetland complexes and riparian areas, with the majority of the settlement lands in Old Crow Flats, Bluefish and Whitefish wetland complexes. The major rivers and lakes are the summer and winter highways of the region, and people's use of the land focuses on the river corridors for harvesting and cultural practices. Future wilderness tourism activities will also likely focus on these areas.

Old Crow Flats, the most significant wetland and lake complex in Yukon, is fully protected within Old Crow Flats SMA and Vuntut National Park. The Bluefish and Whitefish wetland complexes are within VGFN settlement lands, but are not designated as protected.

Of the region's unprotected major wetlands, the Whitefish wetland complex has the greatest potential to sustain impacts resulting from industrial land use. The entire complex is within the Eagle Plain oil and gas basin. The Porcupine, Eagle, Whitestone and Bell rivers are also within the Eagle Plain oil and gas basin.

Implications for land use plan:

The land use plan should consider potential future development impacts on water, wetlands and riparian areas (outside of existing protected areas), and recommend specific management strategies for these features to ensure adequate conservation measures are in place prior to large-scale industrial land uses occurring.

5.2.5 Land Status

Natural resource industries require the ability to secure rights to, explore for and develop the desired resources. Establishing land use certainty is an important consideration for investment in natural resource industries. Establishing a 'working landscape' and providing clear management guidelines for accessing that landscape is important to create a positive investment climate for natural resource industries.

A large amount of land in the North Yukon Planning Region is currently withdrawn from oil and gas and mineral exploration, gravel extraction and other industrial land use activities. Existing Parks and SMAs provide long-term protection for approximately 32% of the planning region; an additional 12% of the region is currently not available for natural resource exploration and development activities as the result of an Order in Council interim land withdrawal (i.e., North Yukon Interim Land Withdrawal).

Additional land withdrawals in areas of high oil and gas potential, particularly Eagle Plains, may affect the ability to develop a viable energy sector. The interim land withdrawal contains significant habitats for the Porcupine Caribou Herd, important heritage resources, and culturally significant areas, with the northern Richardson Mountains and foothills being of special significance. The future status of the North Yukon Interim Land Withdrawal within the planning region is undetermined

Implications for land use plan:

The land use plan should recommend tools and approaches to ensure adequate conservation measures are in place while providing opportunities to access lands for a range of activities, including natural resource exploration and development. The land use plan should consider future land use options for the North Yukon Interim Land Withdrawal.

5.2.6 Transportation

Construction of future all-season access roads and additional air strips may be required to support economic development in the region. A lack of road transportation infrastructure is commonly referenced as being a barrier to natural resource development. All-season access roads and people's use of those roads have the potential to cause impacts to wildlife and fish populations and habitats.

Important future surface transportation considerations include potential construction of industrial access roads required for oil and gas, mineral and other resource development, and construction of an all-season access road to Old Crow. Long-term transportation concepts associated with port access on the Yukon North Slope are unlikely to proceed in the coming decades, but require consideration. Identification of and access to adequate aggregate (gravel) resources is a key consideration for all future transportation issues in the region.

Implications for land use plan:

The land use plan should consider and account for the management of existing transportation infrastructure and future transportation requirements. The Plan must also recommend measures to minimize the potential impacts of existing and future transportation requirements.

5.2.7 Land Use Conflicts

The greatest potential land use conflicts in the region are likely to occur between future oil and gas activities and wilderness/cultural tourism and subsistence use/harvesting in the vicinity of Eagle Plains, the Dempster Highway and major river corridors. Future potential mineral exploration and development activity may also create land use conflicts, but the nature of these impacts is generally more localized. The Dempster Highway viewscape in the Southern Richardson Mountains and foothills requires special consideration. Gravel extraction associated with transportation and industrial infrastructure in the vicinity of major rivers and human viewscapes also has the potential to create land use conflicts.

Implications for land use plan:

As required by the VGFN Final Agreement (11.4.5.4), the land use plan must recommend measures to minimize land use conflicts in these areas.

5.2.8 Integrated Land Management

A regional land use plan cannot address all of the potential cumulative impacts of development and climate change on fish and wildlife habitats and populations, and heritage resources. The management of ecological and cultural resources therefore requires periodic monitoring, reporting, and evaluation. Such efforts will require collaboration and sharing of resources between governments, land claim boards, and other groups.

The NYPC envisions that ecological and heritage resources will be managed under the spirit and intent of the VGFN Final Agreement, and by the guiding principles of the regional land use plan. In particular, the link between Chapter 11 (Land Use Planning) and Chapter 12 (Development Assessment Process), must be effective and meaningful for the regional plan to fulfill its goals. The North Yukon regional land use plan will be the first Chapter 11 plan to explore this linkage. An effective land management regime will also provide a framework for assessing and reporting the health and status of the region’s resources.

The land use plan can recommend tools and approaches that foster pro-active and coordinated decision-making with and among governments, key components of integrated land management and cumulative effects management. However, to achieve integrated land management, implementation and adoption of the regional land use plan may require governments to re-examine and re-align some of their decision-making processes.

Implications for land use plan:

As required by the VGFN Final Agreement, the land use plan should ensure that social, cultural, economic and environmental policies are applied to the management, protection and use of land, water and resources in an integrated and coordinated manner so as to ensure Sustainable Development (11.1.1.6).

5.2.9 Socio-economic Effects of Land Use Activities

The regional land use plan cannot directly address socio-economic effects of land use activities, but can consider the effects of land use activities and land management recommendations on socio-economic outcomes. Population, employment, resource royalties and revenues and maintenance of opportunities for traditional economic activities are all important considerations.

Implications for land use plan:

Socio-economic factors should be considered at the land use scenarios stage of the planning process.

5.2.10 Climate Change

Climate change has the potential to affect all sectors and/or resources in the North Yukon Planning Region. While the significance is still uncertain, climate-induced changes are expected to result in habitat change, wetland loss or alteration, changes in stream water flow, permafrost degradation, increasing fire rates and highly variable winter temperature and snow conditions. These changes will impact wildlife and fish and their habitats, people's ability to travel on and use the land (both for subsistence and transportation), and the length of the winter work period available for industrial land uses.

Implications for land use plan:

The land use plan should consider and account for current and future effects of climate change in land use recommendations, with special consideration of climate change impacts on the Porcupine Caribou Herd and its' important habitats.

References

Macleod Institute. 2002. Carrying capacity and thresholds: Theory and practice in environmental management. Prepared for Canadian Arctic Resources Committee. Calgary, Alberta. 63 pp.

North Yukon Planning Region Resource Assessment Report
Appendix One - List of Resource Assessment Maps

Updated October 2007

Appendix One

List of Resource Assessment Maps

Map #	Title	Description	Data Sources
1	Regional Overview	Overview of North Yukon Planning Region – communities, land ownership, transportation, important features and existing protected and special management areas	Yukon Government; North Yukon Planning Commission
2	Land Status	Land ownership, existing permits and exploration rights (oil and gas and minerals), and lands withdrawn from disposition (Protected Areas and North Yukon Interim Land Withdrawal in North Yukon Planning Region (current as of October 2007)	Yukon Government
3	Simplified Geology and Ecodistricts	Overview of regional bedrock geology conditions and Ecodistricts	Yukon Geological Survey
4	Simplified Surficial Geology and Ecodistricts	Overview of regional surficial geology conditions, significant terrain features (wetland complexes and major riparian features) and Ecodistricts	North Yukon Planning Commission; Yukon Environment; Gartner Lee Limited
5	Porcupine River Watershed and Major Sub-Basins	Overview of major sub-basins in Porcupine River watershed	North Yukon Planning Commission; Department of Fisheries and Oceans

6	Regional Ecosystems – Ecoregions and Ecodistricts	Ecoregions and Ecodistricts of North Yukon Planning Region	Yukon Environment; Gartner Lee Limited; Cryogeographic Consulting; Yukon Ecoregions Working Group; North Yukon Planning Commission
7	Regional Ecosystems – Bioclimate Zones and Ecodistricts	Bioclimate zones and Ecodistricts of North Yukon Planning Region	North Yukon Planning Commission; Yukon Environment; Gartner Lee Limited
8	Landscape Types	Landscape Types (biophysical map) of North Yukon Planning Region as described by regional biophysical mapping (current to March 2006).	North Yukon Planning Commission; Yukon Environment
9	Identified Wetlands	Lakes, wetlands, wetland complexes, and river/stream networks in North Yukon Planning Region as described by Yukon Wetlands Technical Working Group, regional terrain mapping and topographic mapping.	Yukon Wetlands Technical Working Group; Gartner Lee Limited; 1:50-1:250K NTDB
10	Fire History (1950-2005)	Historical fire activity in North Yukon Planning Region and surrounding areas of Yukon for period 1950-2005 (current to March 2006).	Yukon Fire Management
11	Landscape Types with High Susceptibility to Climate-induced Change	Landscape Types in North Yukon Planning Region anticipated to experience high rates of climate-induced change (measurable vegetation changes within in a 3-5 decade period).	North Yukon Planning Commission

12	Porcupine Caribou Herd – Yukon Wildlife Key Areas Inventory and Old Crow Traditional Knowledge	Synthesis of Porcupine Caribou herd distribution and movement information as documented by Yukon Wildlife Key Areas Inventory database and Old Crow community workshops.	Yukon Environment; Community of Old Crow Land Users
13	Moose - Yukon Wildlife Key Areas Inventory and Old Crow Traditional Knowledge	Synthesis of moose distribution and movement information as documented by Yukon Wildlife Key Areas Inventory database and Old Crow community workshops.	Yukon Environment; Community of Old Crow Land Users
14	Bears - Yukon Wildlife Key Areas Inventory and Old Crow Traditional Knowledge	Synthesis of bear distribution and movement information as documented by Yukon Wildlife Key Areas Inventory database and Old Crow community workshops.	Yukon Environment; Community of Old Crow Land Users
15	Furbearers - Yukon Wildlife Key Areas Inventory and Old Crow Traditional Knowledge	Synthesis of furbearer (marten, mink, beaver, otter, lynx, wolf, wolverine and arctic fox) distribution and movement information as documented by Yukon Wildlife Key Areas Inventory database and Old Crow community workshops.	Yukon Environment; Community of Old Crow Land Users
16	Sheep - Yukon Wildlife Key Areas Inventory and Old Crow Traditional Knowledge	Synthesis of sheep distribution and movement information as documented by Yukon Wildlife Key Areas Inventory database and Old Crow community workshops.	Yukon Environment; Community of Old Crow Land Users
17	Waterbirds- Yukon Wildlife Key Areas Inventory and Old Crow Traditional Knowledge	Synthesis of waterbird distribution information as documented by Yukon Wildlife Key Areas Inventory database and Old Crow community workshops.	Yukon Environment; CWS; DU; Community of Old Crow Land Users

18	Raptors- Yukon Wildlife Key Areas Inventory and Old Crow Traditional Knowledge	Synthesis of raptor (peregrine falcon, bald eagle, golden eagle, gyrfalcon, osprey, merlin, rough legged hawk, 'other raptors') distribution information as documented by Yukon Wildlife Key Areas Inventory database and Old Crow community workshops.	Yukon Environment; Community of Old Crow Land Users
19 A	Range of the Porcupine Caribou Herd	Porcupine Caribou Herd range, including Alaska, Yukon and NWT (version 2004).	Environment Canada, Canadian Wildlife Service;
19 B	Distribution of Radio-Collared Porcupine Caribou (1983-2005)	Porcupine Caribou distribution patterns in North Yukon Planning Region based on 1983-2005 radio telemetry – calving and general use areas are shown by use period.	Environment Canada, Canadian Wildlife Service; United States Geological Survey, Biological Resources Division; North Yukon Planning Commission
20	Distribution of Radio-Collared Porcupine Caribou (1983-2004)	Porcupine Caribou distribution patterns for entire herd range based on 1983-2004 radio telemetry – calving and general use areas.	Environment Canada, Canadian Wildlife Service; United States Geological Survey, Biological Resources Division; North Yukon Planning Commission
21	Fall to Late Fall Distribution and Migration of Satellite-Collared Porcupine Caribou (1985-2004)	Summary of identified migration routes and high use areas in fall and late fall periods within Porcupine Caribou Herd range.	Environment Canada, Canadian Wildlife Service; United States Geological Survey, Biological Resources Division; North Yukon Planning Commission

22	Late Fall to Winter Distribution and Migration of Satellite-Collared Porcupine Caribou (1985-2004)	Summary of identified migration routes and high use areas in late fall and winter periods within Porcupine Caribou Herd range.	Environment Canada, Canadian Wildlife Service; United States Geological Survey, Biological Resources Division; North Yukon Planning Commission
23	Winter to Spring Distribution and Migration of Satellite-Collared Porcupine Caribou (1985-2004)	Summary of identified migration routes and high use areas during late winter within Porcupine Caribou Herd range.	Environment Canada, Canadian Wildlife Service; United States Geological Survey, Biological Resources Division; North Yukon Planning Commission
24	Caribou Habitat Suitability - Winter	Winter (November 1 – March 31) Porcupine Caribou Herd habitat suitability conditions in North Yukon Planning Region as described by Community of Old Crow land users, biologists and regional biophysical mapping.	Community of Old Crow Land Users; Yukon Environment; CWS; North Yukon Planning Commission
25	Location of Moose and Aerial Survey Boundaries (1995 – 2003)	Location of moose aerial survey boundaries (summer, fall and winter) and observed moose locations within those survey areas for period 1995 – 2003.	Yukon Environment; U.S. Fish and Wildlife Service; Access Consulting Group
26	Moose Habitat Suitability – Spring/Summer	Spring / Summer (June 1 – July 31) moose habitat suitability conditions in North Yukon Planning Region as described by Community of Old Crow land users, biologists and regional biophysical mapping.	Community of Old Crow Land Users; Yukon Environment; North Yukon Planning Commission

27	Moose Habitat Suitability – Early Fall	Fall (pre-rut, August 15 – September 15) moose habitat suitability conditions in North Yukon Planning Region as described by Community of Old Crow land users, biologists and regional biophysical mapping.	Community of Old Crow Land Users; Yukon Environment; North Yukon Planning Commission
28	Moose Habitat Suitability – Late Fall	Fall (rut to late fall/freeze up, September 16 – October 31) moose habitat suitability conditions in North Yukon Planning Region as described by Community of Old Crow land users, biologists and regional biophysical mapping.	Community of Old Crow Land Users; Yukon Environment; North Yukon Planning Commission
29	Moose Habitat Suitability - Winter	Winter (November 1 – March 31) moose habitat suitability conditions in North Yukon Planning Region as described by Community of Old Crow land users, biologists and regional biophysical mapping.	Community of Old Crow Land Users; Yukon Environment; North Yukon Planning Commission
30	Marten Habitat Suitability - Winter	Winter (November 1 – March 31) marten habitat suitability conditions in North Yukon Planning Region as described by Community of Old Crow land users and regional biophysical mapping.	Community of Old Crow Land Users; Yukon Environment; North Yukon Planning Commission
31	Waterbird Population Surveys and Major Wetland Complexes	Summary of documented waterbird population surveys in North Yukon Planning Region in relation to major wetland complexes and rivers for the period 1955-present.	DU; CWS; US Fish and Wildlife Service; Yukon Wetlands Technical Working Group
32	Waterbird Habitat Potential	Summary of waterbird habitat potential in North Yukon Planning Region based on adjacency to major open water features, riparian zones and wetlands.	North Yukon Planning Commission; DU; CWS

33	Fisheries Stream Information Watershed Summary	Summary of known fish species information and general level of fisheries knowledge for major sub-basins of the Porcupine River watershed.	Environmental Dynamics Inc. 2005. Porcupine River watershed fisheries summary; North Yukon Planning Commission
34	Fisheries Specific Lake Information Summary	Summary of fish species information for identified lakes in the North Yukon Planning Region.	Environmental Dynamics Inc. 2005. Porcupine River watershed fisheries summary; North Yukon Planning Commission
35	Historic Fish Trap Locations and Important Lake/Wetland Complexes	Summary of documented traditional use fish trap locations and their relationship to important wetland complexes with high fisheries value.	Environmental Dynamics Inc. 2005. Porcupine River watershed fisheries summary; North Yukon Planning Commission
36	Identified and Potential Over-Wintering Fish Habitat	Summary of documented and potential over-wintering fish habitat based on literature review and Community of Old Crow land user knowledge.	Environmental Dynamics Inc. 2005. Porcupine River watershed fisheries summary; North Yukon Planning Commission
37	Coho Salmon Spawning Habitat	Identified Coho salmon spawning habitat in Porcupine River watershed (information current as of spring 2005).	Environmental Dynamics Inc. 2005. Porcupine River watershed fisheries summary; North Yukon Planning Commission
38	Chum Salmon Spawning Habitat	Identified and potential Chum salmon spawning habitat in Porcupine River watershed (information current as of spring 2005).	Environmental Dynamics Inc. 2005. Porcupine River watershed fisheries summary; North Yukon Planning Commission

39	Chinook Salmon Spawning Habitat	Identified and potential Chinook salmon spawning habitat in Porcupine River watershed (information current as of spring 2005).	Environmental Dynamics Inc. 2005. Porcupine River watershed fisheries summary; North Yukon Planning Commission
40	Heritage Values and Traditional Land Use	Summary of documented archaeological sites and Vuntut Gwitchin traditional use and culturally significant areas (including caribou fences and fish traps) in North Yukon Planning Region (updated October 2007)	Vuntut Gwitchin First Nation; North Yukon Planning Commission
41	Vuntut Gwitchin Current Land Use	Current Old Crow resident land use patterns - important travel routes, trails and use areas (updated October 2007)	Vuntut Gwitchin First Nation; North Yukon Planning Commission
42	Tourism and Recreation	Tourism and recreation values documented for North Yukon Planning Region. Values include existing and future potential activities. Tourism and recreation values as displayed include wilderness travel corridors, road-based tourism corridors, important tourism nodes and features, and high recreational feature values based on landscape properties	Yukon Tourism; Vuntut Gwitchin Heritage Department; Yukon Parks; North Yukon Planning Commission
43	Oil and Gas Potential and Resource Interests	Oil and gas basins, current oil and gas permits and significant discovery licenses (current October 2007), historical well locations and documented seismic lines.	Yukon Oil and Gas Management Branch
44	Mineral Potential and Resource Interests	Mineral potential, documented mineral occurrences and existing mineral interests (i.e. mineral claims) in North Yukon Planning Region (current October 2007)	Yukon Geological Survey; Yukon Energy, Mines and Resources

45	Coal and Iron Potential	Coal and iron potential map of North Yukon Planning Region based on documented occurrences and interpretation of bedrock geology mapping.	Yukon Geological Survey
46	Tree Height in Old Crow Area	Tree height classes in the Old Crow area based on 1:50,000 scale vegetation (forest) inventory mapping.	Yukon Forest Management
47	Forest Site Potential in Old Crow Area	Long-term forest site potential in the Old Crow area based on 1:50,000 scale vegetation (forest) inventory mapping.	Yukon Forest Management
48	Important Areas for Future Economic Development	Synthesis of important areas for future economic development consideration with focus on oil and gas, tourism and recreation and transportation. High mineral potential areas as displayed on *Map 44 - Mineral Potential and Resource Interests* are not currently shown due to uncertain knowledge of resource. Updated October 2007.	Yukon Tourism; Vuntut Gwitchin First Nation; Yukon Energy, Mines and Resources; North Yukon Planning Commission
49	Existing Land Use Impacts	Synthesis of existing and historical land use impacts based on compilation of human feature mapping. North Yukon land use impacts as displayed include direct, visible footprints resulting from transportation, industrial and community/communications features (current as of March 2006).	Yukon Oil and Gas Management Branch; Geomatics Yukon; Yukon Lands Branch; North Yukon Planning Commission; Vuntut Gwitchin First Nation
50	Contaminated Sites	Identified contaminated sites in North Yukon Planning Region resulting from historical land use activities (current as of 2004).	DIAND, Yukon contaminated sites database

51	Areas of Previous Conservation Interest and Existing and Interim Protected Areas	Existing and interim protected areas / special management areas and documented areas of previous conservation interest. Areas shown represent a synthesis of previous documented conservation area concepts.	International Biological Programme; North Slope Order in Council 2005/53; Porcupine-Peel Landscape Summary Report; Yukon Protected Areas Secretariat
52	Ecologically Important Areas (detailed)	Synthesis of ecologically important areas in North Yukon Planning region based on compilation of important Porcupine Caribou Herd calving and concentrated use areas, wetland complexes, major river corridors, significant riparian areas, and identified sheep areas.	Community of Old Crow Land users; Environment Canada, CWS; Environment; United States Geological Survey, Biological Resources Division; DU; Yukon Wetlands Technical Working Group; North Yukon Planning Commission
53	Ecologically Important Areas (generalized)	Synthesis of ecologically important areas in North Yukon Planning region based on compilation of important Porcupine Caribou Herd calving and concentrated use areas, wetland complexes, major river corridors, significant riparian areas, and identified sheep areas.	Community of Old Crow Land users; Environment Canada, CWS; Environment United States Geological Survey, Biological Resources Division; DU; Yukon Wetlands Technical Working Group; North Yukon Planning Commission

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