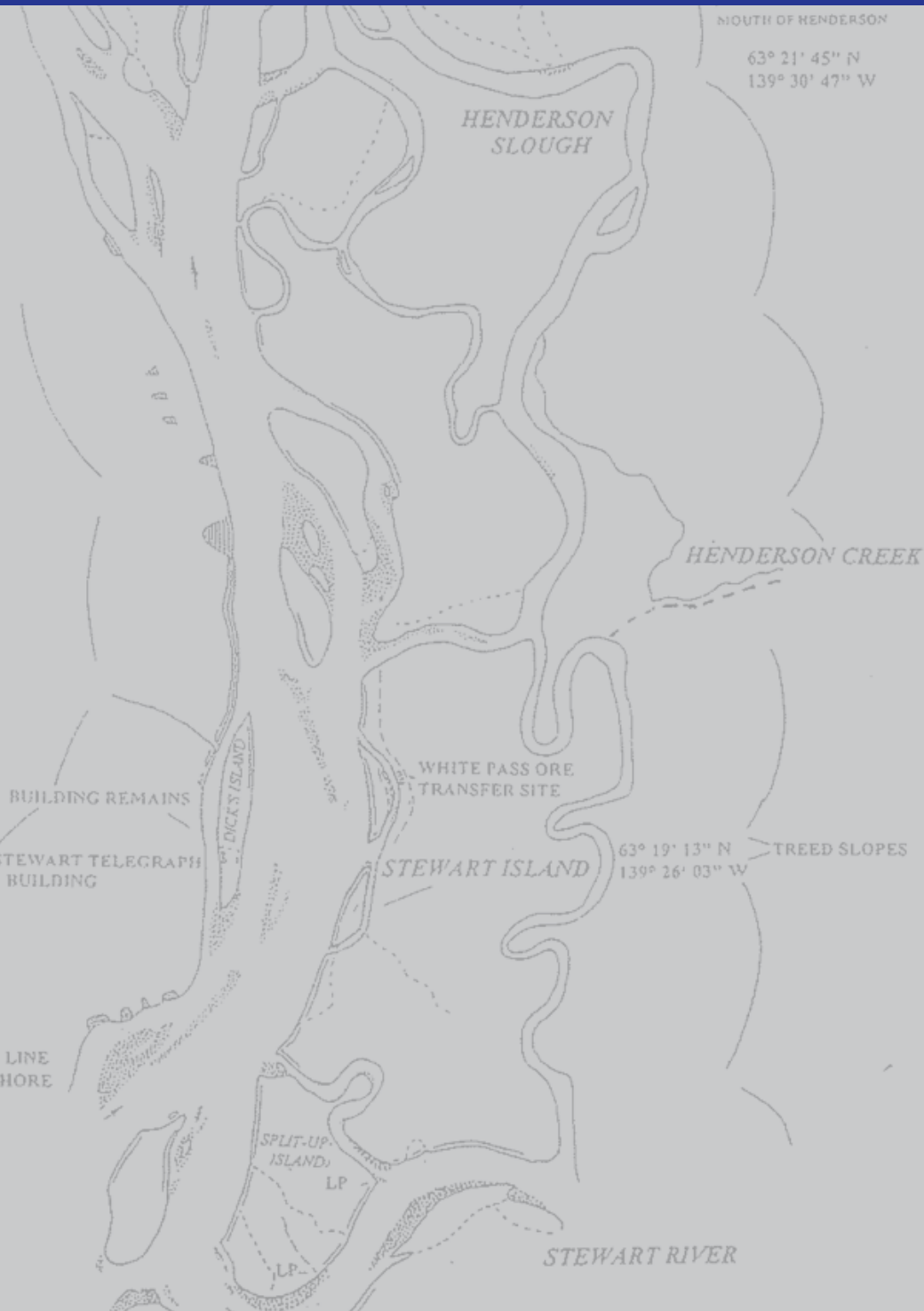




Dawson Planning Region Resource Assessment Report





Dawson Regional Planning Commission

Moving Forward • Nän kää ndä tr'ädäl

ACKNOWLEDGEMENTS

In Memory

Commission members Steve Taylor and Bill Bowie passed away during the time of writing. Their enthusiasm and dedication greatly assisted in the production of this report and the important work of the Commission, and they are truly missed.

This report would not have been possible without the contributions of the following people and organizations, and we sincerely thank everyone for their guidance and suggestions.

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Highways and Public Works
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Resource Maps were produced by Mammoth Mapping, Dawson City, Yukon.

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Suggested Citation:

Dawson Regional Planning Commission. 2013. *Dawson Planning Region Resource Assessment Report*. City of Dawson, Yukon, Canada.

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Cover Page Photos:

Left top: Placer mining © Jeff Hamm

Left bottom: Fish wheel © Jeff Hamm

Right: Caribou © Government of Yukon

Map: © Mike Rourke 1983

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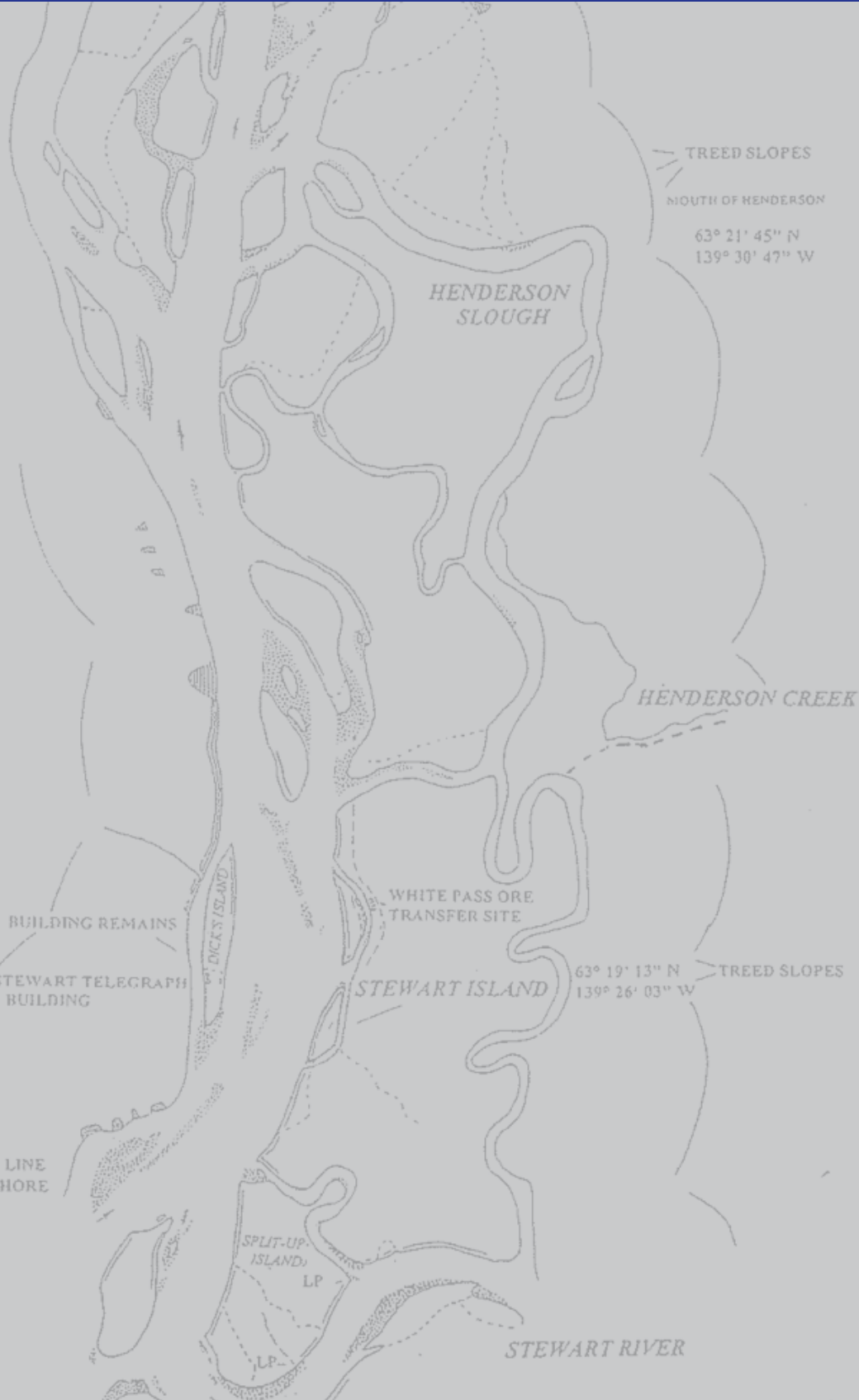
Dawson Land Use Planning Mineral Potential Assessment

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Placer Potential Map

Section 1

Framework and Regional Context



1 INTRODUCTION

1.1 Overview

Chapter 11 of Yukon First Nation Final Agreements (FAs), *Land Use Planning*, sets out the following objectives for a common planning process outside community boundaries (NND – DIAND 1993, VGFN – DIAND 1993, TH – DIAND 1998):

- 11.1.1 The objectives of this chapter are as follows:
 - 11.1.1.1 to encourage the development of a common Yukon land use planning process outside community boundaries;
 - 11.1.1.2 to minimize actual or potential land use conflicts both within Settlement Land and Non-Settlement Land and between Settlement Land and Non-Settlement Land;
 - 11.1.1.3 to recognize and promote the cultural values of Yukon Indian People;
 - 11.1.1.4 to utilize the knowledge and experience of Yukon Indian People in order to achieve effective land use planning;
 - 11.1.1.5 to recognize Yukon First Nations' responsibilities pursuant to Settlement Agreements for the use and management of Settlement Land; and
 - 11.1.1.6 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.

Section 11.4.5 of the Final Agreements establishes the mandate for a Regional Land Use Planning Commission:

- 11.4.5 In developing a regional land use plan, a Regional Land Use Planning Commission:
 - 11.4.5.1 within its approved budget, may engage and contract technical or special experts for assistance and may establish a secretariat to assist it in carrying out its functions under this chapter;
 - 11.4.5.2 may provide precise terms of reference and detailed instructions necessary for identifying regional land use planning issues, for conducting data collection, for performing analyses, for the production of maps and other materials, and for preparing the draft and final land use plan documents;
 - 11.4.5.3 shall ensure adequate opportunity for public participation;
 - 11.4.5.4 shall recommend measures to minimize actual and potential land use conflicts throughout the planning region;
 - 11.4.5.5 shall use the knowledge and traditional experience of Yukon Indian People, and the knowledge and experience of other residents of the planning region;
 - 11.4.5.6 shall take into account oral forms of communication and traditional land management practices of Yukon Indian People;
 - 11.4.5.7 shall 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;
 - 11.4.5.8 shall take into account that the management of land, water and resources, including Fish, Wildlife and their habitats, is to be integrated;
 - 11.4.5.9 shall promote Sustainable Development; and

11.4.5.10 may monitor the implementation of the approved regional land use plan, in order to monitor compliance with the plan and to assess the need for amendment of the plan.

These objectives are further refined by the Yukon Land Use Planning Council (YLUPC), in conjunction with Yukon government and affected Yukon First Nations, into general terms of reference for a planning commission.

The Dawson Regional Planning Commission (herein referred to as “DRPC” or “the Commission”) was established in August 2010, with a mandate to recommend a regional land use plan for the Dawson planning region to Yukon government, Tr’ondëk Hwëch’in (TH) and Vuntut Gwitchin First Nation (VGFN), as described in *Terms of Reference* (YLUPC 2009).

The Commission’s terms of reference call for a process to produce a regional land use plan that will “create a vision of future land use, including identifying conservation and development areas, and providing land use decision makers with guidance and direction.” During the planning process, the Commission is required to:

- Identify regional issues and interests;
- Identify areas where regional land use conflicts are occurring or may occur;
- Summarize the valued resources of the region;
- Establish plan goals and objectives;
- Provide regional management direction; and
- Apply a land designation system, including priority areas for conservation and land development.

1.2 Planning Boundary

The Dawson planning region (herein referred to as “the planning region”) is located in the west central part of Yukon, encompassing 45,288 km² (4,528,800 ha) or about 10 per cent of Yukon (Figure 1-1). Contained entirely within TH Traditional Territory, the planning region is bounded on the west by the international boundary between Yukon and Alaska; on the north by the North Yukon planning region; on the east by the Peel Watershed planning region and proposed Northern Tutchone planning region; and on the south by the Traditional Territories of the White River and Kluane First Nations.

The planning region also includes areas where TH Traditional Territory overlaps with VGFN and First Nation of Na-Cho Nyak Dun (NND) Traditional Territories. Under terms of a separate agreement between TH and NND in 2006, a boundary was agreed upon to delineate the limits of the planning region within NND Traditional Territory (YLUPC 2009). Similarly, an agreement between TH and VGFN in 2008 included the overlapping area within the planning region (YLUPC 2009).

In February 2013, White River First Nation presented Yukon and Canada governments with a confidential ‘Northern Boundary DRAFT Report’, asserting traditional and ancestral territory within the planning region. Traditional Knowledge is confidential; therefore the Northern Boundary report will not become a public document (WRFN, 2013).

See also **Section 3 – Resource Summary Maps – Dawson Planning Region.**

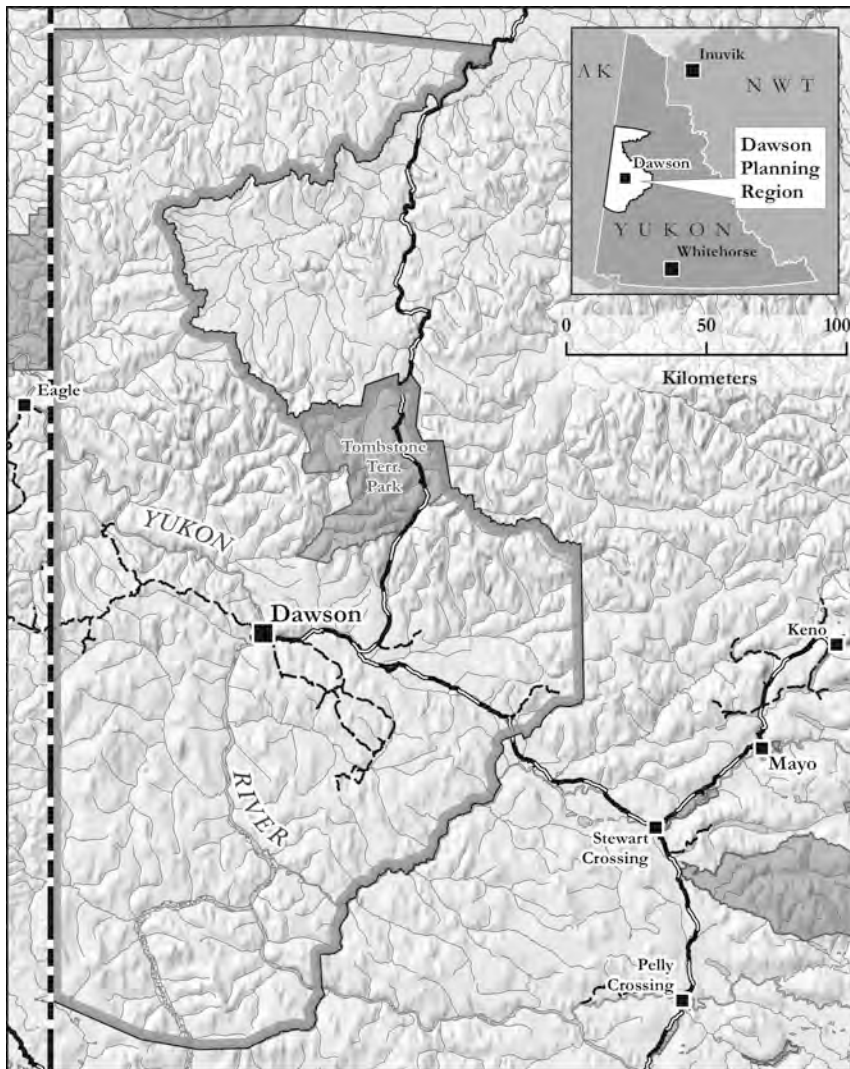


Figure 1-1 Dawson planning region boundary

The planning region excludes the southeastern portion of TH Traditional Territory that is overlapped by the Traditional Territory of the Selkirk First Nation. The planning region also excludes the communities of Dawson, West Dawson and Sunnysdale, which are addressed in official community or local area plans (City of Dawson 2012, West Dawson and Sunnysdale plans are in progress). Settlement Lands adjacent to the planning region, while outside the scope of the regional land use plan, will still be directly impacted by land use decisions made under that plan, and in turn have an interest in and exert influence on the land use priorities for the region.

Although Tombstone Territorial Park lies inside the planning region, the Dawson regional land use plan will not apply, as the park is administered under an existing management plan (Government of Yukon 2009).

Other trans-boundary considerations are necessary for lands within the planning region and adjacent to designated conservation areas: Yukon-Charley Rivers National Preserve (Alaska), Fishing Branch Wilderness Preserve and Habitat Protection Area (North Yukon) and Tombstone Territorial Park. Oil and gas basins that cross into adjacent planning regions, such as the Kandik or Eagle Plain basins, should be considered in a consistent manner.

1.3 Objectives

The Dawson Planning Region Resource Assessment Report (RAR) has the following objectives:

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

The RAR will examine renewable and non-renewable resources on Settlement and Non-Settlement Land within the planning region. Resource descriptions are drawn from information contributed by Yukon and First Nation government departments, from the knowledge and experience of Yukon Indian People and other residents of the planning region, as well as from other authoritative sources documented at the end of each section.

This document represents the knowledge base that the Commission will draw upon during the land use planning process. The RAR will provide the basis for analysis of plan alternatives in subsequent stages of the Dawson planning process.

1.4 Regional Interests and Issues

In the spring of 2011, the Commission began conducting community consultations and solicited written submissions to identify interests and issues in the planning region. Subsequently, the Commission released an *Interests and Issues Report* in December 2011, summarizing the stakeholder input (DRPC 2011).

Management of cumulative effects, promotion of economic diversity and maintenance of ecological integrity were common concerns from a wide range of perspectives. Access was clearly identified as a significant management concern, as an opportunity for realizing economic potential, and as a threat to sensitive areas and vulnerable wildlife populations.

The Commission recognized that the diverse ecological, cultural and economic interests all share a common resource base. The Commission's planning process should establish consensus on a sustainable vision for the foreseeable future that minimizes conflict among interests. Four main themes for a land use plan were identified from public consultation and written submissions:

1.4.1 Mineral Exploration and Mining

The Dawson region in general has experienced significant historic mineral exploration and mining activity. Recent discoveries in the region will lead to further exploration and possible mine development. The land use plan will need to address the cumulative effects of mineral exploration, mine development and access issues.

1.4.2 Conservation of Fish and Wildlife Habitat

The desire to maintain a healthy ecosystem was clearly expressed. The land use plan must provide the framework for identification and designation for protection of areas of high ecological significance or sensitivity.

1.4.3 Defining a “Workable Balance” for Sustainable Development

Balancing economic development with environmental protection may provide greater equity in social outcomes by sustaining traditional subsistence activity. A regional land use plan can establish a framework for evaluating the “workable balance” of alternative approaches to achieving the desired future state.

Sustainable development is defined in Chapter 1 of Yukon First Nation FAs as “beneficial socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent” (NND – DIAND 1993, VGFN – DIAND 1993, TH – DIAND 1998).

1.4.4 Land Use Conflict Within the Yukon River Corridor

The Yukon River is a key artery for the region and for Yukon as a whole. It experiences multiple uses, a wide range of user groups and it is very important to the subsistence of TH. Overlapping interests in this river corridor will be one of the more important issues that the land use plan will need to address.

For more complete discussion of issues, see **Appendix A – Interests and Issues Report**.

1.5 Report Format

This document is organized into four major sections:

- Section 1 – Framework and Regional Context
- Section 2 – Regional Resource and Land Use Descriptions
- Section 3 – Resource Summary Maps
- Appendices

1.6 Maps and Data Sources

Potential sources of resource data within Government of Yukon (YG) and TH were identified and a protocol was developed to guide submission of data to the Commission. See **Appendix B – Guidelines for Data Submission**.

Reports and data sources provided by YG and TH are included in **Appendix C – Tr’ondëk Hwëch’in Resource Report** and **Appendix D – Information Submission to Resource Assessment**.

Twenty-four resource summary maps were prepared to reflect the abundance, diversity and distribution of resource values across the regional landscape and can be found in **Section 3 – Resource Summary Maps**. Regional data were not available for all resource values; some have been inventoried and mapped only for a portion of the region, while others have no associated spatial data at all. Spatial data sets regarding sensitive cultural or ecological resources are not included with the report, but will be considered in the future work of the Commission.

1.7 Background Documents

The following key technical documents are included as appendices to this report:

- APPENDIX A: Dawson Regional Planning Commission. 2011. *Interests and Issues Report*. Dawson, Yukon, Canada.
- APPENDIX B: Dawson Regional Planning Commission. 2011. *Guidelines for Data Submission*. Dawson, Yukon, Canada.
- APPENDIX C: Tr’ondëk Hwëch’in. 2012. *Tr’ondëk Hwëch’in Resource Report for the Dawson Regional Planning Process*. Dawson, Yukon, Canada.
- APPENDIX D: Government of Yukon. 2012. *Information Submission to Resource Assessment*. Whitehorse, Yukon, Canada.

- APPENDIX E: McKenna, K., T. Braumandl, R. Rosie, R.C. Albricht, K. Stehle, A. DeGroot and P. Dykstra. 2010. *Bioclimate, Ecodistrict and Ecologically Significant Mapping for the Dawson Planning Region, Yukon*. Environment Yukon Final Report, Whitehorse, Yukon, Canada.
- APPENDIX F: Kilby, W.E. 2013. *Dawson Land Use Planning Mineral Potential Assessment*. Yukon Geological Survey, Miscellaneous Report 8. Whitehorse, Yukon, Canada.
- APPENDIX G: Bond, J. 2013. *Placer Potential Map, Dawson Land Use Plan*. Yukon Geological Survey. Whitehorse, Yukon, Canada.

1.8 Chapter References

- City of Dawson. 2012. *The City of Dawson Official Community Plan Bylaw No. 12-23, 2012*. Dawson, Yukon, Canada.
- Dawson Regional Planning Commission (DRPC). 2011. *Interests and Issues Report*. Dawson, Yukon, Canada.
- Government of Yukon. 2009. *Tombstone Territorial Park Management Plan*. Department of Environment. Whitehorse, Yukon, Canada.
- NND – DIAND. 1993. *First Nation of Na-Cho Nyak Dun Final Agreement*. Department of Indian Affairs and Northern Development. Ottawa, Ontario, Canada.
- TH – DIAND. 1998. *The Tr'ondëk Hwëch'in Final Agreement*. Department of Indian Affairs and Northern Development. Ottawa, Ontario, Canada.
- VGFN – DIAND. 1993. *Vuntut Gwitchin First Nation Final Agreement*. Department of Indian Affairs and Northern Development. Ottawa, Ontario, Canada.
- White River First Nation. 2013. *White River First Nation Update Summer 2013*. Beaver Creek, Yukon Canada.
- YLUPC (Yukon Land Use Planning Council). 2009. *Terms of Reference for the Dawson Regional Planning Commission*. Yukon Land Use Planning Council Recommendation #08-001. Whitehorse, Yukon, Canada.

2 VISION, GOALS and PLANNING PRINCIPLES

Note: Vision and Goal Statements presented in this chapter are provisional. Further refinement of the plan goals will occur during preparation of the Draft Land Use Plan.

2.1 Vision Statement and Plan Goals

A vision statement and goals are intended to lay the groundwork for subsequent stages of planning, providing a sense of plan direction and focus. In developing a draft vision statement and goals the Commission considered the principles contained in First Nation Final Agreements; objectives established for the Commission in its terms of reference; and general aspirations expressed for the planning region by residents and other stakeholders in community meetings held to develop the *Interests and Issues Report* (DRPC 2011).


The Commission participated in a visioning exercise to develop a draft vision statement and goals for the regional land use plan. The Vision Statement was released for public comment in May 2012, and will be finalized during development of the plan (Figure 2-1).

2.2 Governance Principles

General principles for decision-making and collaboration in sustainable natural resource management were reviewed (Government of British Columbia 2004, Davidson et al. 2006, Litman 2013) to aid decision-makers in defining appropriate policy alternatives, to serve as ethical guidelines for the conduct of stakeholder consultations, and to provide a standard to evaluate the quality of the planning process.

Governance principles clarify the Commission’s intended approach to developing recommendations for sustainable development within the region:

Certainty	Make timely and clear decisions within a predictable and understandable framework
Efficiency	Minimize administrative overhead and ensure optimal use of resources now and in the future
Fairness	Establish open, transparent and respectful processes for considering First Nation, public and other key interests
Integration	Make decisions that integrate economic, environmental and social elements, while considering the limits of each, for the benefit of present and future generations
Stewardship	Work cooperatively, engaging First Nations, governments, industry and non-governmental organizations in a shared responsibility for achieving sustainability objectives



VISION STATEMENT

The Dawson Region is an ancient and uniquely unglaciated landscape, with an abundance of natural resources and a diverse cultural legacy that contributes to the well being of all Yukoners.

People have been and continue to be an integral part of the landscape, acting as stewards to protect natural values, and working together as a community to realize opportunities for well-balanced economic growth.

Shared and respectful use of resources contributes to a sustainable and self-supporting economy.

Ecological or cultural values are undiminished by the careful development of economic resources; ensuring healthy ecosystems and clean drinking water are enjoyed by future generations.

People engage in consensus building; working with purpose and in harmony to sustainably balance the environment, economy and quality of life.



Dawson Regional Planning Commission

GOALS

Economic Prosperity

People with a diversity of perspectives and interests engage in consensus building to realize and benefit from economic, social and cultural opportunities.

Active Management

Innovative and efficient methods for integrated management of natural resources contribute to an enhanced quality of life and a healthy ecosystem.

Equitable Balance

Economic, ecological and social outcomes are considered in decision-making about land use.

Stewardship

All resources are used or conserved wisely to ensure benefits are enjoyed by future generations.




Figure 2-1 Draft vision statement and goals

2.3 Chapter References

- Government of British Columbia. 2004. *Sustainable Resource Management Planning Standards*. Ministry of Sustainable Resource Management; Forest, Lands and Marine Branch.
- Davidson, J., M. Lockwood, A. Curtis, E. Stratford, and R. Griffith. 2006. *Governance Principles for Regional Natural Resource Management*. University of Tasmania, School of Geography and Environmental Studies, Australia.
- Dawson Regional Planning Commission (DRPC). 2011. *Interests and Issues Report*. Dawson, Yukon, Canada.
- Litman, T.A. 2013. *Planning Principles and Practices*. Victoria Transport Policy Institute. Victoria, British Columbia, Canada.

3 RELEVANT LEGISLATION and POLICIES

Information for this section is taken from a document entitled *Overview of Legislation and Policies Pertaining to Regional Land Use Plans in the Yukon*, prepared by the Government of Yukon's Department of Energy, Mines and Resources to assist the Commission with the policy and legislative context in which regional land use planning occurs (Government of Yukon 2011).

The Umbrella Final Agreement (UFA) and First Nation Final Agreements (FAs) between the Government of Canada, Government of Yukon (YG), and Yukon First Nations (YFNs) establish a policy framework for regional land use planning in the Yukon. Chapter 11 of these agreements deals specifically with regional land use planning. Resource sectors relevant to land use planning are administered and regulated, in some cases jointly, by the federal, Yukon, and First Nations governments. Regional plans must adhere to the regulatory environment while providing guidance on land and resource development within the planning region.

3.1 First Nation Final Agreements

The First Nation Final Agreements are Treaties under Section 35 of *The Constitution Act, 1982*. Provisions of the Final Agreements take precedence over other laws of general application. Final Agreements affecting land and resource management in the planning region are:

- Tr'ondëk Hwëch'in (1998)
- Vuntut Gwitchin First Nation (1995)
- First Nation of Na-Cho Nyak Dun (1995)

Pertinent provisions relating to regional land use planning are found in the following chapters of the FAs:

- Chapter 2 – General Provisions
- Chapter 10 – Special Management Areas
- Chapter 11 – Land Use Planning
- Chapter 12 – Development Assessment
- Chapter 13 – Heritage
- Chapter 14 – Water Management
- Chapter 16 – Fish and Wildlife
- Chapter 17 – Forest Resources
- Chapter 18 – Non-renewable Resources
- Chapter 22 – Economic Development Measure

3.2 Umbrella Final Agreement Boards

The Yukon Umbrella Final Agreement provides for appointment of Boards to consider matters relating to implementation of Yukon land claims. The following Boards have land and resource management mandates that are integrated with those of the Planning Commission:

- Yukon Fish and Wildlife Management Board
- Dawson Renewable Resource Council
- North Yukon Renewable Resource Council
- Yukon Salmon Sub-Committee
- Yukon Heritage Resources Board
- Porcupine Caribou Management Board

3.3 Legislation

Acts governing land and resources management in Yukon are shown in Table 3.1.

Table 3-1 Legislation pertaining to Dawson regional land use planning

FEDERAL		
Legislation	Enactment	Purpose
Canada Wildlife Act	RSC 1985, c W-9	Preservation of habitat critical to migratory birds and other wildlife species
Canadian Environmental Assessment Act	SC 2012, c 19, s 52	A very limited number of instances of trans-boundary projects where CEAA might apply; the vast majority of environmental assessments are done under the Yukon Environmental and Socio-Economic Assessment Act (YESAA)
Fisheries Act	RSC 1985, c F-14	Provides for the sustainability and ongoing productivity of commercial, recreational and Aboriginal fisheries Revisions (Bill C-38) focus management on fisheries and away from managing impacts on areas that may or may not contain fish
Migratory Birds Convention Act	SC 1994, c 22	Conservation of migratory bird populations through establishment of bird sanctuaries
Navigable Waters Protection Act	RSC 1985, c N-22	All construction of works built or placed in, over, through or across navigable waterways must be licensed by the federal Navigable Waters Protection Program. Would be renamed the Navigation Protection Act under Bill C-45 and restricted in scope to large navigable waterways, such as Yukon River Regulates and protects the public's right to marine navigation on all navigable waterways in Canada
Yukon Environmental and Socio-Economic Assessment Act	SC 2003, c 7	Establishes a process for review and assessment of a broad range of activities on federal, territorial, First Nation and private land

TERRITORIAL		
Legislation	Enactment	Purpose
Area Development Act	RSY 2002, c 10	<p>Regulates the orderly development of land in a 'local development area' including zoning, allocation of land for different uses, public infrastructure, fire protection, and public health and safety</p> <p>Establishes a local development area, such as Bear Creek (OIC 1983/132), Dempster Highway (OIC 1979/64), Klondike Valley (OIC 1992/029), and Sunnydale and West Dawson (OIC 1990/118)</p>
Environment Act	RSY 2002, c 76	<p>Ensures the management of the environment, preservation of biological diversity and promotion of sustainable development; integration of land and resource management</p> <p>Provides for establishment of a wilderness management area for preserving areas with intrinsic, ecological and economic value</p> <p><i>Pesticide Regulation</i> (OIC 1994/125) for handling of waste, application of pesticides and remediation of contaminated sites</p> <p><i>Solid Waste Regulation</i> (OIC 2000/11) for operation of dumps and waste disposal facilities</p> <p><i>Special Waste Regulations</i> (OIC 1995/47) for handling and transporting of special waste</p> <p><i>Spills Regulations</i> (OIC1996/193) requires reporting of spills of specified substances</p> <p><i>Storage Tank Regulations</i> (OIC 1996/194) regulates storage of petroleum and hazardous substances in storage tanks</p> <p><i>Contaminated Sites Regulation</i> (OIC 2002/171) characterizes contaminated sites and establishes requirements and standards for restoration</p>
Forest Resources Act	SY 2008, c 15	<i>Forest Resources Regulation</i> (OIC 2010/171) to administer disposition and harvesting of timber on public lands
Highways Act	RSY 2002, c 108	<i>Highways Regulation</i> (OIC 2002/174) regulate highway use, construction and maintenance, protection of highways, access control, land acquisition and disposal, and safety
Historic Resources Act	RSY 2002, c 109	<p>Preservation, development and interpretation of heritage resources in Yukon</p> <p>Establishes regulations for access to, recovery and protection of historic resources, including the <i>Archaeological Sites Regulation</i> (OIC 2003/73)</p>

Parks and Lands Certainty Act	RSY 2002, c 165	Creation and management of parks in Yukon, including Ni'iinlii Njik - Fishing Branch Ecological Reserve (OIC 2003/31), Ni'iinlii Njik - Fishing Branch Wilderness Preserve (OIC 2003/32), and Tombstone Territorial Park (OIC 2004/203)
Placer Mining Act	SY 2003, c 13	<p>Administration and control of leasehold interests for the purposes of placer mining</p> <p>May prohibit entry on certain lands for purpose of locating a claim or prospecting for gold or other precious minerals and stones, such as land withdrawals for Fishing Branch Wilderness Preserve (OIC 2003/48), Fishing Branch Ecological Reserve (OIC 2003/49), Dawson Airport (OIC 2003/102), Tombstone Territorial Park (OIC 2004/204), TH Settlement Lands (OIC 2006/164), Clinton Creek (OIC 2006/173), Forty Mile – Ft. Cudahy/Ft. Constantine (OIC 2008/134), and Tr'ochek (OIC 2008/135)</p> <p><i>Placer Mining Land Use Regulations</i> (OIC 2003/59) establish a specific threshold for each class of mining activity; environmental standards for all classes of activity on claims and leases; and recording and reporting requirements for archaeological, paleontological, or historic objects and burial sites discovered during placer operations</p>
Public Health and Safety Act	RSY 2002, c 176	<p>Set standards for protection of public health and safety</p> <p>Regulations for public campgrounds and campsites (OIC 1974/94), camp sanitation (CO 1961/38), sewage disposal systems (OIC 1999/82) and drinking water (OIC 2007/139)</p>
Quartz Mining Act	SY 2003, c 14	<p>Provides for the ability to stake, record and hold claims and the administrative management of that process</p> <p>Establishes a right to enter, locate, prospect and mine for minerals on any vacant public lands; may prohibit entry on certain lands for purpose of locating a claim or prospecting for minerals (see lands withdrawn from staking noted under Placer Mining Act)</p> <p><i>Quartz Mining Land Use Regulations</i> (OIC 2003/64) establish a specific threshold for each class of mining activity; environmental standards for all classes of activity on claims and leases; and recording and reporting requirements for archaeological, paleontological, or historic objects and burial sites discovered during mining</p>
Subdivision Act	RSY 2002, c 209	Regulates creation of an interest in a parcel of land within a municipality or on public land

Territorial Lands (Yukon) Act and Lands Act	SY 2003, c 17 RSY 2002, c 132	<p>Orderly administration of Crown land under Yukon jurisdiction, specifically land disposition, use and development; the legislation also applies to land-based activities that occur directly adjacent to water; provisions for withdrawal of land from disposition</p> <p>Associated regulations established under the <i>Lands Act</i> include: <i>Lands Regulations</i> (O.I.C. 1983/192); <i>Quarry Regulations</i> (O.I.C. 1983/205)</p> <p>Associated regulations established under the <i>Territorial Lands (Yukon) Act</i> include: <i>Territorial Lands Regulation</i> (O.I.C. 2003/50); <i>Land Use Regulation</i> (O.I.C. 2003/51); <i>Coal Regulation</i> (O.I.C. 2003/54); <i>Dredging Regulation</i> (O.I.C. 2003/55); <i>Grazing Regulations</i> (O.I.C. 1988/171)</p> <p>Ni'iinlii Njik (Fishing Branch) Ecological Reserve and Wilderness Preserve withdrawal Disposition Order, No. 1O.I.C. 2003/30; Lands Withdrawn from Disposal (Tombstone Territorial Park) O.I.C. 2004/202; Order Respecting the Withdrawal from Disposal of Certain Lands in Yukon (Tr'ondëk Hwëch'in First Nation) O.I.C. 2006/152</p>
Wildlife Act	RSY 2002, c 229	<p>Pertains to the non-subsistence harvesting of wildlife; prohibits hunting and possession of protected wildlife</p> <p>A Habitat Protection Area can be established if it is deemed necessary to do so because of the sensitivity of the area to disturbance, the likelihood of disturbance and the importance of the area as habitat for any population, species or type of wildlife.</p>
Waters Act	SY 2003, c 19	<p>Establishes the Yukon Water Board</p> <p><i>Waters Regulation</i> (OIC 2003/58) regulates surface and ground water use and waste disposal into water for a variety of undertakings including mining, forestry, transportation, agriculture, power generation and conservation</p>
Wilderness Tourism Licensing Act	RSY 2002, c 228	<p>Helps sustain wilderness quality of Yukon lands and waters</p> <p><i>Wilderness Tourism Licensing Regulation</i> (1999/69) establishes standards for safety and guiding skills in commercial wilderness tourism operations</p>

<p>Yukon Oil and Gas Act</p>	<p>RSY 2002, c 162</p>	<p>Regulates and administers the orderly disposition and development of rights for oil and gas lands in a way that is consistent with principles of sustainable development, maintenance of essential ecological processes and preservation of biological diversity.</p> <p>Section 65(1) permits the Commissioner in Executive Council to make regulations for all stages of oil and gas exploration and production, including the transportation of substances by pipeline or other means. Section 69(1), subject to any other Yukon legislation, permits any person to enter on and use the surface of the land for the purposes of exercising rights under a disposition or licence.</p> <p>Various associated regulations include: <i>Oil and Gas Disposition Regulations</i> (OIC 1999/147); <i>Oil and Gas Geoscience and Exploration Regulations</i> (OIC 2004/156); <i>Oil and Gas Licence Administration Regulations</i> (OIC 2004/157); <i>Oil and Gas Drilling and Production Regulations</i> (OIC 2004/158); <i>Oil and Gas Processing Plant Regulation</i> (OIC 2013/162)</p> <p>Ministerial orders withdraw certain lands from disposition under the Act: Tombstone Territorial Park (MO 2004/11); Ní'íinlíi Njik Ecological Reserve (MO 2003/05); and Ní'íinlíi Njik Wilderness Preserves (MO 2003/06)</p>
<p>Tr'ondëk Hwëch'in have exercised the following powers for the use and occupation of Settlement Land</p>		
<p>Legislation</p>	<p>Enactment</p>	<p>Purpose</p>
<p>Tr'ondëk Hwëch'in Fish and Wildlife Act</p>	<p>2009</p>	<p>Regulates subsistence harvesting on TH Settlement Land</p>
<p>Tr'ondëk Hwëch'in Land and Resources Act</p>	<p>2004</p>	<p>Regulates access, occupancy and use of TH Settlement Land</p>
<p>Tr'ondëk Hwëch'in Oil and Gas Act</p>	<p>Draft August 2013</p>	<p>Establishes a requirement for reciprocal consultation prior to granting oil and gas rights on Category A Settlement Land</p>

3.4 Management Plans and Other Policies

Applicable policies and plans governing land and resources management in Yukon are shown in Table 3-2.

Table 3-2 Management plans and other policies pertaining to Dawson Regional Land Use Planning

Policy Or Plan	Date Of Adoption	Purpose
Dempster Highway Development Area	1979	The Dempster Highway Development Area extends for 8 km on either side of the Dempster Highway, from km 68 to the border with Northwest Territories. Any development or motorized use of the land (except snow machines) within the corridor requires an Authorization under the <i>Area Development Act</i> .
Klondike Valley District Land Use Plan	1988	Establish a framework for the use and disposition of public lands in the Klondike Valley to meet short and long-term social, economic and environmental needs of the region. Yukon Community and Transportation Services prepared an implementation strategy for this plan in September 1989. The Plan is implemented by <i>Area Development Regulations</i> (OIC 1992/029)
Fish Habitat Management System	2005	Adaptive Management Framework implemented under the <i>Fisberies Act</i> , administered by Yukon Placer Secretariat. Protocols for: Aquatic Health Monitoring, Water Quality Objectives Monitoring, & Economic Health Monitoring
Mine Reclamation and Closure Policy	2006	Duty of mine operators to plan, implement and fund mine site reclamation and closure Reflects Government of Yukon's objectives in the areas of environmental protection, responsible economic development and fiscal responsibility Does not apply to prospecting, grassroots exploration or advanced exploration on a mineral property
Tombstone Territorial Park Management Plan	2009	In developing a land use plan that includes all or part of the Park, a Regional Land Use Planning Commission shall consider the Management Plan (THFA Chapter 10, Schedule A, Clause 13.2)
Forty Mile Caribou Working Group		The Working Group shall review how the Development Assessment Process, land use planning process, existing wildlife management plans, existing programs in respect of habitat protection, and such other programs and plans that may be relevant, could be used to address habitat protection in the area (THFA Chapter 16, Schedule B, Clause 3.1.3)
North Yukon Regional Land Use Plan	2009	Land Management Unit and Land Designation System provisions will guide land use management recommendations in the shared Traditional Territory of VGFN and TH

Policy Or Plan	Date Of Adoption	Purpose
Resource Access Roads Program	2009	Describes the application, principles, roles and responsibilities, policy parameters and processes that will be used to manage resource access roads in Yukon
Resource Access Roads Framework	2012	Framework was completed in 2012 outlining the process for development and management of resource access roads, and providing guidance to regulators, industry and the public.
Grazing Policy	2010	General policies that guide land use activities throughout the Yukon, not necessarily addressing issues specific to the region.
Big Game Outfitting Policy	2013	
Commercial and Industrial Land Application Policy	2013	
Rural Residential Policy	2013	
Spot Land Application Policy	2013	
Trapping Cabin Policy	2013	
Water Lot Lease Policy	2013	
Dawson City Official Community Plan (Bylaw 12-23)	2013	To provide rational decisions about Dawson City's short and long-term land use, development characteristics and timing of development that are met in a manner that is both environmentally sound and sensitive to the heritage of the community. The Plan seeks to establish a framework of planning, coordination and evaluation criteria for land use changes and development applications in Dawson, having consideration for both short and long-term implications. These implications are based on the collective needs and aspirations of the community.
Dawson Forest Resources Management Plan	2013	Provides the framework for sustainable management of forest-based economy in the Dawson forest planning region A forest management plan and forest fire management plan shall be consistent with any approved regional land use plans (FNFA's Chapter 17, Section 6.1)
Tr'ondëk Hwëch'in Mining Mandate	2011	Applies to mining activities on Crown lands within TH Traditional Territory. Describes the matters to be addressed in agreements with proponents of mining and exploration projects.

3.5 Best Management Practice Protocols

A "Best Management Practice" (BMP) is a non-regulatory practice or combination of practices that represent best available knowledge about effective and practical methods for preventing or reducing the amount of adverse impact or land-use conflict resulting from a land use activity. BMPs are non-

enforceable guidelines that are intended to provide commercial and industrial operators with up-to-date information on best practices for minimizing environmental damage.

Simpson (2005) outlined guidelines for the application of BMPs as follows:

Proportionality	Measures should not be disproportionate to the desired level of protection or the management objective set and must not aim at zero risk
Nondiscrimination	Comparable situations should not be treated differently and different situations should not be treated in the same way, unless there are objective grounds for doing so
Consistency	Measures should be comparable in nature and scope with measures already taken in equivalent areas in which all the scientific data are available and results understood
Examination of the benefits and costs of action or lack of action	This examination should include an economic cost/benefit analysis when this is appropriate and feasible
Examination of scientific developments	The measures should be considered provisional in nature pending the availability of new or more reliable scientific data and scientific research should be continued with a view to obtaining more complete data. Actions taken to protect the environment and human health should take precedence over other BMPs

Challenges in the use of BMPs for minimizing environmental damage include a lack of adoption, a lack of adaptation and the absence of regulatory consequences for non-compliance. In the introductory disclaimer to the *Oil and Gas Best Management Practices for Historic Resources* (Government of Yukon 2006), it is noted that BMPs cannot anticipate solutions for site-specific problems and may become obsolete over time; expert advice is recommended for operational level planning.

Best Management practices identified for land use activities occurring in the Dawson planning region are listed below.

- Tr'ondëk Hwëch'in. 2011. *Tr'ondëk Hwëch'in Best Practices for Heritage Resources*. Tr'ondëk Hwëch'in Heritage Department. Dawson City, Yukon, Canada.
- Government of Yukon. 2006. *Flying in Sheep Country: How to minimize disturbance from aircraft*. Revised edition, second printing 2006. Mining Environment Research Group. Whitehorse, Yukon, Canada.
- Government of Yukon. 2006. *Oil and Gas Best Management Practices for Wilderness Tourism*. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada.
- Government of Yukon. 2006. *Oil and Gas Best Management Practices for Historic Resources*. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada.
- Government of Yukon. 2006. *Oil and Gas Best Management Practices for Seismic Exploration*. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada.
- Government of Yukon. 2010. *Flying in Caribou Country: How to minimize disturbance from aircraft*. Revised edition, second printing 2010. Mining Environment Research Group. Whitehorse, Yukon, Canada.

- Government of Yukon. 2010. *Yukon Placer Mining Best Management Practices for Heritage Resources*. Edition 1. Department of Tourism and Culture. Whitehorse, Yukon, Canada.
- Government of Yukon. Undated. *Best Management Practices Bulletin: Fencing to contain horses on Yukon Government grazing agreements*. Whitehorse, Yukon, Canada.
- Wilderness Tourism Association of the Yukon. 2002. *Code of Conduct for Operating Wilderness Tours: WTAY Guidelines*. Whitehorse, Yukon, Canada.
- Wilderness Tourism Association of the Yukon. 2013. *Best Environmental Practices on Yukon Rivers: A minimal impact guide for river travellers*. Whitehorse, Yukon, Canada.
- Yukon Chamber of Mines. 2010. *Yukon Mineral and Coal Exploration Best Management Practices and Regulatory Guide*. Whitehorse, Yukon, Canada.

3.6 Chapter References

Government of Yukon. 2011. *Overview of Legislation and Policies Pertaining to Regional Land Use Plans in the Yukon*. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada.

Simpson, K. 2005. *Guidelines for application of Best Management Practices Oil and Gas Best Practices Web Portal*. Oil and Gas and Mineral Resources Directorate. Whitehorse, Yukon, Canada.

The Constitution Act, 1982. Schedule B to the Canada Act 1982 (UK), 1982, c 11, <http://canlii.ca/t/ldsx>.

4 PEOPLE, SETTLEMENT and ECONOMY

This chapter presents a high-level overview of the planning region. More detailed descriptions of natural, cultural and economic resources are contained in **Section 2 – Regional Resource and Land Use Descriptions**.

4.1 First Nations

Two self-governing First Nations own land and have administrative authority within the Dawson planning region: Vuntut Gwitchin First Nation (VGFN) and Tr'ondëk Hwëch'in (TH). The eastern portion of the planning region lies within the Traditional Territory of Na-Cho Nyak Dun (NND), however no NND settlement lands exist in the region. White River First Nation has identified a land selection in the southeastern corner of the region.

Vuntut Gwitchin literally means “people of the lakes.” VGFN homelands are centered on the Old Crow River and the lakes of the Old Crow Flats, north of the planning region. As part of a larger Gwich'in Nation, Vuntut Gwitchin people have strong family and cultural ties with communities in the Northwest Territories and Alaska. Of approximately 800 VGFN citizens, 250 live in the community of Old Crow (Yukon Community Profiles 2004)

Tr'ondëk Hwëch'in are primarily Han, Gwich'in, and Northern Tutchone people. Tr'ondëk Hwëch'in have lived across western Yukon and eastern Alaska and along the Yukon River for millennia. They continue to maintain strong family and cultural ties throughout Yukon and Alaska.

For generations, Tr'ondëk Hwëch'in people lived and travelled in a large area of the Yukon River valley spanning the Yukon-Alaska border. They relied heavily on the salmon runs of the Yukon River and had fish camps along its shores. They also hunted big game, trapped furbearers and harvested other resources by moving to different areas of the land according to the seasons. There were also extensive trading networks with other groups to exchange resources.

Tr'ondëk Hwëch'in cultural identity is embedded in language, stories, places, events, activities and relationships that reinforce a long connection with the land and natural resources. Heritage is considered as something inherited from the ancestors, to be passed along to future generations. A “story cycle” associated seasonal and place-based stories with the traditional round of subsistence activity and reinforced values, practical skills and a moral code that became an essential element of physical and cultural survival.

Tr'ondëk Hwëch'in are actively promoting their heritage, language, songs, and dances and passing them on to the children. The Dänojà Zho Cultural Centre, on the shore of the Yukon River in Dawson City, is a year-round meeting place for cultural activities, performances and special events that celebrate Tr'ondëk Hwëch'in traditions, culture and history.

Of an estimated 964 TH citizens, about 420 live elsewhere (Yukon Community Profiles 2004). Other sources record 338 TH citizens residing in the Dawson area, of which 183 are male and 155 are female (Hennessey 2011). Forty-seven per cent of the First Nation population is under the age of 30, 47 per cent is between 31 and 64 years old, and six per cent is over the age of 65 (Hennessey 2011).

4.2 Human History Since Contact

The use of traditional sites and settlements changed after the arrival of Europeans. Since their first contact with Europeans, Tr'ondëk Hwëch'in people and their traditional economy have been significantly impacted by economics, epidemics and conflicts well beyond their homelands (Tr'ondëk Hwëch'in 2012).

Chilkat traders had long held a monopoly over trade routes from the coast and by the mid 1700's Russian trading goods were being brought into the region. As large Russian and European trading companies overcame the Chilkat monopoly, a new economy evolved based on the trade of fur for trade goods, including guns and steel traps. These technological advances dramatically improved hunting success resulting in significant changes to wildlife populations and the pattern of traditional land use. Jack McQuesten established a trading post for the Alaska Commercial Company in 1874 at Fort Reliance on the Yukon River, approximately 13 km downriver from Dawson City. The first Yukon town was established 10 years later at the mouth of Forty Mile River (so named for being 40 miles downriver from Fort Reliance), as miners and traders arrived with the discovery of gold in nearby tributaries.

Throughout the 1800s and 1900s, a series of epidemics including small pox, scarlet fever, diphtheria, tuberculosis and influenza had a dramatic effect on social organization, trading networks and the cultural landscape of Tr'ondëk Hwëch'in people. As large portions of the population died off, survivors had to regroup. Reduced resource harvesting and gaps in important land and resource management roles resulted in economic decline.

The discovery of gold in the Klondike valley in 1896 led to the establishment of a tiny settlement where the Klondike River flows into the Yukon River. By the summer of 1898, Dawson City was the largest city in Canada west of Winnipeg, with a population of 40,000 in the immediate area. The surge of newcomers led to widespread overharvesting of moose and caribou.

As roads surpassed river travel, harvest activities became focused on easily accessed areas along the highway corridors and side roads. Imported foods began to replace traditional sources and gradually people moved closer to roads and away from the river.

By the mid-1950s, government regulation was beginning to erode traditional resource management practices. Traditional activities were being restricted or prohibited and backcountry outfitters began focusing wildlife harvest on the strongest and largest animals. Collective ownership of natural resources was replaced by a system of individual concession holders. Overhunting decimated the Forty Mile caribou herd, once numbering in the hundreds of thousands. By 1957, Tr'ondëk Hwëch'in had mostly relocated from Moosehide into Dawson City.

A further loss of traditional knowledge and language skills occurred as many children were sent off to residential school in communities away from their families. The resulting crisis of cultural identity has led many down a path of addiction to chronic health problems (Tr'ondëk Hwëch'in 2012).

4.3 Human Settlement

4.3.1 Tr'ochëk

At the heart of Tr'ondëk Hwëch'in homeland was a fishing camp at the confluence of the Klondike and Yukon rivers. Known as Tr'ochëk, the location was an important as gathering spot in summer, as a base for hunting moose in the Klondike Valley and as a site for processing of hides into clothes, dwellings, bone for tools, sinew and babiche (Dobrowolsky and Hammer 2001). Repeated flooding of Tr'ochëk covered evidence of past occupations of the site, resulting in a well-preserved legacy of artifacts. The layering of silt deposited by floodwaters allows archaeologists to identify distinct time periods during which people were using the site.

During the Klondike Gold Rush the traditional Hän village at Tr'ochëk was transformed from a fishing camp into a crowded settlement and industrial site. Rafts of logs being floated downriver destroyed fish traps; development of sawmills put an end to salmon fishing. Tr'ochëk was soon displaced by a red-light district, known as Lousetown, with one-room “cribs” of prostitutes.

Eventually, industrial development followed, including a brewery, stores, saloons, a farm and the location became known as Klondike City.

Chief Isaac, the leader of the Tr'ondëk Hwëch'in during the Gold Rush, guided his people through the upheaval, initially moving them from Tr'ochëk across the Klondike River; then, with the assistance of the Anglican missionary Bishop Bompas, 5 kilometers farther downriver from Dawson City to Moosehide, in the spring of 1897.

The importance of Tr'ochëk to Tr'ondëk Hwëch'in culture and history is recognized in Final Agreement provisions that led to the designation of Tr'ochëk as a National Historic Site (THFA Chapter 13, Section 4.6.2).

4.3.2 Moosehide

Moosehide is located about 5 km downstream from Dawson City. The location was a traditional fish camp (Jëjik Ddhà Dënezhu Kek'it), sited on a high bench overlooking the river. In 1897, Tr'ondëk Hwëch'in people relocated to Moosehide from Tr'ochëk, building cabins, a church, mission and a day school. Moosehide remained a vibrant community until the 1950's, when the highways replaced sternwheelers as the main transportation. By 1957, most people had moved into Dawson.

A gathering is held every other year at Moosehide, when all people are invited to camp out and share in Tr'ondëk Hwëch'in traditional culture.

4.3.3 Dawson City

The town of Dawson City, located 536 km north along the Klondike Highway from Whitehorse, is the only major permanent community in the planning region (note: the Dawson Regional Land Use Plan will exclude areas within Dawson and West Dawson). At the height of the Klondike stampede in 1898, Dawson City boasted telephones, running water, steam heat, steamboat services and a wide range of elaborate hotels, theatres and dance halls. A year later the gold rush was over; 8,000 people left town in a single summer. By 1902, Dawson City's population had dropped to 5,000 and the economy and community continued to erode through most of the 20th century.

In the mid-1950s, Parks Canada began to acquire and stabilize designated historic structures and artifacts. In the early 1960s Dawson City was declared a National Historic Site. Today, the Dawson City Historical Complex consists of 17 buildings associated with the Klondike Gold Rush, two of which are designated as being of national significance, the Auditorium (Palace Grand) Theater and Robert Service Cabin. Many houses and buildings in Dawson City are original structures from the early 1900s. Preservation of buildings and historic areas, an assortment of activities related to the Klondike Gold Rush, and other heritage tourism initiatives draw thousands of visitors each year. Surviving heritage structures that are privately owned may be subject to demolition (under municipal jurisdiction). Commercial, residential and waterfront development also threaten the integrity of the heritage context of Dawson City.

Dawson City is still a gold mining community today although the main economic activity is tourism. Dawson is also home to a growing arts community. Students from around the world are drawn to the creative programming at the Klondike Institute of Arts and Culture and the accredited Yukon School of Visual Arts.

According to Statistics Canada's 2011 Census, the population of Dawson City was 1,319 showing almost no change from the previous census in 2006 (1,327) (Statistics Canada 2012). Yukon Bureau of Statistics includes residents in the unorganized communities of West Dawson, Sunnydale, Rock Creek and others for a total community population in December 2011 of 1,959, an increase of 78 people from the previous year (Government of Yukon 2012a). This represents approximately five

per cent of Yukon's total population of 35,440. These estimates exclude a substantial population of non-winter residents and seasonal workers.

As with other small Yukon communities, a significant demographic shift is occurring as the younger groups diminish in number and the number of seniors rises. Over the period from 2002 to 2010, the population under the age of 24 dropped by 31 per cent, while the group over the age of 54 grew by 71 per cent. The challenges of this shift include mismatched housing stock, business succession planning, skilled labour shortages, lack of volunteers, decreasing school enrollment, and increasing demands on health care and social services (Across the River Consulting 2011).

4.3.4 Klondike Valley

Several settlements with permanent residents occur within the Klondike Valley region, outside of the community of Dawson. These areas include: Sunnyside and West Dawson (OIC 1990/118); Bear Creek (OIC 1983/132); and Rock Creek, Henderson's Corner and Flat Creek (OIC 1992/029). Land uses in these areas are governed by Area Development Regulations. These areas are excluded from the regional plan under the Commission's terms of reference, but existing management plans for such areas are to be considered in development of the plan (YLUPC 2009).

A small number of residential properties also occur along major highway corridors as a result of spot land applications under Government of Yukon's Rural Residential Land Application Policy, which allow people to acquire land "where existing road access facilitates rational rural residential development" (Government of Yukon 2012*b*).

The pattern of settlement in unorganized areas reflects a history of informal evolution of small communities, a phenomenon that continues in the Dawson area. Land for development within planned subdivisions is not readily available and spot land applications and residential use of mineral claims is a persistent symptom.

Some historic communities are indicated on maps but no longer exist as extant settlements, including Granville and Stewart River.

4.4 Economy

The contemporary economy is a mix of market-based activity, primarily in the resource sectors of mining, tourism and forestry, alongside a traditional economy characterized by a stewardship and subsistence mode of production. Government regulation and environmental protection are also a part of the regional economy.

4.4.1 Traditional Economy

A traditional economy evolved through a continuous process of adaptation and innovation for survival in the face of harsh climate, periodic starvation, warfare and natural disasters. The traditional economy has sustained Tr'ondëk Hwëch'in people and an abundance of natural resources over thousands of years. An intimate knowledge of natural cycles, sustainable patterns of resource use and resource stewardship to preserve diversity and abundance were cultural assets that passed from generation to generation through oral traditions and customary practices (Tr'ondëk Hwëch'in 2012).

The traditional economy is a system of harvesting, processing, production, technological adaptation and innovation. A network of trails, campsites, shelter locations and harvest infrastructure, a seasonal pattern of resource use and sustained stewardship roles together define a cultural landscape. In this landscape, traditional economic infrastructure enables people move from place to place; to focus harvest on areas of seasonally abundant plants, fish and animals; and to develop trading relationships with people in neighbouring regions.

While the concept of traditional economy was based on the harvest of natural resources, this concept – both in history and in the modern context – also includes the broader traditional aboriginal society, land use and environment (Tr'ondëk Hwëch'in 2012).

In traditional social systems, kinship groups were the principal unit of economic production. Each group followed a similar seasonal cycle, moving from location to location and occupying different areas, purposefully conserving resources and allowing natural capital to rebuild. The traditional economy, based on sustainability and reciprocity, reflects the core values of environmental stewardship, cultural preservation and social development (Tr'ondëk Hwëch'in 2012).

The traditional economy has been impacted by numerous events over the historic past. A series of epidemics from 1835 through 1953 decimated aboriginal populations throughout the Yukon. The introduction of foreign trading goods broke the aboriginal monopoly, while bringing new technologies such as guns and steel that improved productivity of harvesting. An influx of prospectors and rapid development during the Gold Rush led to unsustainable use of moose and caribou and eventually government regulation of wildlife harvesting and trapping. The development of the highway moved most economic and harvest activity off the river and into areas with easy road access. Poor health conditions and social problems followed the collapse of trapping and woodcutting as economic opportunities and the loss of cultural knowledge through forced attendance at residential schools (Tr'ondëk Hwëch'in 2012).

The traditional economy continues to be important in a modernized economy. Established patterns of land and resource use are closely tied to central elements of the traditional economy, including stewardship, infrastructure design, technology adaptation, and governance systems. The traditional economy, along with other Tr'ondëk Hwëch'in values and principles, contributes to an adaptive response to landscape-level change and uncertainty in the environment, the economy, and in the availability of resources (Tr'ondëk Hwëch'in 2012).

4.4.2 Market Economy

Although record levels of hard rock mineral exploration occurred as recently as 2011, the regional economy is strongly linked to tourism and placer mining. The fastest growing sector of the regional economy is in art, recreation and cultural industries.

According to Statistics Canada's analysis of the 2006 Census (Statistics Canada 2007), the accommodation and food service sector employed about 20 per cent of the Dawson workforce, nearly twice the proportion for the rest of Yukon. Mining employed about 10 per cent of the workforce, considerably higher than the two per cent reported for all of Yukon (Figure 4-1).

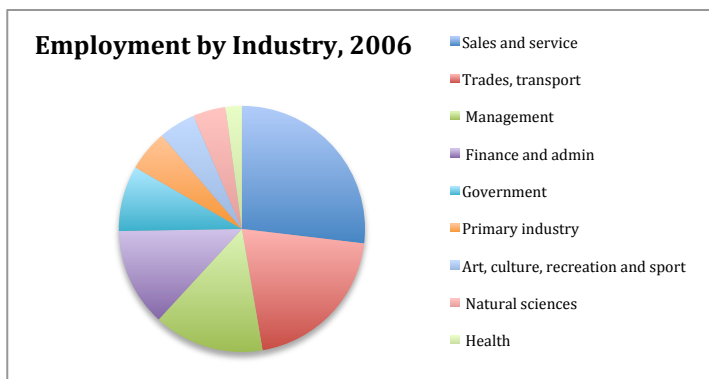


Figure 4-1 Employment by Industry, Dawson (data from Statistics Canada 2007)

Federal and Yukon governments are important employers, maintaining educational, health and safety services as well as a number of regional resource management offices. Tr'ondëk Hwëch'in government is a substantive economic presence; it is Dawson's largest employer, maintaining several offices and facilities in the community.

The 2006 Census also shows that Dawson has a high unemployment rate, particularly for males. Some people mine placer gold during the summer and work in another sector for most of the year. Much of the available work is seasonal or short-term and this lack of year-round employment is a major concern among young people. Income is high compared to the rest of Canada but low compared to Yukon as a whole.

The economy is highly dependent on government employment and investment. The economic basis of the region is vulnerable given the small market reach, limited local demand, and considerable reliance on the volatile sectors of tourism and gold mining.

Economic development planning has focused on niche opportunities around the unique cultural, historic and natural characteristics of the region. Areas identified for development include tourism and a traditional knowledge economy. Non-renewable resource development will continue to be important, but requires management to ensure other valued resources are not impacted.

4.5 Community Infrastructure

The majority of transmission lines are routed along highways and other major existing corridors. See map at **Section 3 – Resource Summary Maps – Infrastructure, Access and Land Status** for locations of telecommunications towers and transmission lines within the region.

The Quigley Landfill (located within Dawson municipal boundaries and managed by the City of Dawson) services Dawson City, the Klondike Valley, and the Dempster and North Klondike Highways. The Conservation Klondike Society (CKS) administers several programs to divert waste from the landfill.

The broader Dawson area is experiencing increased demand for land and services in connection with increased mineral exploration activities, and the current Dawson landfill appears to be reaching its capacity. Concern was expressed in 2008 regarding capacity for construction, renovation and demolition waste (Larsen 2008; Taylor 2009). Completion of large capital projects since then, including the wastewater treatment plant and hospital, has likely aggravated this situation. Future growth of residential, commercial and/or infrastructure developments including potential landfill expansion or commissioning a new landfill may require changes to the municipal boundary. Infrastructure planning and management must consider that both Dawson proper and outlying rural areas are being serviced.

Climate change could have major impacts on infrastructure in the region. Known potential effects include changes to water flow, quantity and quality; increases in mean air temperature; changes in snow depth; and changes in weather patterns. These changes could result in melting of permafrost, changes to winter flow in streams, reduced stability of structures, engineering challenges and increases in construction costs, shifts in operational costs, and changes in accessibility on land and rivers. Regular upgrades to combat the effects of permafrost and freeze-thaw are an expensive necessity, and continuing improvements to infrastructure will need to remain a priority (City of Dawson and Tr'ondëk Hwëch'in 2008).

4.6 Chapter References

- Across the River Consulting. 2011. *Klondike Development Organization Strategic Plan 2011-15*. Dawson, Yukon, Canada.
- City of Dawson and Tr'ondëk Hwëch'in. 2008. *After the Gold Rush: The Integrated Community Sustainability Plan*. Dawson City, Yukon, Canada.
- Dobrowolsky, H. and T.J. Hammer. 2001. *Tr'ochek: The Archaeology and History of a Han Fish Camp*. Edited by Ruth Gotthardt. Joint publication of the Tr'ondëk Hwëch'in, Parks Canada and Government of Yukon, Heritage Branch. Available at: http://www.tc.gov.yk.ca/publications/trochek_2001.pdf.
- Government of Yukon. 2012a. *Yukon Bureau of Statistics, Population Report, December 2011*. Executive Office, Bureau of Statistics Information Sheet no. 58.38 – February 2012. Whitehorse, Yukon, Canada.
- Government of Yukon. 2012b. *Rural Residential Land Application Policy*. Department of Energy, Mines and Resources, Land Management Branch. Whitehorse, Yukon, Canada.
- Hennessey, R., S. Jones, S. Swales and F. Duerden. 2011. *Dawson Climate Change Adaptation Plan, Revised Edition*. Northern Climate ExChange, Yukon Research Centre, Yukon College, Whitehorse, Yukon, Canada.
- Larsen, Jacob. 2008. *Quigley Sustainable Landfill Study – Phase I*. Conservation Klondike Society. Dawson City, Yukon, Canada.
- Taylor, Jeremy. 2009. *Quigley Sustainable Landfill Study – Phase II*. Conservation Klondike Society. Dawson City, Yukon, Canada.
- Statistics Canada. 2007. Dawson, Yukon Territory (Code 6001029) (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Released March 13, 2007. <http://www12.statcan.gc.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E>.
- Statistics Canada. 2012. Dawson, Yukon (Code 6001029) and Yukon, Yukon (Code 6001) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa. Released October 24, 2012. <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E>.
- Tr'ondëk Hwëch'in, 2012. *Tr'ondëk Hwëch'in Resource Report for the Dawson Regional Planning Process*. Dawson, Yukon, Canada.
- YLUPC. 2009. *Terms of Reference for the Dawson Regional Planning Commission*. Yukon Land Use Planning Council Recommendation #08-001. Whitehorse, Yukon, Canada.
- Yukon Community Profiles. 2004. Available at <http://www.yukoncommunities.yk.ca>

5 BIOPHYSICAL SETTING

This chapter provides a landscape scale¹ description of physiography, geology, climate, glacial history, landscape types (i.e., vegetation and soils) and natural disturbance regimes in the planning region and potential impacts from climate change.

5.1 Geology

Rock formations throughout the region reflect an origin along the margins of ancient North America (Laurentia). Erosion of the Laurentian landmass created thick deposits of sediment in adjacent ocean basins 300-1000 Ma (million years ago). Limestone deposits accumulated in shallower waters of the continental shelf. Offshore, island arcs formed where volcanic and intrusive activity marked the meeting of ocean and continental plates. Over millions of years, the islands and shelf deposits merged with the continental mass and experienced extended periods of uplift and erosion as ocean and continental plates collided (20 to 350 Ma). Faults formed as layers of rock were thrust upward or displaced laterally about 60 Ma.

During the Pliocene (5- 2.6Ma), rivers draining the upland area reached three oceans, with the course of the “proto” Yukon River carving through ancient mountains south toward the Pacific. When continental glacier ice covered the rest of Canada during the Pleistocene ice age (2.6 Ma – 11 ka), these upland areas in west-central and northern Yukon remained ice-free, but the glaciers blocked the regional drainage which subsequently breached the watershed divide and diverted Yukon River to the northwest, along the fault line. As the ice sheets retreated, the gravel channels of the ancient rivers were reworked by glacial melt water.

Today, the most distinctive and recognizable geologic feature within the planning region is the northwest-southeast trending Tintina Trench, a nearly 1,000-km long fault line along the continental margin of ancient North America (Figure 5-1). To the north of the fault lie the “foreland” sedimentary shelf and basin deposits of oceans along the ancient coastline. South of the fault lie volcanic and intrusive formations of island arcs that formed near, then merged with, the coastal shelf (Yukon-Tanana Upland). Over the last 60 million years, land to the south of the fault has been displaced along the fault line to the northwest by approximately 430 km.

Immediately north of the Tintina Fault, rocks in the South Ogilvie and Mackenzie mountains formed from sediment deposited in the Selwyn Basin along the ancient North American coastal margin (shale, slate, sandstone and chert). Volcanic rocks, including basalt flows and breccia, and intrusive rocks, such as diorite and syenite, are also found. East-to-west trending thrust faults from the Wernecke to Southern Ogilvie mountains and steeply dipping rock units combine to produce the distinctively rugged topography of the Tombstone and Cloudy ranges.

Farther north, the North Ogilvie and Nahoni ranges are composed almost entirely of deposits of the ancient continental shelf. Successive layers of erosional sediment and carbonate shelf deposits form the Yukon Block. Known mineral deposits include coal seams in the Kandik basin and silver, copper and zinc mineralization near Rusty Springs. Iron sulphide (pyritic) shales naturally produce acidic drainage that becomes mixed and diluted with groundwater or surface water. The pH may increase toward neutral or alkaline over calcareous stream bottoms, causing dissolved metals to precipitate and form a distinctive orange coating of the stream bottom.

¹ Landscape scale refers here to ecological processes and systems operating at large spatial scales, typically over thousands of hectares, containing a diversity of habitats and species and linked to human activity through ownership, resource management and physical infrastructure.

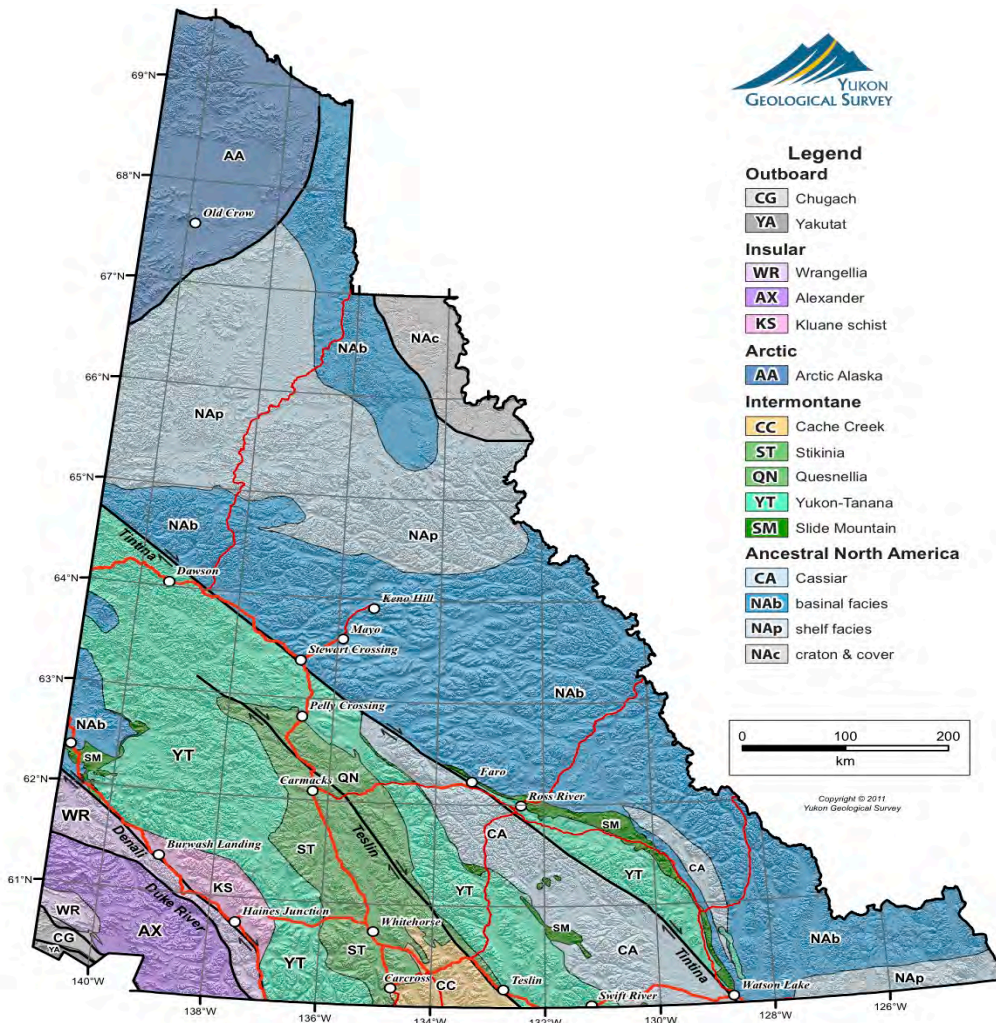


Figure 5-1 Yukon Terranes and Tintina Fault (Colpron and Nelson 2011)

South of the Tintina Trench lie deeply weathered metamorphosed sedimentary deposits and younger volcanics and intrusives of the Yukon-Tanana Terrace. These rocks contain a variety of minerals including asbestos, copper and gold. Significant gold deposits have been located in the White Gold district. Pre-ice age rivers draining southward concentrated gold eroding from quartz veins into alluvial (placer) sand and gravel deposits. The most accessible placer deposits have been extensively sluiced and dredged over the last 100 years.

Please refer to the map at **Section 3 – Resource Summary Maps – Physiographic Units and Simplified Geology** for further information on regional geologic formations.

5.2 Landscape and Glacial History

As part of a greater ice-free landscape once known as Beringia, most of the Klondike Plateau and much of the North Ogilvie Mountains remained ice-free for most of the last three million years. This extended unglaciated period has had a major influence on the landforms and ecology of the region. Surficial materials in unglaciated regions consist largely of weathered bedrock, colluvium, re-transported loess (wind-blown silt), and organic and fluvial deposits.

Prior to glaciation, extended cycles of uplift and erosion resulted in a well-developed landscape, with rounded summits and valley systems draining southward to the Pacific Ocean. It was during this period that the “White Channel Gravel,” a significant local source of placer gold, was deposited. Cordilleran glaciation resulted in a reversal of pre-glacial patterns, diverting the Yukon River northwest into the Tanana basin of Alaska. Subsequent evolution of drainage resulted in the reworking and redistribution of alluvial, gold bearing sediments, concentrating placer gold in pay streaks along valley bottoms, alluvial side-fans and bedrock terraces (Duk-Rodkin et al. 2003).

The stratigraphic record of sediments within the region contains one of the most complete records of glacial and inter-glacial periods in North America. Three main glacial periods may be identified:

- Pre-Reid (three million to 780,000 years ago): Glaciations extended as far west as Dawson and covered parts of the North and South Ogilvie mountains. This glaciation was responsible for deposition of the “Klondike Wash” gravels that overlie the White Channel Gravels along Hunker and Bonanza creeks.
- Intermediate Reid Glaciation (maximum extent about 200,000 years ago): Reid moraines and till are evident throughout the South Ogilvie Mountains.
- McConnell Glaciation (maximum extent about 20,000 years ago): Covered most of southern Yukon, but in the planning region was limited to localized areas in the South Ogilvie Mountains and Wellesley Basin.

The Ogilvie Mountains are the only area in the planning region that supported glaciers (ice caps) during the last glaciation. These ice caps were surrounded by unglaciated terrain and therefore isolated from the Cordilleran ice sheet to the southeast.

In contrast to the glaciated portions of southern Yukon, V-shaped valleys, convex slopes, rolling broad ridges and bedrock tors characterize the terrain in the unglaciated portion of the planning region. The U-shaped valleys, alpine cirques and tarns more characteristic of glaciated mountain terrain may be found in the Tombstone Ranges, but due to the absence of glacial moraines elsewhere, few large lakes have been impounded.

With each glacial advance, then retreat of the surrounding ice sheet, large volumes of wind-blown silt, or loess, were repeatedly carried onto the unglaciated landscape, mixing with soil horizons of weathered bedrock. Thicker loess units are found closest to the source in the St. Elias Mountains to the south.

Please refer to the map at **Section 3 – Resource Summary Maps – Glacial History** for further information on regional glacial history.

5.3 Climate

The climate of the planning region is continental (i.e., little temperature moderation by oceans) with long, cold winters and relatively warm summers. Most of the annual precipitation comes in the form of convective showers and thunderstorms from June to August. The driest months are February to April (Figure 5-2).

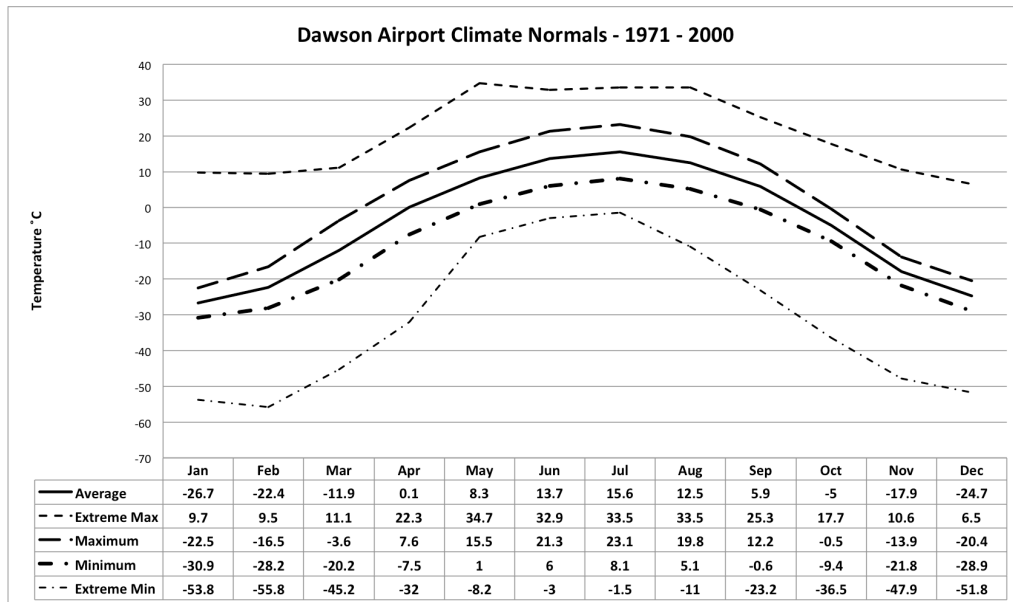


Figure 5-2 Climate Normals 1971-2000, Dawson A Station (Environment Canada 2011)

Two primary features drive weather patterns: a low-pressure area centered over central Arctic islands during the summer and the Aleutian Low/Pacific High pressure system. Flow aloft is generally northwesterly in winter and westerly in summer. Stronger flows in winter may drive cold Arctic high-pressure systems deep into the southern Prairies.

The planning region includes an area that receives the highest frequency of lightning strikes in Yukon. Persistent ridges forming in the upper atmosphere can cause prolonged warm, dry periods during the summer. Dry thunderstorms tend to occur after dry spells as the first surge of cold air aloft breaks down a persistent upper ridge. Upper troughs produce narrow bands of convective thundershowers in the summer, but are generally stronger during the winter, leading to broad cloud shields and widespread precipitation.

Elevation has a major effect on precipitation patterns. As warm moist air is forced upward by topography, it loses heat and increases in humidity, forming clouds or precipitation to the windward side. On the lee side, descending air becomes warmer and drier, creating a rain-shadow effect (Figure 5-3). The high portion of the Klondike Plateau, along the Yukon-Alaska border to the west and southwest of Dawson City, is the wettest part of the planning region. While not quite as wet, the South Ogilvie Mountains produce a similar orographic effect, with higher elevations generally receiving more snow and rain.

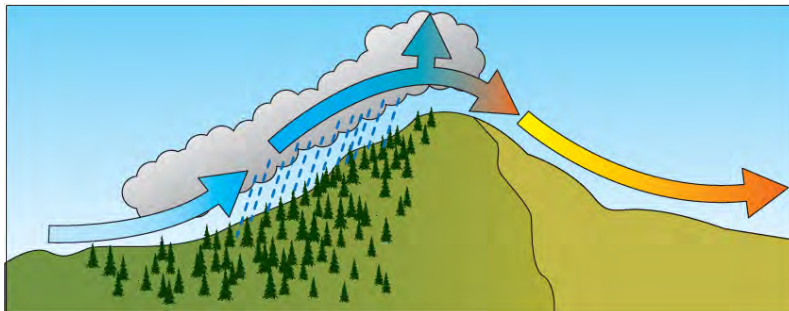


Figure 5-3 Moist air loses moisture as it passes over higher ground

Elsewhere in the planning region, the Mackenzie Mountains act as a barrier to stop cold arctic air draining into central and southern Yukon. Winter temperature inversions can lead to extremes in temperature; -50 C is not uncommon in major river valleys, while mean winter temperatures may be 10 C warmer at higher elevations (Klock et al. 2001).

Natural cycles of climatic variability can cause recurring and persistent changes in regional weather patterns. Two significant circulation patterns causing abnormal temperature and precipitation events are the El Niño/La Niña Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO). The ENSO shifts irregularly between El Niño (warm phase), neutral and La Niña (cool phase) every two to seven years.

El Niño years are typically warmer than La Niña years. However, during some La Niña years, such as winter 2011-2012, warm moist air from the South Pacific can bring higher snowfalls and milder winter temperatures to the planning region.

The PDO is marked by persistent changes in sea surface temperature and atmospheric pressure anomalies in the North Pacific Ocean, with phases lasting 20 to 30 years. A possible change from a warm to cool phase of the PDO may have been occurring since the mid-to-late 1990s, but until many years of data have accumulated, it will remain difficult to discern a pattern or distinguish it from the effects of human-induced climate impacts. The PDO may amplify or dampen the effect of ENSO years.

5.4 Permafrost

Permafrost is soil that remains continuously frozen year round, for at least two years. Discontinuous permafrost occurs where mean annual temperatures are at or slightly below 0°C, and frozen soil occurs only in sheltered and northerly aspects. Continuous permafrost occurs where the depth of frozen ground is a relic of colder climatic conditions from glacial periods, and soil remains frozen in spite of aspect or exposure. Permafrost is more widespread in the northern and higher-elevation areas of the planning region (Figure 5-4).



Figure 5-4 Permafrost Distribution

Periglacial features, such as patterned ground or cryoplanation terraces, may be associated with permafrost in unglaciated areas. In discontinuous permafrost areas, permafrost is generally found on valley bottoms, on most gentle slopes and ridge tops, and on nearly all north-facing slopes. Steep south-facing slopes are commonly free of permafrost.

A unique characteristic of permafrost within the planning region is the effect of frequent winter temperature inversions during the winter, which causes colder air to be trapped at lower elevations. As a result, the transition from discontinuous to continuous permafrost does not necessarily follow a linear trend with elevation. Low winter temperatures are required to maintain permafrost, however ground temperature may be moderated by snow depth and density, causing permafrost to remain warmer in winter than would otherwise occur in the absence of snow. An increase in winter snow cover could result in increased permafrost thawing, however many other factors, such as the insulating properties of surface moss and organic soil, current average snowpack and redistribution of snow on the landscape play a significant role (Schuur et al. 2008).

Permafrost thicknesses of 60 m have been recorded in the planning region. The depth active-layer (i.e., depth of seasonal thaw at the ground surface) is generally less than 1 m, although can be deeper where soils are well drained, and as little as 20 cm under the insulating cover of an organic mat. Soils over permafrost are generally moister and cooler than soils in permafrost-free landscapes. Limited infiltration of surface water results in saturation, slow decomposition and low nutrient availability.

Disturbance of surface vegetation causes degradation and thaw of permafrost and results in the development of thermo-karst ponds commonly found in valley bottoms. The presence of discontinuous permafrost in this area generally limits groundwater recharge, subsequently affecting the hydrological response of streams. This interaction is described in more detail in **Section 2 – Chapter 9, subsection 9.2.**

Most discontinuous permafrost south of Eagle Plains is warmer than -2 C. This permafrost is easily disturbed and its degradation can be readily initiated by any construction activity that disturbs the natural surface vegetation or drainage. Increasing rates of permafrost melt associated with climate change may cause changes in slope stability and local drainage patterns. Much of the undisturbed discontinuous permafrost south of the Yukon River in Alaska has warmed significantly since the mid-1700s and some of it is thawing (Jorgenson et al. 2001).

Recent studies from Dominion Creek in the Klondike Goldfields have revealed that permafrost has survived and remained frozen in this region since Middle Pleistocene, at least 750,000 years ago. This permafrost survived multiple interglacial periods within climate as warm as those at present. It highlights that permafrost in the discontinuous permafrost zone has been resilient to past warmer climates and suggest that this frozen ground and associated carbon reservoirs may be more stable with future warming climates than previously envisioned (Froese et al. 2008).

Historically, permafrost increased the difficulty of extracting placer gold from perennially frozen gravels. Operations were limited to warmer weather when the ground thawed and restricted to one or two metres deep by the shallow permafrost. The practice of lighting fires to thaw the ground was expensive; until steam became more readily available, this practice was restricted to the richest deposits.

The presence of permafrost is a critical consideration in the design of mining operations and for the long-term stability of tailings ponds. Increased exposure to sunlight following linear development, especially the removal of surface insulation, can lead to increased thaw and degradation of permafrost. This can lead to accelerated erosion and may complicate maintenance considerations (EBA Engineering 2004). This may be cause for concern for the design and maintenance of roads and other infrastructure, as well as creating engineering challenges in the design and construction of buildings.

Permafrost plays a significant role in the carbon cycle, locking a considerable fraction in bio-geochemically inert frozen soil. Carbon stored in permafrost regions is one of the least understood and potentially most significant carbon-climate feedbacks because of the size of the carbon pools and the intensity of climate forcing at high latitudes (Schuur et al. 2008). Under warming soil conditions, carbon released from decomposition following the melting of permafrost would more than offset the additional fixing of carbon by green-up of arctic vegetation.

5.5 Ecosystems

The classification of ecosystems into units of similar physical landscape and ecological function is an important component of ecosystem based management and conservation planning.

Two parallel and complimentary systems of classification are developed for classifying and mapping the diversity of landscapes within the planning region: The National Ecological Framework (NEF) and the Yukon Ecological and Landscape Classification framework (ELC).

The NEF defines ecosystems in a hierarchy of spatial scales, from broad ecozones to ecoregions and, finally, ecodistricts. Key indicators such as elevation, soil conditions, weather patterns and vegetation are used to classify different ecological communities. The NEF is useful at large scales (e.g., 1:1,000,000) for management applications and ecological reporting at the nation-wide level.

The Yukon ELC is under development by the Government of Yukon's Department of Environment. While not formally a part of the NEF, the ELC is similarly organized along a spatial hierarchy of bioclimatic zones, broad ecosystem units and eco-sites. The ELC may be used at more localized scales of 1:50,000 for broad ecosystem description, environmental assessment, input to cumulative effects and biodiversity modeling, and other planning applications requiring standardized descriptions of vegetation and landform. The ELC facilitates mapping the distribution and abundance of ecosystems; monitoring of change over time; estimation of ecosystem productivity; modeling of cumulative effects and biodiversity; and assessment of the ability of landscapes to recover after disturbance (Flynn and Francis 2011).

Descriptions of ecodistricts and ecologically significant features in the planning region were completed in 2010 (McKenna et al. 2010).

5.5.1 Ecoregions and Ecodistricts

The Taiga Cordillera is a subarctic region that covers most of the northern half of Yukon and the southwest corner of the Northwest Territories (Smith et al. 2004). The Boreal Cordillera, an extension of the boreal forest zone that stretches from Labrador to Yukon, lies over the mid-section of the Western Cordillera. Distinct geological and climatic features support the further definition and mapping of six unique ecoregions in the planning region: Eagle Plains, North Ogilvie Mountains, Mackenzie Mountains, Yukon Plateau – North, Yukon Plateau – Central, and Klondike Plateau. Ecodistricts may be used to further subdivide ecoregions according to differentiating characteristics of landform, permafrost, soil development, soil texture, vegetation cover, annual precipitation and mean temperature.

Please refer to the map at **Section 3 – Resource Summary Maps – Ecodistricts** for depiction of regional ecodistrict boundaries. See also **Appendix E – Ecodistrict Mapping**.

Ecoregions within each ecozone are summarized in Table 5-1.

Table 5-1 Ecoregions within the planning region (Grods et al. 2012)

ECOZONE Ecoregion Ecodistrict (ESWG 1995)	Area within Yukon (km ²)	Area within planning region		
		km ²	% of Ecodistrict	% of planning region
TAIGA CORDILLERA				
Eagle Plains	18,581	1,769	9.5	3.9
ID6	18,581	1,769	9.5	3.9
Mackenzie Mountains	14,910	7,128	47.8	15.8
South Ogilvie Taiga	14,910	7,128	47.8	15.8
North Ogilvie Mountains	28,276	10,069	35.6	18.2
Keele Range	12,384	1,998	16.1	4.4
Tatonduk Mountain	8,403	5,479	65.2	12.1
Blackstone River Uplands	7,489	2,592	34.6	5.7
BOREAL CORDILLERA				
Yukon Plateau – North	17,748	4,616	26.0	10.2
ID19	13,735	3,795	27.6	8.4
Tintina North	4,013	821	20.5	1.8
Yukon Plateau – Central	5,596	582	10.4	1.3
Flat Top Mountain	5,596	582	10.4	1.3
Klondike Plateau	34,020	21,025	61.8	46.5
Dawson Range	12,085	2,428	20.1	5.4
King Solomon's Dome	11,060	8,740	79.0	19.3
Top of the World	10,875	9,857	90.6	21.8
Scottie Creek	2,188	58	2.7	0.1
TOTAL	119,131	45,247		100%

5.5.2 Bioclimate Zones

The highest level of the ELC framework is the bioclimate zone, which is defined as broad areas with similar climate and elevation characteristics that influence the type and pattern of vegetation that occurs. Regional climate is the primary controlling factor of vegetation potential and ecosystem distribution while other influences, such as soils and terrain, are considered secondary. Seven bioclimate zones are recognized in Yukon: Boreal Low, Boreal High, Subalpine, Taiga Wooded, Taiga Shrub, Tundra, and Alpine. All except Tundra are represented in the planning region (Table 5-2). Please refer to the map at **Section 3 – Resource Summary Maps – Bioclimate** for further information on regional bioclimate classification.

In mountainous areas, bioclimate zone boundaries may be visible as relatively abrupt changes in general vegetation communities or species and are organized along a gradient of transition. In lower elevation or rolling terrain, bioclimate zone boundaries may be subtle and transitional. The boundary between two bioclimate zones occurs at lower elevations as latitude increases.

Table 5-2 Yukon bioclimate zones (Grods et al. 2012)

Bioclimate Zone	Code	Description	Elevation Range (m)	Area in region (km ²)	Area of region (%)
Boreal Low	BOL	BOL is limited to the major river valleys (Yukon, Stewart, Pelly and White) and low-lying wetland ecosystems within the project area. This is the most productive area of the region	<450	3,223	4
Boreal High	BOH	BOH is the largest bioclimate zone in the project area, occurring in all mountain valleys and plateaus of the Boreal Cordillera. Large areas of shrub and deciduous forest result from frequent wildfires	450 – 1,100	33,697	40
Subalpine	SUB	SUB occurs at high elevations of the Boreal Cordillera (southern) portion of project area. Sparse coniferous forests and shrub vegetation characterize the SUB	1,100 – 1,500	5,707	7
Taiga Wooded	TAW	TAW covers the low and middle elevations of the Taiga Cordillera. Extensive shrub areas may also occur as a result of wildfire or cold air drainage/frost pockets/poor drainage	<800	23,817	28
Taiga Shrub	TAS	TAS covers the high elevation shrub and sparsely forested areas in the mountains and plateaus of the Taiga Cordillera	880 – 1,200	13,988	16
Alpine	ALP	The non-forested ALP is found throughout the highest elevations, but is most prominent in the Ogilvie Mountains	>1,500 (Boreal) >1,200 (Taiga)	4,649	5

5.5.3 Broad Ecosystem Units

Broad Ecosystem Units (BEU) describe generalized vegetation conditions occurring on different landforms and/or topographic position and represent the stable sites upon which vegetation grows. BEU types are grouped into three relative soil moisture groups: dry, moist or wet. These groups are further organized into upland ecosystems, wetlands and floodplains, or other ecosystems and are described in terms of their vegetative phase, being either herbaceous, shrub, deciduous, mixed wood or coniferous (Table 5-3). Some vegetative phases are considered successional while others are relatively stable. For example, in low-to-middle elevation bioclimate zones (i.e., BOH, BOL, TAW), moist sites tend toward a forested condition following a disturbance such as wildfire. Herbaceous and shrub communities in areas undisturbed for long periods may be relatively stable vegetation communities, in other words, not successional to coniferous forest. Please refer to *Regional Ecosystems of West-Central Yukon, Part 1: Ecosystem Descriptions* (Grods et al. 2012) for a full description of bioclimate zone and broad ecosystem mapping and descriptions.

Table 5-3 Broad ecosystems of West Central Yukon (Grods et al. 2012)

Group	Type *	Phase *
DRY	Rock (700)	Not applicable
	Ridge (110)	Ridge – Herb-Bryoid (111) Ridge – Shrub (112) Ridge – Deciduous (113) Ridge – Mixedwood (114) Ridge – Coniferous (115)
	Steep South-Facing Slope (120)	Steep South-Facing Slope – Herb-Bryoid (121) Steep South-Facing Slope – Shrub (122) Steep South-Facing Slope – Deciduous (123) Steep South-Facing Slope – Mixedwood (124) Steep South-Facing Slope – Coniferous (125)
MOIST	Upper Slope (130)	Upper Slope – Herb-Bryoid (131) Upper Slope – Shrub (132) Upper Slope – Deciduous (133) Upper Slope – Mixed-wood (134) Upper Slope – Coniferous (135)
	Gentle Slope and Plain (140)	Gentle Slope – Herb-Bryoid (141) Gentle Slope – Shrub (142) Gentle Slope – Deciduous (143) Gentle Slope – Mixedwood (144) Gentle Slope – Coniferous (145)
WET	Steep North-Facing Slope (150)	Steep North-Facing Slope – Herb-Bryoid (151) Steep North-Facing Slope – Shrub (152) Steep North-Facing Slope – Deciduous (153) Steep North-Facing Slope – Mixedwood (154) Steep North-Facing Slope – Coniferous (155)
	Drainage and Depression (160)	Drainage and Depression – Herb-Bryoid (161) Drainage and Depression – Shrub (162) Drainage and Depression – Deciduous (163) Drainage and Depression – Mixedwood (164) Drainage and Depression – Coniferous (165)
OTHER	Wetland (310)	Wetland – Herb-Bryoid (311) Wetland – Shrub (312) Wetland – Treed (315)
	Floodplain (370/380/390)	High Flood Frequency (370): <ul style="list-style-type: none"> • Floodplain – Gravel Bar-Herb-Bryoid (371) • Floodplain – Shrub (372) Moderate Flood Frequency (380): <ul style="list-style-type: none"> • Floodplain – Deciduous (383) • Floodplain – Mixedwood (384) Low Flood Frequency (390): <ul style="list-style-type: none"> • Floodplain – Coniferous (395)
	WATER and ICE (400)	Water (401) Ice (Glacier) (403)
	DISTURBANCE (500)	Natural Disturbances (501) Anthropogenic Disturbances (502) Minesite Disturbances (503)

5.5.4 Rare, Unique and Special Features

Most of the planning region was part of Beringia, a landscape spanning northwestern North America to eastern Siberia that remained unglaciated during the Pleistocene glacial periods (20,000 and 200,000 years ago). Beringia supported many glacial relict species that are found nowhere else in the world. The unglaciated area was a refugium for plants and animals and those arctic, alpine and boreal

species that would eventually repopulate northwestern Canada. Many of these plant and animal populations became isolated following the ice age.

Table 5-4 summarizes the relative Beringia coverage by ecoregion. Within the planning region the Ogilvie Mountains are the only area that supported glaciers (i.e., ice caps) during the last glaciation. These ice caps were surrounded by unglaciated terrain making them isolated from the Cordilleran ice sheet to the southeast. Peripheral areas that were influenced by the Ogilvie Mountain ice caps but not included in the Table 5-4 calculations are the glaciofluvial landforms that emanate from the upland.

Table 5-4 Beringian area in ecoregions within the planning region (Government of Yukon 2012a)

Ecoregion	Area within Dawson Region (km²)	Area within Dawson Region (%)	Beringian Area within Dawson Region (%)
Eagle Plains	1761	9	100
Mackenzie Mountains	7111	16	63
Yukon Plateau-Central	525	2	100
Yukon Plateau-North	4630	8	100
North Ogilvie Mountains	10055	25	96
Klondike Plateau	21205	55	100

5.5.5 Wetlands

Wetlands are represented by approximately six per cent of the landscape types in the planning region. Due to their low abundance relative to other areas of Yukon, all wetland areas in the planning region are considered ecologically important. Distribution of wetland areas by bioclimate zone is shown in Table 5-5.

Table 5-5 Area of wetland classes within region, by bioclimate zone (McKenna et al. 2010)

Bioclimate Zone	Toe and gentle slope wetlands (S) (ha)	Riparian wetlands (R) (ha)	Depressional wetlands (D) (ha)	Polygonal wetlands (P) (ha)	River (ha)	Open Water (W) (ha)	Lake (ha)	Grand Total (ha)	% of all wetlands	% of bioclimate zone mapped wetland
BOH	83,620	13,285	8,031	0	1,684	717	1	107,337	37%	4%
BOL	16,710	26,981	11,077	0	34,116	366	73	89,324	31%	33%
WTA	35,295	12,294	347	0	848	66	0	48,849	17%	16%
STA	13,639	4,966	303	19,548	172	666	138	39,431	14%	12%
SUB	3,911	279	3	84	0	130	0	4,406	2%	1%
ALP	0	2	0	0	0	42	0	44	0%	0%
Total	153,175	57,807	19,761	19,631	36,819	1,986	211	289,391	100%	
% of all wetlands	53%	20%	7%	7%	13%	1%	0%	100%		

5.6 Hydrology

10 sub-watersheds within the Yukon River Basin and one in the Arctic Basin are identified in Table 5-6. The largest sub-watershed is the Central Yukon, which includes the tributaries of Sixty Mile River and Indian River. Six sub-watersheds straddle the international boundary into Alaska and five straddle the boundary of the planning region (Figure 5-5). Three of the sub-basins are the headwaters for their respective watersheds: Tanana, Peel and Porcupine.

Table 5-6 Sub-watersheds within and adjacent to the planning region

	Drainage Area (km ²)	Area within region (km ²)	% of Sub-Basin in Region	% of Planning Region
MACKENZIE RIVER BASIN				
Upper Peel (Blackstone River)	37,523	1,177	3.1	2.6
YUKON RIVER BASIN				
Lower White River	8,269	4,465	54.0	9.9
Upper Yukon – White River	52,735	1,736	3.3	3.8
Headwaters Tanana	14,165	366	2.6	0.8
Lower Stewart River	16,423	2,700	16.4	6.0
Central Yukon – Sixty Mile	12,957	12,693	98.0	28.0
Klondike	8,046	6,894	85.7	15.2
Forty Mile	16,827	1,211	7.2	2.7
Central Yukon - Tatonduk	23,045	7,878	34.2	17.4
Headwaters Porcupine River	23,685	5,822	24.6	12.9
Lower Porcupine Mouth	4,239	363	8.6	0.8
TOTAL	217,914	45,305	20.8%	100%

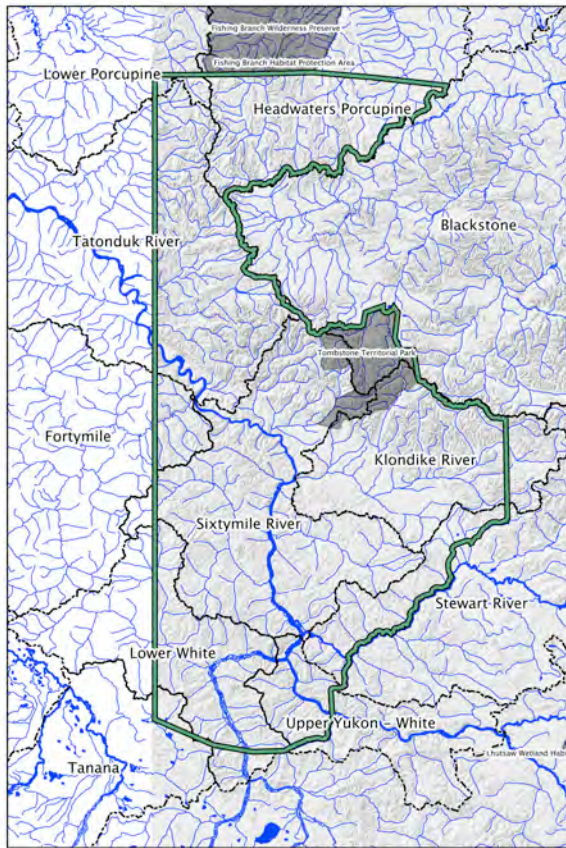


Figure 5-5 Sub-watersheds in planning region

The Yukon River generally flows north and west to the Canada-Alaska boundary. Significant tributaries include the White River (which contributes inflow from extensive snowfields in the Wrangell–St. Elias Mountains) and the Stewart River (which drains the area east toward the Northwest Territories border). When combined with the inflow of the Pelly River, just south of the region, these tributaries result in an increase in width of the Yukon River from 180 m at Carmacks to 300 m at Dawson. Upon reaching the Canada-USA border, the river attains a width of about 450 m. Annual discharge for the Yukon River is shown in Figure 5-6.

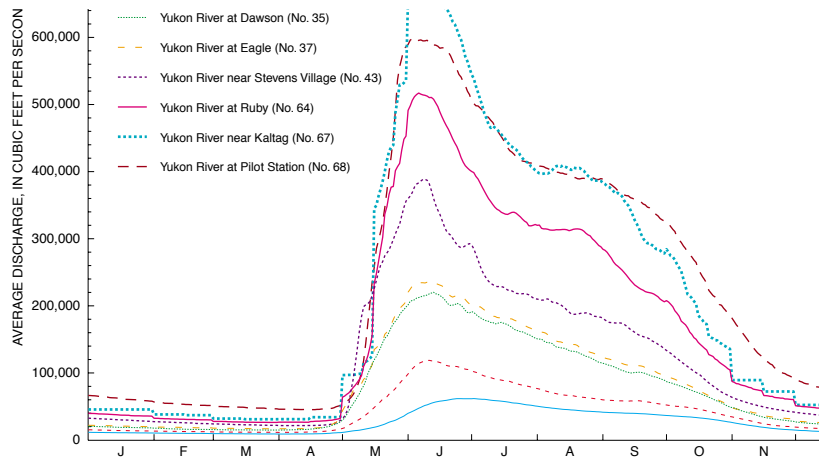


Figure 5-6 Average discharge of the Yukon River at eight locations (Brabets et al. 2000)

In the Taiga Cordilleran ecozone, the underlying permafrost largely controls stream flow characteristics. Runoff is large relative to precipitation because of limited infiltration through the underlying permafrost and low rates of evapotranspiration. Peak flows generally occur in June, although summer rain events can produce secondary peaks and occasionally annual peaks on smaller streams, especially in mountainous areas. Minimum flows generally occur in March and tend to be lower than Boreal Cordillera ecozones to the south because of the effect of lower winter temperatures on groundwater flow. Small streams within this ecozone frequently experience zero flows, while some intermediate-sized streams may occasionally experience zero winter flows.

In the Boreal Cordilleran ecozone, rapid increase in stream flow discharge occurs in May due to snowmelt, with high flow continuing for a few weeks maintained by summer rainfall. Streams in the southwest can have peak flows in July or August due to snowfield and glacier melt. Ground water discharge generally continues throughout winter.

5.7 Natural Disturbance Processes

5.7.1 Wildfire

A key influence on the forest ecology of the region, particularly in the southern portion, is wildfire. The Klondike Plateau has some of the highest levels of fire activity in Yukon, with an average fire cycle of approximately 100 years. In extreme fire years, such as 2004, 10 to 20 per cent of the plateau can be affected by fire in a single season. In contrast, wildfire occurs much less frequently in the Ogilvie Mountains and is generally limited to forested valley bottoms.

While most precipitation falls during the summer, it results principally from thunderstorms that also bring a relatively high density of lightning strikes. The rolling, forested terrain on plateau portions of the region presents few topographic barriers to fires; combined with warm summer temperatures,

this means that upland forests experience extensive and frequent burns, resulting in large areas of early-successional shrub and deciduous forest. Frequent wildfire may contribute to a decline in caribou habitat quality, while at the same time providing more browse for moose and snowshoe hare.

Yukon forest fire history data were obtained for the period from 1950 to 2011 (Government of Yukon 2012b). Fires early in that period were often unrecorded and poorly mapped, especially in remote northern areas. For an analysis of fire rates, the period 1960 to 2011 was used. Data include a record of point location of fire occurrences indicating date of fire, cause, nature of response (if any) and an estimate of area burned. Larger fires are mapped and a calculation of area burned may be performed using GIS tools. Ecodistrict boundaries (ESWG 1995) were used to stratify the region for calculation of differential fire rates. Calculations were performed over the full extent of ecodistricts occurring within the planning region (Figure 5-7).

Fire history by fire district is shown in Table 5-7. The Dawson Fire Management District has the highest frequency of fire and largest area burned by wildland fire. In the Dawson Fire District the number and area of fires occurring annually is highly variable, but the area burned per decade has increased since the 1970s (Figures 5-8 through 5-11).

Regional fire history is displayed on the map in **Section 3 – Resource Summary Maps – Fire History**.

On average, approximately 0.5 per cent of the study area burns in any given year, which results in an average fire cycle of 200 years. This is consistent with a previous assessment of fire rates for central Yukon (McVoy and Burn 2005). However, a large number of fires occurred in 2004, when approximately eight per cent of the study area burned in a single fire year.

Causes of fire within the region are shown in Table 5-8. Lightning is by far the most frequent cause of fire (85 per cent) and accounts for over 98 per cent of the area burned. The largest fires, those over 1,000 ha in size, account for less than 15 per cent of all fires, but cause 96 per cent of the burned area (Table 5-9). Median fire sizes indicate the high frequency of small fires associated with lightning strikes. When calculated only on the basis of the larger mapped fire occurrences, median fire size approaches 2,000 ha in the ecodistricts most prone to fire.

Fire does not occur with the same frequency or intensity in all parts of the region (Table 5-10). Fire is more common in the southern Boreal ecozone, where a fire cycle of 100 to 200 years is typical, whereas the more northern Taiga ecozone has a fire cycle of more than 500 years. In the Flat Top Mountain area (boreal), the fire cycle was determined to be approximately 75 years, while in the Tatonduk ecodistrict (taiga), the fire cycle was found to be nearly 4,000 years.

Climate change projections indicate that the fire regime in central Yukon will continue to vary from year to year, but overall, the occurrence and extent of forest fires may increase. Within the next 50 years, the projected number of fires could potentially be four times higher than the present level, and the area burned more than seven times greater (McVoy and Burn 2005).

Limitations of the data:

Discrepancies can occur between the area attribute of the point location and the calculated area for the fire polygon. Mapped areas may include islands of unburned forest within the burned extent. Point fire data are associated with only one ecodistrict, while the fire may straddle multiple ecodistricts. Spatial data may be distorted, causing errors in positional and areal calculations.

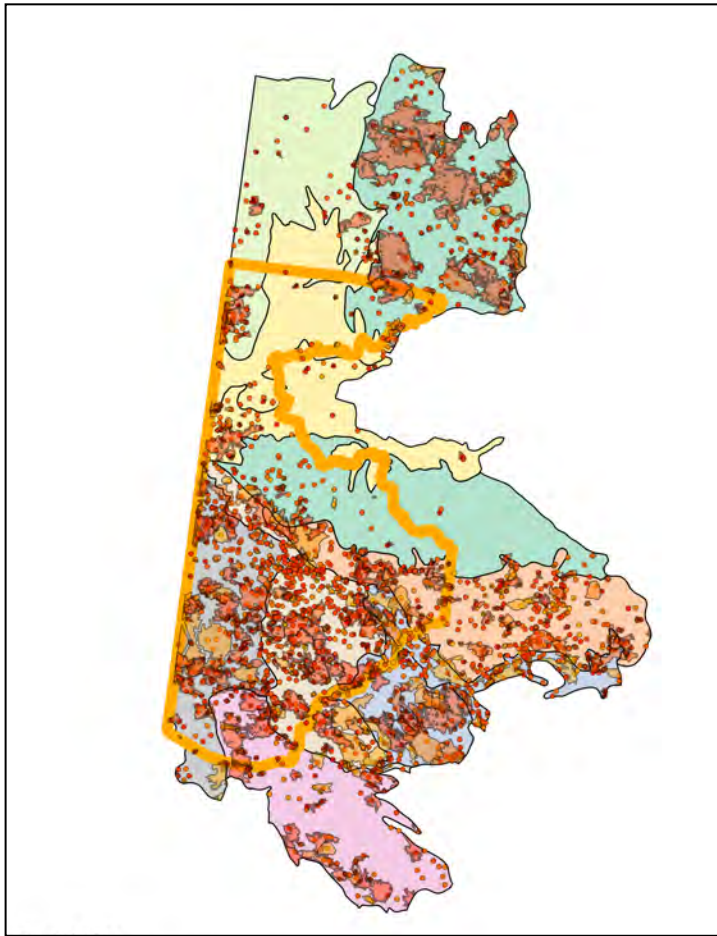


Figure 5-7 Study area, showing Fire Management Districts and Historic Burn Areas

Table 5-7 Fire History by Fire Management District, 1960-2011

Fire Management District	Area Burned (ha)	# of Fires
Beaver Creek	317,318.84	229
Carmacks	1,049,553.04	598
Dawson	1,564,474.40	1,063
Haines Junction	16,530.87	252
Mayo	1,260,027.12	800
Old Crow	1,451,838.20	380
Ross River	693,193.48	553
Teslin	43,449.93	212
Watson Lake	825,722.50	753
Whitehorse	142,939.83	1,539

Table 5-8 Dawson District fire history by cause of fire, 1960-2011

Fire Cause	# of Fires	% of Fires	Area (ha)
Not Specified	14	1.32	3,531
Lightning	900	84.75	1,539,604
Campfire	2	0.19	<1
Fire Use	3	0.28	<1
Equipment Use	1	0.09	<1
Miscellaneous	10	0.94	10,470
Human General	132	12.43	10,504

Table 5-9 Fire size class distribution, Dawson Region Ecodistricts, 1960-2011

Class	Fire Size (ha)	Area Burned (ha)	# of Fires	% of Fires	% of Area Burned
A	Up to 0.1	13.38	329	18.89	0.00
B	0.11-10	176.62	317	18.20	0.01
C	1.1-10	1,405.26	325	18.66	0.05
D	10.1-100	11,764.57	273	15.67	0.40
E	100.1-1,000	92,941.33	232	13.32	3.19
F	1,000.1-10,000	733,453.95	194	11.14	25.15
G	10,000.1-100,000	1,530,796.9	68	3.90	52.50
H	Over 100,000	545,439.94	4	0.23	18.71

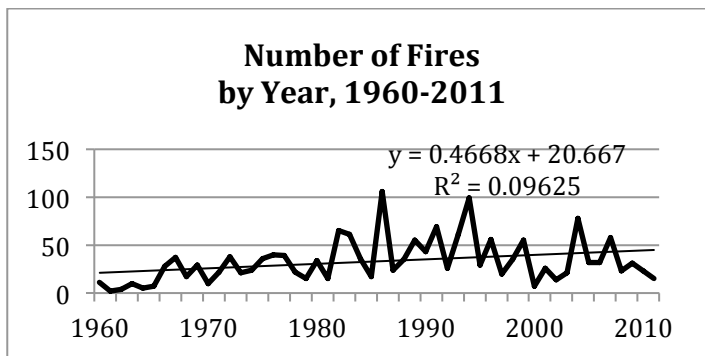


Figure 5-8 Annual number of fires in study area (1960-2011)

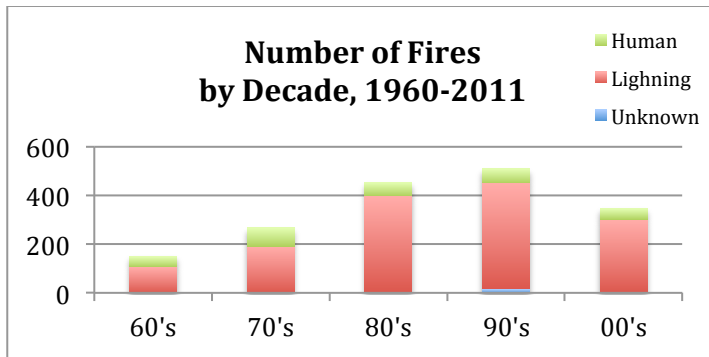


Figure 5-9 Number of fires in study area by decade (1960-2011)

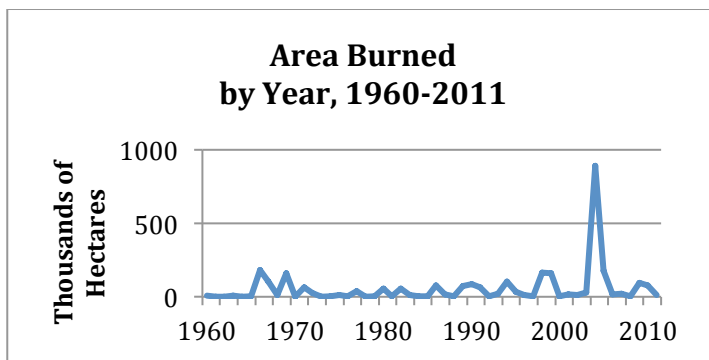


Figure 5-10 Annual area burned in study area (1960-2011)

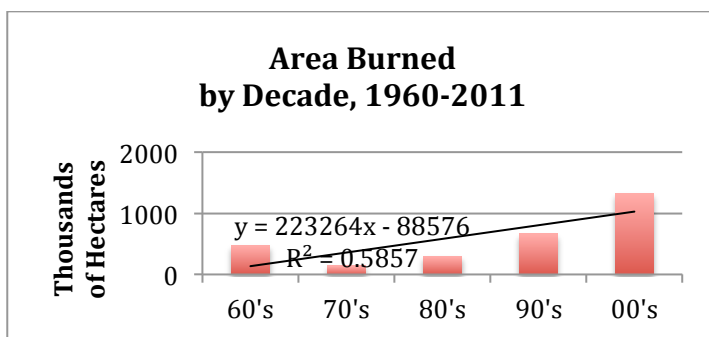


Figure 5-11 Area burned in study area by decade (1960-2011)

Table 5-10 Fire rate, fire cycle and median fire size by ecodistrict, 1960-2011

Ecodistrict	Average Annual Area Burned (%)	Fire Cycle (years)	Median Fire Size (ha)	
			All Fires	Large Fire only
ID6	0.87	115.4	86.4	1,823.13
South Ogilvie Taiga	0.08	1,284.8	35	538.09
Keele Range	0.14	731.2	45	448.91
Tatonduk Mountain	0.03	3,805.1	142	405.75
Blackstone River Uplands	0.15	662.1	35	1,020.86
ID19	0.47	214.1	4	851.74
Tintina North	0.51	195.6	0.4	966.43
Flat Top Mountain	1.28	78.3	5.7	1,792.37
Dawson Range	0.48	207.7	62	994.60
King Solomon's Dome	0.81	123.2	1	808.67
Top of the World	0.96	104.4	10	857.77

5.7.2 Floods

Active riparian areas along rivers and streams are periodically flooded by flowing water. Active riparian zones cover 191,455 ha or four per cent of the planning region. Half of this area is in the occasional-to-rare flood regime class (i.e., greater than five years between flood events). The largest area of active riparian (54 per cent of all active riparian) and the largest proportion by bioclimate zone (38 per cent) is found in the Boreal-Low (BOL) (Table 5-11).

Table 5-11 Active riparian areas by bioclimate zone (McKenna et al. 2010)

Bioclimate Zone	Permanent water (0) (ha)	Strong annual flooding (1) (ha)	Annual flooding (2) (ha)	Occasional to frequent flooding (3) (ha)	Occasional to rare flooding (4) (ha)	Unclassified (ha)	Grand Total (ha)	% of all active riparian	% of bioclimate zone
ALP	42	0	0	0	0	0	42	0%	0%
BOH	2,204	1,402	7,052	7,163	36,596	74	54,490	28%	2%
BOL	34,796	9,057	4,069	19,895	35,910	12	103,739	54%	38%
STA	453	506	1,677	1	4,248	0	6,884	4%	2%
SUB	39	21	125	0	275	0	460	0%	0%
WTA	905	991	5,167	254	18,521	2	25,840	13%	8%
Grand Total	38,438	11,977	18,090	27,313	95,549	88	191,455	100%	
% of all active riparian	20%	6%	9%	14%	50%	0%	100%		

Flooding is most common with the spring freshet in late May or early June during periods of snowmelt or combined rainfall and snowmelt. Flooding may also arise from ice jams that form during spring break-up in May or while freeze-up is occurring in winter. Moderate flooding (i.e., 0.5 to 1 m above flood line) generated by snowmelt occurs with a return period of 20 to 50 years. Periods of intense summer rain may contribute to localized flooding of bridges or culverts near highway stream crossings.

Dawson City is located on the floodplain just below the confluence of the Yukon and Klondike rivers and has been flooded a number of times since 1898. Protective dikes built along the banks of the rivers in 1959, and raised higher in 1968, were insufficient to prevent \$28 million² of devastation to the historic townsite during flooding in the spring of 1979. A new dike was completed in 1987, following much discussion about the impact a dike would have on Dawson City's waterfront. In May 2009, ice jams caused significant spring flooding downriver at Eagle, Alaska.

5.8 Climate Change

5.8.1 Trends in Climate Data

Climate trends are based on departure of temperature and precipitation data from climate normal: consistent periods of time for which a calculation of statistical mean, maximum and variance may be performed for comparison of historic data with current or projected future data, or to compare historic data from one geographic area with another. Departures from normal used here refer to departures from the climate normal period of 1961 to 1990.

Warming trends in the Dawson planning region exceed those of southern regions of Canada; an analysis of temperature records for the period from 1955 to 2004 at weather stations in Dawson and Mayo reflect a warming trend of approximately 6 C per century, with a slightly greater increase noted in daily minimum temperatures as compared to daily maximums (Werner et al. 2009). Trends in precipitation over the last century show greater spatial variability, with a 29 per cent per century decline in precipitation in the Dawson area, yet significant increase in the Mayo (27 per cent per century) and Pelly (30 per cent per century) areas. Precipitation is highly sensitive to modes of climate variability and caution is advised when using trends to predict future precipitation change. An increase in stream flows in the Yukon River above the White River from November to April, and decreases in the late summer, suggest that snowmelt could be occurring faster and earlier in the spring. Such early onset of snowmelt may result in reduced stream flow in the summer and fall.

Trends for Canada as a whole indicate a mean annual temperature departure of 1.4 C above normal over the period from 1948 to 2009, with a mean annual departure of +2.4 C in mean winter (i.e., December, January and February) temperature and +1.8 C in mean spring (i.e., March, April and May) temperature (Statistics Canada 2011). All eleven climatic regions of Canada showed positive warming trends for the period, but the strongest warming trends are in the far north of Canada (Arctic tundra, Arctic mountains and fjords, Mackenzie District, and Yukon and Northern B.C. mountain regions). Trends for these regions show a mean increase from normal temperatures of 1.6 to 2.2 C over the 62-year period.

Some climatic variability in the planning region may be associated with large meso-scale climate patterns, such as the well-known El Niño/La Niña Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO) and the Arctic Oscillation (AO). During an ENSO warm phase (i.e., El Niño), December to February temperatures are 3.5 C to 3.9 C warmer on average than during the cool phase (i.e., La Niña). During the warm phase of the PDO, monthly average temperatures increase in both winter and spring, and spring precipitation increases as much as 20 per cent versus

² Adjusted to 2009 dollar value as reported in Hennessey et al. (2011)

the cool phase PDO. The AO may be related to increased temperatures from May through August, an increase in stream flow during April and a decrease in August stream flow (Werner et al. 2009).

Variations to solar radiation and the release of atmospheric aerosols from volcanic eruptions over the past 50 years would likely have produced global cooling. The observed patterns of warming are simulated only by models that include the impact of human activity (Intergovernmental Panel on Climate Change 2007).

5.8.2 Greenhouse Gas Emissions

The ‘greenhouse effect’ is a naturally occurring process that traps heat in the atmosphere. Some of the incoming solar radiation reflected by the earth’s surface is absorbed by gases in the atmosphere and re-emitted back to earth. The largest contributor to the greenhouse effect is water vapour. Four other long-lived atmospheric gases, known as ‘greenhouse gases’ (GHGs), are considered to contribute to the greenhouse effect: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (NO₂) and halocarbons (i.e., gases containing fluorine, chlorine or bromine). Changes to the atmospheric concentration of GHGs and other aerosols (e.g. water vapour, dust), as well as to land cover and solar radiation, alter the energy balance and are drivers of climate change. They affect absorption, scattering and emission of radiation within the atmosphere and on the ground.

Natural processes and human activity both contribute greenhouse gases to the atmosphere. The natural decay of organic matter releases carbon stored in soil and permafrost; fires release carbon stored in forests. Natural sources do not exist for halocarbons. Anthropogenic contributions to climate change originate primarily through the increased emissions, principally carbon dioxide, that result from the combustion of fossil fuels. Other anthropogenic sources include release of methane from decomposition of buried waste in landfill operations. Land use activities such as placer mining that disturb vegetative cover may result in degradation of permafrost, thus contributing to the release of methane. In 2005, a net decrease in GHG emissions (-4.1 per cent) in Yukon, Northwest Territories and Nunavut was attributed largely to a reduction in combustion emissions from electricity and heat generation in Yukon (Statistics Canada 2008).

Historic data indicate that greenhouse gases have been increasing in the atmosphere since industrialization. The Intergovernmental Panel on Climate Change (IPCC), an international body established by United Nations Environment Programme (UNEP) and World Meteorological Organization (WMO), suggest that “most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic GHG concentrations” (Intergovernmental Panel on Climate Change 2007).

Positive and negative changes to the earth-atmosphere system are expressed in terms of influence on the balance of incoming and outgoing energy (i.e., “radiative forcing”). A common metric used to describe warming influences is “CO₂-equivalent emission,” which is the amount of CO₂ emission that would cause the same radiative forcing over time as the emitted amount of long-lived GHG or mixture of GHGs. This measure is also referred to as the “carbon footprint” and may be used to compare relative influences of various human activities on global climate.

The Government of Yukon’s *Climate Change Action Plan* (2009) notes that GHG emissions in Yukon over the period from 1990 to 2006 were significantly higher during periods of increased activity in the mining sector (mid-90s). Transportation was the sector responsible for most GHG emissions, with heavy-duty diesel vehicles being the largest contributor, along with off-road diesel use in construction, agriculture and mining activity. Diesel generation of electricity during periods of high energy demand can also be a major contributor to GHG emissions. Total GHG emissions for Yukon in 2006 were estimated at just under 0.4 megatonnes of CO₂ equivalent; for the same period GHG emissions for all of Canada were estimated at nearly 750 megatonnes of CO₂ equivalent. Globally,

Canada produces about two per cent of the annual GHG emissions originating from human activity (Environment Canada 2013).

Further discussion on GHGs and carbon balance may be found in **Section 2 – Chapter 10 – Forests** and **Chapter 14 – Energy**.

5.8.3 Projected Climate Changes

Average annual temperatures are increasing in the planning region. It is expected that temperature increases will be greater in Arctic and sub-Arctic regions than in southerly parts of Canada (Statistics Canada 2011).

For the *Dawson Climate Change Adaptation Plan* (Hennessey et al. 2011) projected climate changes were derived from the Canadian Regional Climate Model (CRCM) for the 2050s (i.e., an average of the period 2041 to 2070) under the assumption that there is “no change to global consumption of fossil fuels” (it should be noted that the Canadian Global Climate Model 3 (CGCM3) used tends to produce warmer, wetter conditions as compared to other Global Climate Models). Greater uncertainty is associated with projections of future precipitation due to the large variability in precipitation over space and time. Projections indicate a relatively uniform increase in annual average temperature of 2.5 C to 3.5 C by the middle of this century. These are some of the largest projected temperature increases for western North America (Rodenhuis et al. 2007).

Annual average precipitation amounts are expected to increase by 10 to 40 per cent in the Dawson area, while drier conditions are expected to the north and east of Dawson City. More precipitation is expected during the winter months than in the summer. Assessments of historical data show the following trends for the northern boreal mountains (Reid et al. 2010):

- Increasing annual mean temperature (at least 1 C) throughout.
- Strong increases (greater than 2 C) in spring mean temperature.
- Increasing length of frost-free period (approximately 10 days).
- Increasing mean annual precipitation (approximately 15 cm) in southern portions of the site.
- Decreasing ratio of spring snow to precipitation throughout.
- Decreasing annual snow cover duration.

5.8.4 Ecosystem Responses to Climate Change

Notwithstanding that natural ecosystems are dynamic and undergo continuous change, the resilience of many ecosystems may be compromised by the unprecedented combination of climate change, changes to natural disturbance regimes (e.g., fire and insect pests) and other global influences, including pollution, over-use of resources and land-use change (Ogden 2008). A more rapid shift to warmer conditions is likely to result in significant effects on vegetation, habitat and wildlife including:

- Alteration of habitat and vegetation;
- Northward shifts in species habitats;
- Changes to forest composition;
- Invasive species competing with native species;
- Changes in wildlife migration patterns, routes and timing;
- Changes in hibernation periods;
- Changes in snow depth, ice thickness and presence of open water;
- Changing weather patterns;
- Changing water volume and quality;
- Changes in water temperature, impacting invertebrates and fish survival;
- Changes in the rate, frequency and/or intensity of wildfire and floods; and

- Changes to the carbon cycle affecting the balance of atmospheric carbon dioxide levels.

Potential landscape impacts include:

- Increased slumping and mass wasting from melting permafrost and increased slope instability, possibly resulting in catastrophic landslides;
- Increased variability in precipitation and storms;
- Shift in timing of break-up and freeze-up on lakes and rivers;
- Increased precipitation and floods and increased runoff and deposit of sediments and silt in water bodies;
- Altered flow of glacier-fed lakes and rivers; and
- Increased wind and dust.

5.8.5 Potential Land Use Impacts

A changing climate can affect many of the interests and activities in the Dawson planning region. It is therefore important that consideration be given to both challenges and potential opportunities associated with climate change during the planning process. Potential effects of climate change include:

- Damage to infrastructure and increases in construction costs;
- Increase in maintenance costs for access roads;
- Shifts in operational costs for activities;
- Changes in accessibility on the land and rivers;
- Change of areas and timing of resource use (e.g., hunting, trapping and fishing);
- Changes to effectiveness of land use practices;
- Lowered operational costs for thawing of permafrost;
- Changes to seasonal conditions for travel over land or water and travel safety;
- Increasing floods, forest fires, storms and other unpredictable weather patterns; and
- Changes in the abundance or distribution of traditional food or medicinal plant resources, adversely affecting the traditional economy.

5.8.6 Potential Socio-economic impacts

The impact of climate change on access to valued natural resources is likely to result in an indirect change to economic and social values. For example:

- Longer or shorter work seasons may impact the availability of employment;
- Shorter, warmer winters present the possibility of reduced winter heating costs;
- Greater variability in weather has consequences for operational planning;
- Recreation and tourism opportunities might expand under a warmer climate or with greater snowfall, but unpredictable timing for freeze-up/break-up and poor travel conditions may present challenges;
- Thawing of permafrost may reduce stability of historic structures;
- Increased costs are anticipated for maintaining failing infrastructure such as roads, tailings ponds, water/sewer lines and landfills; and
- Reclamation practices that rely on permafrost for stability may become vulnerable.

5.8.7 Adaptation Planning and Research

Understanding of the magnitude of impacts from climate change will require improved monitoring of groundwater, stream flow and water quality. Local strategies are proposed to address the potential impacts of climate change include (Hennessey et al. 2011):

- Emergency response planning;
- Fire management;
- Infrastructure planning (e.g., wells and waste disposal);
- Additional and continued research and monitoring;
- Integrating climate change considerations into planning processes, new construction and other initiatives (e.g., choice of materials and design);
- Diversifying the economy;
- Increased local food production and storage;
- Education and awareness; and
- Risk assessment and management.

5.9 Chapter References

Brabets, T.P., B. Wang and R.H. Meade. 2000. *Environmental and Hydrologic Overview of the Yukon River Basin, Alaska and Canada*. USGS Water-Resources Investigations Report 99-4204.

Colpron, M. and J.L. Nelson. 2011. *A Digital Atlas of Terranes for the Northern Cordillera*. Accessed online from Yukon Geological Survey (www.geology.gov.yk.ca), [March 21, 2012].

Duk-Rodkin, A., R.W. Barendregt, D.G. Froese, F. Weber, R.J. Enkin, I.R. Smith, P. Waters and R. Klassen. 2003. *Timing and Extent of Plio-Pleistocene glaciations in North-Western Canada and East-Central Alaska*. In J. Ehlers and P.L. Gibbard, editors. *Quaternary Glaciations – Extent and Chronology: Part II: North America*. Elsevier B.V., Amsterdam, The Netherlands.

EBA Engineering. 2004. *Permafrost Considerations in Effective Mine Site Development in the Yukon Territory*. Mining Environment Research Group.

Ecological Stratification Working Group (ESWG). 1995. *A National Ecological Framework for Canada*. Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research and Environment Canada, State of Environment Directorate, Ecozone Analysis Branch, Ottawa/Hull. Report and national map at 1:7,500,000 scale.

Environment Canada. 2011. Environment Canada Website, Canadian Climate Normals 1971-2000 Station Data, Dawson A Yukon Territory. Available at: http://climate.weather.gc.ca/climate_normals/results_e.html?stnID=1535&autofwd=1.

Environment Canada. 2013. *National Inventory Report 1990-2011. Greenhouse Gas Sources and Sinks for Canada*. Her Majesty the Queen in Right of Canada, represented by the Minister of the Environment, Ottawa, Canada. Available at: <http://www.ec.gc.ca/Publications/default.asp?lang=En&xml=A07ADAA2-E349-481A-860F-9E2064F34822>.

Flynn, N. and S. Francis. 2011. *The Yukon Ecosystem and Landscape Classification (ELC) Framework: Overview and Concepts*. ELC Working Group.

Froese, D.G., Westgate, J.A., Reyes, A.V., Enkin, R.J., Preece, S.J. 2008. *Ancient Permafrost and a future, warmer Arctic*. Science 321, 1648.

Government of Yukon. 2009. *Climate Change Action Plan*. Department of Environment. Whitehorse, Yukon, Canada. Available at: <http://www.env.gov.yk.ca/air-water-waste/ccactionplan.php>.

- Government of Yukon. 2012a. *Summary of Fish, Wildlife and Habitat Data for the Dawson Regional Land Use Planning Process*. Department of Environment. Whitehorse, Yukon, Canada.
- Government of Yukon. 2012b. *Yukon Fire History 1950-2011*. Yukon Wildland Fire Management Protective Services Branch, Community Services. Whitehorse, Yukon, Canada.
- Grods, J., S.R. Francis, J.C. Meikle and S. Lapointe. 2012. *Regional Ecosystems of West-Central Yukon. Part 1: Ecosystem Descriptions*. Prepared for Government of Yukon, Department of Environment by Makonis Consulting Ltd. and Associates, West Kelowna, British Columbia, Canada.
- Hennessey, R., S. Jones, S. Swales and F. Duerden. 2011. *Dawson Climate Change Adaptation Plan*. Revised Edition. Northern Climate ExChange, Yukon Research Centre, Yukon College, Whitehorse, Yukon, Canada.
- Intergovernmental Panel on Climate Change. 2007. *Climate Change 2007: Synthesis Report*. Valencia, Spain.
- Jorgenson, M.T., C.H. Racine, J.C. Walters and T.E. Osterkamp. 2001. *Permafrost Degradation and Ecological Changes Associated with a Warming Climate in Central Alaska*. *Climatic Change* 48(4): 551-579.
- Klock, R., E. Hudson, D. Aihoshi and J. Mullock. 2001. *The Weather of Yukon, Northwest Territories and Western Nunavut*. NavCanada Graphic Area Forecast #35.
- McKenna, K., T. Braumandl, R. Rosie, R.C. Albricht, K. Stehle, A. DeGroot and P. Dykstra. 2010. *Bioclimate, Ecodistrict and Ecologically Significant Mapping for the Dawson Planning Region, Yukon. Final Report*. Government of Yukon, Department of Environment, Whitehorse, Yukon, Canada.
- McVoy, V.M. and C.R. Burn. 2005. *Potential Alteration by Climate Change of the Forest-Fire Regime in the Boreal Forest of Central Yukon Territory*. *Arctic* 58(3): 276-285.
- Ogden, A. 2008. *Climate Change Adaptation and Sustainable Forest Management in the Boreal Forest*. Doctoral Thesis, University of British Columbia, Vancouver, British Columbia, Canada.
- Reid, D., B. Pelchat and J. Weaver. 2010. *Strategic Conservation Assessment for the Northern Boreal Mountains of Yukon and British Columbia*. Wildlife Conservation Society Canada Conservation Report No. 5. Toronto, Ontario, Canada.
- Rodenhuis, D., K. Bennett, A. Werner, T.Q. Murdock and D. Bronaugh. 2007. *Hydro-climatology and Future Climate Impacts in British Columbia*. Pacific Climate Impacts Consortium, University of Victoria, Victoria, British Columbia, Canada.
- Schuur, E.A.G., J. Bockheim, J.G. Canadell, E. Euskirchen, C.B. Field, S.V. Goryachkin, S. Hagemann, P. Kuhry, P.M. Lafleur, H. Lee, G. Mazhitova, F.E. Nelson, A. Rinke, V.E. Romanovsky, N. Shiklomanov, C. Tarnocai, S. Venevsky, J.G. Vogel and S.A. Zimov. 2008. *Vulnerability of Permafrost Carbon to Climate Change: Implications for the Global Carbon Cycle*. *BioScience* 58:701–714. Available at: http://www.globalcarbonproject.org/global/pdf/pep/Schuur2008_Permafrost_Bioscience2.pdf.
- Smith, C.A.S., J.C. Meikle and C.F. Roots. 2004. *Ecoregions of the Yukon Territory Biophysical Properties of Yukon Landscapes*. Agriculture and Agri-food Canada, Yukon Ecoregions Working Group, Summerland, British Columbia, Canada. PARC Technical Bulletin No. 04-01.
- Statistics Canada. 2008 *Human Activity and the Environment: Annual Statistics*. 2007 and 2008 (Catalogue no. 16-201-X). <http://www.statcan.gc.ca/pub/16-201-x/16-201-x2007000-eng.pdf>

Statistics Canada. 2011. *EnviroStats*. Spring 2011, Vol. 5, No. 1 (Catalogue no. 16-002-X).

Werner, A.T., H.K. Jaswal and T.Q. Murdock. 2009. *Climate Change in Dawson City, YT: Summary of Past Trends and Future Projections*. Pacific Climate Impacts Consortium, University of Victoria, Victoria, British Columbia, Canada.

6 LAND STATUS

This chapter describes the disposition of land within the planning region. The planning region excludes land within the City of Dawson municipal boundary, National Historic Sites and Special Management Areas previously designated under Chapter 10 of the First Nations Final Agreements (FNFAs). The Dawson Regional Land Use Plan includes both Settlement and Non-Settlement Lands throughout the region (YLUPC 2009).

6.1 First Nation Traditional Territory and Settlement Land

The planning region contains portions of the Traditional Territory of three Yukon First Nations: Na-Cho Nyak Dun (NND), Tr'ondëk Hwëch'in (TH) and Vuntut Gwitchin (VGFN). The interests of First Nations within overlapping Traditional Territories are subject to Overlap Agreements between the affected First Nations, under Chapter 2, Section 9 of the FNFAs.

Traditional Territory boundaries evolved over time as economic exchange, harvesting and land stewardship traditions established cultural and familial ties across the landscape. Traditional Territory boundaries identified through comprehensive land claim negotiations are shown in **Section 3 – Resource Summary Maps – Dawson Planning Region**. White River First Nation (WRFN) have more recently asserted traditional territory within the planning region, but the extent of their claim is not known at this time. The planning region is contained entirely within TH Traditional Territory. Settlement Land within the planning region and overlap areas with other First Nations are summarized in Table 6-1. Site-specific Settlement Land parcels within the planning region are listed in Tables 6-2 and 6-3. Yukon Government have provided interim protection for a parcel of interest to WRFN, for purposes of facilitating future Land Claim agreement with WRFN.

Table 6-1 Settlement Land and Traditional Territory within the planning region (Yukon Planning Atlas 2012)

Yukon First Nation	Traditional Territory	Settlement Land					
		Fee Simple		Category A		Category B	
		#	Hectares	#	Hectares	#	Hectares
TH	45,253 (70.7%)	1	0.1	43	988.3	113	735.5
VGFN	7,179 (10.6%)			2	253.8	-	-
NND	8,388 (6.4%)						
WRFN	Unknown	1	0.1				

Table 6-2 List of Tr’ondek Hwëch’in Settlement Lands – Category A

Category A Lands			
LCSELECTN	Area (ha)		
TH R-2A	414.1	TH R-31A	3.8
TH R-3A	154.8	TH R-33A	2.7
TH R-4A	44.7	TH R-43A	2.5
TH R-12A	41.9	TH R-71A	2.4
TH R-48A	41.6	TH R-66A	1.7
TH R-7A	35.2	TH R-32A	1.6
TH R-5A	23.8	TH R-62A	1.5
TH R-11A	22.2	TH R-44A	1.5
TH R-18A	22	TH R-63A	1.4
TH R-9A	19.2	TH R-26A	1.3
TH R-76A	15.4	TH R-42A	1.3
TH R-83A	13.6	TH R-29A	1.3
TH R-82A	13.2	TH R-61A	1.1
TH R-38A	9.3	TH R-50A	1.1
TH R-24A	7.9	TH R-28A	0.8
TH R-23A	6.6	TH R-47A	0.8
TH R-14A	4.8	TH S-79A1	0.6
TH R-27A	4.2	TH R-30A	0.4
TH R-46A	4.2	TH-R-20A	53.9
TH 4.	4.1	VGFN R-8A	253.8
TH R-25A	3.8	VGFN S32A1	0
		TOTAL (Category A)	1242.1

Table 6-3 List of Tr’ondek Hwëch’in Settlement Lands – Category B

Category B Lands			
LCSELECTN	Area (ha)		
TH R-79B	497	TH S-72B1	0.2
TH R-22B	51.5	TH S-166B1	0.2
TH R-80B	42.9	TH S-153B1	0.2
TH R-77B	30	TH S-12B1	0.2
TH R-70B	13.9	TH S-143B1	0.2
TH R-19B	12	TH S-27B1	0.2
TH R-21B	4.9	TH R-67B	0.1
TH R-34B	2.8	TH S-145B1	0.1
TH C-17B	1.7	TH S-155B	0.1
TH R-69B	1.3	TH R-65B	0.1
TH R-41B	1.1	TH S-129B1	0.1
TH R-58B	61.1	TH S-126B1	0.1
TH R-78B	1	TH S-186B1	0.1
TH R-45B	1	TH S-200B1	0.1
TH R-75B	0.8	TH S-64B1	0.1
TH R-74B	0.7	TH S-171B1	0.1
TH R-60B	0.7	TH S-122B1	0.1
TH R-59B	0.7	TH S-15B1	0.1
TH S-113B1	0.6	TH S-57B1	0.1
TH S-88B1	0.6	TH S-28B1	0.1
TH S-13B1	0.6	TH S-134B1	0.1
TH S-80B1	0.5	TH S-137B1	0.1
TH S-18B1	0.5	TH S-136B1	0.1
TH S-112B1	0.4	TH S-123B1	0.1
TH S-14B1	0.4	TH S-138B1	0.1
TH C-07B	0.4	TH S-17B1	0.1
TH S-99B	0.3	TH S-213B	0.1
TH S-90B1	0.3	TH S-214B1	0.1
TH S-47B1	0.3	TH S-174B	0.1
TH S-204B1	0.3	TH S-97B1	0.1
TH S-106B1	0.2	TH S-142B1	0.1
TH S-82B1	0.2	TH S-173B1	0.1
TH S-41B	0.2	TH S-42B1	0.1
TH S-144B1	0.2	TH S-77B1	0.1
		TH S-165B	0.1
		TH S-203B	0.1
		TH S-29B1	0.1
		TH S-50B1	<0.1
		TH S-210B1	<0.1
		TH S-49B1	<0.1
		TH S-135B1	<0.1
		TH S-71B1	<0.1
		TH S-172B1	<0.1
		TH S-81B1	<0.1
		TH S-10B1	<0.1
		TH S-176B1	<0.1
		TH S-19B1/D	<0.1
		TH S-175B	<0.1
		TH S-108B1	<0.1
		TH S-208B1/D	<0.1
		TH S-66B1	<0.1
		TH S-73B1	<0.1
		TH S-26B1/D	<0.1
		TH S-6B1	<0.1
		TH S-205B1	<0.1
		TH S-169B1	<0.1
		TH S-107B1	<0.1
		TH S-184B1	<0.1
		TH S-133B1	<0.1
		TH S-75B1	<0.1
		TH S-168B1	<0.1
		TH S-2B1	<0.1
		TH S-109B1	<0.1
		TH S-25B1	<0.1
		TH S-207B1/D	<0.1
		TH S-159B1	<0.1
		TH S-206B1	<0.1
		TH S-24B1	<0.1
		TH S-93B	<0.1
		TOTAL (Category B)	735.5

6.2 Protected Areas

Lands within the planning region currently designated for protection include National Historic Sites, Yukon Historic Sites, and Special Management Areas designated under Chapter 10 of First Nation Final Agreements, namely Tombstone Territorial Park. Conservation designations also occur in the Fishing Branch area immediately north of the Dawson planning region, as well to the west in Yukon-Charley Rivers National Preserve in Alaska.

6.2.1 Internationally Designated Lands

International designation for the “The Klondike Gold Rush International Historical Park” includes National Historic Sites in and outside of the City of Dawson, including Discovery Claim and Dredge No. 4.

6.2.1.1 Klondike Gold Rush International Historic Park (Parks Canada 2012)

- **Location:** Sites in Washington, Alaska, British Columbia and Yukon related to the gold rush trail; Seattle, Skagway, Chilkoot Trail, Thirty Mile, Yukon River Dawson, Discovery Claim and Dredge No. 4
- **Designation Date:** 1998
- **Statute:** Joint declaration between governments of the United States and Canada, commemorating the 100th anniversary of the gold rush

The Klondike Gold Rush was the last of the great gold rushes that marked the last half of the 19th century. Beginning with the California Rush of 1849, successive gold strikes in the Western Cordillera of North America moved ever further northward – the P'end Orielle and Fraser River Rushes in the 1850s, the Cariboo Rush of 1862-63, Cassiar and Juneau in the mid 1870s and the smaller Rushes in the Yukon River Basin at Forty Mile and Circle which set the stage for the great Klondike Gold Rush of 1896-98.

The Klondike Gold Rush transformed the face of the north, creating a new Canadian Territory and turning the American purchase of Alaska from folly to fortune. Where there had been only a couple of riverboats supplying the entire region, there were now fleets of riverboats working both upriver and down from Dawson City. As would-be Klondike prospectors fanned out through the region making new gold finds – Nome on the Alaskan coast, Atlin in northern British Columbia – an unknown backwater became the new land of opportunity.

In 1998 on the 100th anniversary of the great rush, the Canadian and American governments signed a joint declaration creating the Klondike Gold Rush International Historical Park to commemorate this shared chapter in the history of the north. Collectively the individual sites that make up the international park tell the story of what was the last great gold rush:

- Klondike Gold Rush National Historical Park, Seattle Unit
- Klondike Gold Rush National Historical Park, Alaska
- Chilkoot Trail National Historic Site of Canada
- “The Thirty Mile” Yukon River, Canadian Heritage Rivers System
- Klondike National Historic Sites of Canada: Dawson Historical Complex National Historic Site, S.S. Keno National Historic Site, Former Territorial Courthouse National Historic Site, Dredge No.4 National Historic Site, and Discovery Claim National Historic Site

6.2.2 Nationally Designated Lands

Numerous nationally significant historic sites are located within the municipality, including Dawson Historical Complex and Tr'ochëk National Historic Site. Two national historic sites are designated outside of Dawson City, within the planning region.

6.2.2.1 Discovery Claim National Historic Site (Canadian Register of Historic Places 2007)

- **Location:** A combination of titled lot and active claim: Claim No. 37903, Bonanza Creek and Lot 587, Gr 1052, CLSR YT 58479); Area: 468,419 m²
- **Designation Date:** July 15, 1998
- **Statute:** Historic Sites and Monuments Act(RSC 1985, c H-4)

Discovery Claim National Historic Site of Canada is the place where the Klondike Gold Rush began. It is a legally defined mining claim measuring some 152.4 by 609.6 m (500 by 2,000 feet) located on Bonanza Creek, a tributary of the Klondike River near the City of Dawson, Yukon (Figures 6-1 and 6-2).

Discovery Claim is significant as the site where gold was discovered on the afternoon of August 16, 1896 – the event that triggered the Klondike Gold Rush. Economically and administratively, the site marks the beginning of the development of the Yukon. For the Aboriginal people, this piece of land is an affirmation of their cultural values and world view; from a western perspective, the site affirms the 19th-century belief that through hard work and perseverance one could rise from poverty to riches.

The heritage value of Discovery Claim lies in its historical associations with the Klondike Gold Rush as represented by the place where Keich (“Skookum” Jim Mason), of the Tagish First Nation, discovered gold and where George Carmack, an American married to Keich's sister, staked the mining claim that led to the Klondike Gold Rush. The site has been actively mined through the 20th century.

The claim is owned by the Klondyke Centennial Society and was developed in cooperation with the Government of Yukon and Parks Canada as an attraction, with a one-kilometre long walking trail, interpretive signs and mining exhibits.



Figure 6-1 Historic tailing piles at Discovery Claim National Historic Site (Photo: Government of Yukon)



Figure 6-2 Trailhead at Discovery Claim National Historic Site (Photo: Government of Yukon)

6.2.2.2 Dredge No. 4 National Historic Site (Canadian Register of Historic Places 2006)

- **Location:** Lot 586, Group 1052, Bonanza Creek, Lot 1009 Quad 1150/14 CLSR YT 70712
- **Designation Date:** September 22, 1997
- **Statute:** Historic Sites and Monuments Act(RSC 1985, c H-4)

Dredge No. 4 is a preserved bucketline sluice dredge used to mine placer gold (Figures 6-3 and 6-4). It is located at its last place of operation on Bonanza Creek in the Klondike goldfields just outside of Dawson City, Yukon. Dredge No. 4 is symbolic of the importance of dredging operations in the Yukon (1899-1966), and aspects of the evolution of gold mining in the Klondike from early labour-intensive to later corporate industrial phases of gold extraction. Dredge No. 4 was constructed in 1912-13 by the Canadian Klondike Mining Co. to mine the gravels of the Klondike River Valley. From September 1941 to the fall of 1958 it mined Bonanza Creek and sank in 1959. During the summers of 1991 and 1992, the dredge was excavated, refloated and relocated to higher ground.

The heritage value of Dredge No. 4 lies in its association with Klondike gold mining and in its illustration of the process of bucketline sluice dredging used by corporations to mine placer gold in the Klondike Gold Fields in the 1899-1966 period. It is linked to other regional corporate infrastructure such as Bear Creek camp, power plants, business office, dredge camps, transportation network, power and telephone lines, and water management. These combine to tell the story of the development of the Yukon Territory as a major mining region of Canada over the last century. Managed by Parks Canada, Dredge No. 4 has undergone a major stabilization program, which is ongoing. It is one of Yukon's premier heritage tourism attractions.



Figure 6-3 Dredge No. 4 interior tour
(Photo: Government of Yukon)



Figure 6-4 Dredge No. 4 fall 2012 (Photo: Government of Yukon)

6.2.3 Territorially Designated Lands

6.2.3.1 Tombstone Territorial Park

- **Location and Size:** North Ogilvie and Mackenzie mountains ecoregion – 22,050 km², or 4.5 per cent of the planning region
- **Designation Date:** Management Plan Approved June 25, 2009
- **Statute:** Parks Act, RSY 1986, Ch 126 (Now Parks and Lands Certainty Act 2002)

Tombstone Territorial Park (Figure 6-5) is established pursuant to Schedule A of Chapter 10 of the Tr'ondëk Hwëch'in (TH) Final Agreement (FA). The park is managed under the Tombstone Territorial Park Management Plan in accordance with the FA, the Parks and Lands Certainty Act, the Wildlife Act and the Historic Resources Act.

Within the park, the FA imposes a prohibition on locating, prospecting or mining new claims under the Quartz Mining Act and Placer Mining Act, and on the issuance of new interests under the Territorial Lands (Yukon) Act and the Oil and Gas Act.

The Tombstone Territorial Park supports exceptional caribou, grizzly and black bear, moose, and sheep populations. These species have been sustainably harvested by subsistence, resident and non-resident hunters for thousands of years. Today, only TH have the right to harvest fish and wildlife within the park, provided park objectives are met.

Important, intact historical places within the park are related to the Yukon Ditch System that carried water from the Tombstone Mountains to Bonanza Creek, with numerous maintenance camps.

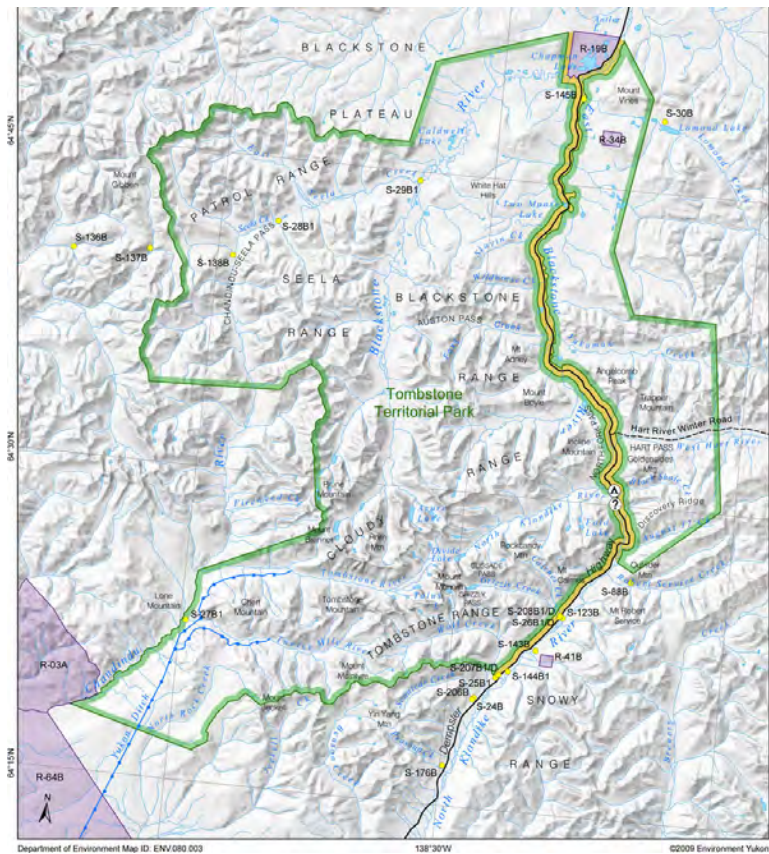


Figure 6-5 Tombstone Territorial Park (Government of Yukon 2009)

The Tombstone Corridor is excluded from the Tombstone Territorial Park to provide for continued highway maintenance activities, a possible future pipeline, transmission line or other public visitor infrastructure that may be required along the Dempster Highway.

The area that now contains Tombstone Territorial Park also has special significance for First Nations people. This land sustained many generations of people, and signs of the ancestors can be found in the Hän and Gwich'in place names, ancient archaeological sites and in Elders' stories. As early as 1972, the United Nations Educational, Scientific and Cultural Organization (UNESCO) recognized the diverse ecology and unique geology of this area. Twenty years later, the Tr'ondëk Hwëch'in requested protection for this part of their traditional territory. With strong public support, the Park's boundaries were finalized in December 1999 and it was officially created on October 25, 2004 after many years of study, planning and negotiation. TH citizens preserve their connection to this land by protecting their ability to participate in activities such as berry picking, hunting, fishing and trapping.

They come here to teach the children how to hunt and be responsible stewards, and work with the Government of Yukon and others to ensure the land continues to provide (Tr'ondëk Hwëch'in 2013).

In developing a land use plan, the Commission is required to consider the park management plan (THFA, Chapter 10, Clause 13.2).

6.2.3.2 Forty Mile, Fort Cudahy and Fort Constantine Historic Site (Ch'ëdä Dëk)

- **Location:** Confluence of the Yukon and Fortymile rivers
- **Designation Date:** In progress
- **Statute:** *Historic Resources Act*, RSY 2002, Ch 109; Tr'ondëk Hwëch'in Final Agreement, Chapter 13, Schedule A, Section 2.3

The Forty Mile, Fort Cudahy and Fort Constantine Historic Site, or simply Forty Mile, is situated on islands and riverbank terraces comprising approximately 50 ha at the mouth of the Fortymile River where it enters the Yukon River, near the Alaska border (Figure 6-6). The site includes a significant material record of late prehistoric Hän use and occupation, overlain by archaeological evidence and collapsed and standing structures from the historic period dating as far back as 1886. Included is evidence of two American trading posts, Yukon's first North-West Mounted Police post, an Anglican mission and church, and a dynamic, mixed community predating the Klondike gold rush.

The Tr'ondëk Hwëch'in Final Agreement requires that Forty Mile be designated as a Yukon Historic Site because of its cultural significance to Tr'ondëk Hwëch'in and to all people of Yukon.

The heritage value of Forty Mile is three fold. From antiquity to contact times, the Hän utilized the site as a caribou interception point and a spring grayling fish camp. The site was also the location where the Hän culture was first exposed to, and changed by, the full spectrum of European influences. Finally, it was the first substantive non-aboriginal settlement in Yukon, associated with a shift in commercial interests from furs to gold, as well as the establishment of the visible authority of the Canadian government. Canadian sovereignty in Yukon enabled regulatory control over the Klondike Gold Rush and paved the way for the creation of Yukon as a distinct territory of Canada.



Figure 6-6 Fortymile and Yukon rivers

6.3 Adjacent Designated Lands

6.3.1 Ni'iinlii'njik (Fishing Branch) Territorial Park

- **Location:** North Yukon
- **Designation Date:** April 2000
- **Statute:** Parks Act, RSY 1986, Ch 126 (Now Parks and Lands Certainty Act 2002)

The Vuntut Gwitchin First Nation (VGFN), the Government of Canada and the Government of Yukon agreed to establish the Fishing Branch Ecological Reserve pursuant to the Parks Act as set out in the VGFN Final Agreement (Chapter 10, Schedule B).

Fishing Branch is comprised of VGFN Settlement Land R-05A, a wilderness preserve, an ecological reserve and a habitat protection area.

The Fishing Branch area is exceptional primarily because of the seasonal congregation of grizzly bears to feed on fall chum salmon. The chum salmon depend on constant water temperatures of the Fishing Branch River, which wells up through the eroded limestone karst substrate. The characteristics that make it important for grizzly bears also make it rich in diversity of other species, as well as historical record and mythic significance for the VGFN.

6.3.2 Yukon-Charley Rivers National Preserve

Location and Size: Alaska; 2,527,000 acres (10, 226 km²)

Designation Date: December 1980

Statute: *Alaska National Interest Lands Conservation Act*

The Yukon-Charley Rivers National Preserve lies immediately west of the Dawson planning region, within Alaska. The preserve provides protection for the entire one million acre (4,046 km²) watershed of the Charley River and a 115-mile (185-km) stretch of the Yukon River. Portions of the preserve are private property under the Alaska Native Claims Settlement Act. Preserve headquarters are located in Eagle, Alaska.

6.4 Other Interests

Third-party interests in the planning region include fee-simple title, leasehold interest, exclusive resource use concession and land use permit. Other map notations include sites of significant historic, ecological or civil importance. Outside municipal boundaries, most titled third-party interests are rural residential parcels. Disposition of Crown land (by the Government of Yukon under Agreement for Sale, Lease, Easement or Reservation) is shown in Table 6-4. Additional land reservations for heritage sites are listed in Table 6-5. Disposition of land for quartz claims, placer claims and prospecting leases is shown in Table 6-6.

Table 6-4 Number and Area of Land Disposition by Purpose (Yukon Spatial Warehouse 2012)

	Agreement for Sale		Easement		Lease		Other		Reservation		Total	
	#	Area (ha)	#	Area (ha)	#	Area (ha)	#	Area (ha)	#	Area (ha)	#	Area (ha)
Agricultural									1	974.29	1	974.29
Airport									1	164.6	1	164.6
Bridgehead									7	73.38	7	73.38
Commercial	2	4.62			8	6.79			2	1.01	12	12.42
Country Residential									1	149.65	1	149.65
Environment									23	15.57	23	15.57
Forestry									2	21.17	2	21.17
Garbage Dump									2	22.92	2	22.92
Gravel Pit									40	1,174.55	40	1,174.55
Heritage									19	233.83	19	233.83
Industrial									3	29.01	3	29.01
Institutional									17	8.02	17	8.02
Marine					1	0.46					1	0.46
Miscellaneous					2	0.72			7	224.76	9	225.48
Parks & Campground									1	6.83	1	6.83
Public Use					1	1.78					1	1.78
Quarry					3	15.17					3	15.17
Quartz Mining Claim (Clinton Creek Mine)									1	1,324.11	1	1,324.11
Recreational					1	18.18			1	0.1	2	18.28
Residential	4	8.38			1	1.15	1	0.07	8	267.59	14	277.19
Residential - Commercial	3	1.76									3	1.76
Roadway									3	1.82	3	1.82
Rural Residential	9	23.15							1	13.63	10	36.78
Trapping					24	9.67					24	9.67
Utility			4	0.26	1	3.35			4	65.77	9	69.38
Wildlife Reserve									1	0.56	1	0.56
Grand Total	18	37.91	4	0.26	42	57.27	1	0.07	144	4,773.17	210	4,868.68

Table 6-5 Dawson Area Heritage Reservations

Name	Location	Area (ha)	Disposition	Map	Historic Function
North Fork Gatehouse and Spillway	North Fork Ditch	24.7	116B02-016	116B/02	Diversion of water from the North Fork ditch into the North Fork Power Plant
Ogilvie Island	Sixty Mile and Yukon Rivers	10.2	115O12-005	115O/12	North West Mounted Police post, sawmill and trading post
Dinner Gulch	Yukon Ditch and the Little Twelve Mile River	2	116B07-002	116B/07	Maintenance camp for the Yukon Ditch
Trail Gulch Diversion	Ridge Road and Yukon Ditch	4.22	2009-0480	116B/03	Pressure box and gate for the Yukon Ditch
Eight Mile Roadhouse	Ridge Road Lot 33	4.05	116B03-144	116B/03	Roadhouse and barn
Murray's Roadhouse	Ridge Road Lot 27	4.03	950026	115O/14	Barn and roadhouse
Eleven Mile Roadhouse	Ridge Road Lot 28	4.05	950026	115O/14	Roadhouse and barn: now a Campground on the Heritage Trail
Fifteen Mile Roadhouse	Ridge Road Lot 29	4.02	950026	115O/14	Roadhouse, outbuildings and barn
Halfway Roadhouse	Ridge Road Lot 30	8.02	950026	115O/14	Roadhouse and barn: now a Campground on the Heritage Trail
Seventeen Mile Roadhouse	Ridge Road Lot 31	4.05	115O14-011	115O/14	Roadhouse and barn
Lot 32	Ridge Road Lot 32	3	115O14-012	115O/14	Junction of the Ridge Road and the road to Gold Bottom Creek
Dome Yukon	Gov't Trunk Road Lot 45	2.02	115O15-024	115O/15	Excavation for Klondike Mines Railway wye, station, sheds, roadhouse, barn
Cooks Roadhouse	Gov't Trunk Road Lot 46	4.02	115O15-022	115O/15	Roadhouse and barn
Sulphur Springs Roadhouse	Sulphur Creek Road Lot 47	4.04	115O15-023	115O/15	Roadhouse and barn
Flag Roadhouse	Ridge Road Lot 48	4.05	115O14-009	115O/15	Barn and roadhouse
Heritage Roadway	Ridge Road and Road to Grand Forks	32.0	115O14-010	115O/14 116B/03 115O/12	The length of the Ridge Road Heritage Trail and the spur road from Eleven Mile Roadhouse to Grand Forks

Table 6-6 Placer, Quartz and Prospecting Interests (Yukon Spatial Warehouse 2012)

Placer Operations		
Location	Number of Operations	
Bonanza-Hunker	51	
South Klondike	13	
Sixtymile	16	
Klondike	8	
Dominion-Sulphur	31	
South McQuesten	3	
Fortymile	3	
Indian	8	
Moosehorn	3	
Matson	2	
Total	138	
Placer Claims		
Status	#	Area (km²)
Active	13,991	1075.7
Pending	149	12.6
Placer Mining Land Use Permits		
Status	#	Area (km²)
Valid	218	836.8
Pending	13	87.8
Quartz Claim		
Status	#	Area (km²)
Active	48,833	9,762.4
Pending	12,418	2,475.0
Quartz Mining Land Use Permits		
Status	#	Area (km²)
Valid	40	4589.6
Pending	4	462.6
Expired with Completion	1	127.1
Prospecting Leases		
Status	#	Area (km²)
Active	97	178.5
Pending	24	28.6

6.5 Existing Land Use Footprint

Existing areal disturbances and access features were identified, classified and mapped using 1:12,500 imagery (Government of Yukon 2010) (see **Section 3 – Resource Summary Maps – Infrastructure, Access and Land Status**). Roads identified in the National Road Network are also mapped and included in the following disturbance summary tables.

6.5.1 Surface Disturbance

Five types of surface disturbance are identified in Table 6-7.

Table 6-7 Surface disturbances in the planning region

Disturbance Type	Area (Ha)
Placer mining	12,060
Quartz mining	792
Gravel Pit/Pull-out	264
Developed Area	833
Uncertain	1,205
TOTAL	15,154

6.5.2 Linear Features

Linear features, classified according to feature width, are shown in Table 6-8.

Table 6-8 Existing linear features, by width class

Width Class	Feature Width	Total Length (km)
Low	2 m	950.80
Med	6 m	4,136.89
High	10 m	1,280.38
Local Street	15 m	365.13
Highway	20 m	339.11
	TOTAL	7,072.31

Most footprints related to human-caused disturbance are located within the immediate vicinity of Dawson City. Outside of Dawson, non-mining disturbances are associated with small farms, residential properties, roads, trails, power lines and gravel pits. Non-mining related disturbances account for 23 km², or approximately 15 per cent of disturbed area within the planning region. Non-mining related disturbance directly affects 0.05 per cent of the planning region.

85 per cent of surface disturbance related to placer operations and hard rock mines is estimated to be approximately 128.52 km² (0.28 per cent of the planning region). Sites in more advanced stages of reclamation, including older tailings, may be otherwise classified as shrub or deciduous phases of floodplain or gentle-slope types.

6.5.3 Disturbance Indicators

Anthropogenic (human-caused) disturbance may be evaluated at a landscape scale using ecodistrict or watersheds as a sub-regional unit of summary. In this fashion, areas within the planning region experiencing relatively higher levels of landscape disturbance may be readily identified.

Disturbance levels range from zero in northern ecodistricts, where there is virtually no footprint, to 1.7 per cent in the mining area around King Solomon's Dome (Table 6-9).

The Indian River drainage has the highest proportion of surface disturbance, roughly four times the level within Sixtymile and Fortymile drainages, and more than twice the level of disturbance in the Klondike drainage (Table 6-10).

Disturbances are found mainly on the predominant gentle slope and plain ecosystem types within the Boreal High bioclimate zone, mostly in shrub and coniferous forest. Wetland herb ecosystem units are disproportionately impacted by development; less than 0.1 per cent of the planning region is of this class, while about a one per cent footprint is found on wetland herb ecosystem units.

Table 6-9 Anthropogenic disturbances by ecodistrict

ECOZONE Ecoregion Ecodistrict	Area of Ecodistrict (km ²)	Area within Region (km ²)	Disturbance		
			Areal Disturbance (km ²)	% of Regional Unit	Linear Disturbance (km)
TAIGA CORDILLERA					
Eagle Plains	18,626	1,773	0.17	0.01	18.1
ID6	18,626	1,773	0.17	0.01	18.1
Mackenzie Mountains	14,895	7,094	1.50	0.02	96.8
South Ogilvie Taiga	14,895	7,094	1.50	0.02	96.8
North Ogilvie Mountains	28,285	10,152	0.54	0.01	27.4
Keele Range	12,350	1,998	0	0.00	0
Tatonduk Mtn	8,425	5,521	0	0.00	0
Blackstone River Uplands	7,510	2,633	0.54	0.02	27.4
BOREAL CORDILLERA					
Yukon Plateau - North	17,580	4,616	14.81	0.32	932.6
ID19	13,540	3,795	12.50	0.33	778.0
Tintina North	4,040	821	2.31	0.28	154.6
Yukon Plateau - Central	5,596	582	0.26	0.04	10.8
Flat Top Mtn.	5,596	582	0.26	0.04	10.8
Klondike Plateau	36,025	21,086	185.55	0.55	5991.4
Dawson Range	12,065	2,428	0.11	0.00	10.9
King Solomon's Dome	11,005	8,740	147.29	1.69	3,783.4
Top of the World	10,767	9,860	38.15	0.39	2,189.4
Scottie Creek (74)	2,188	58	0	0.00	7.7
TOTAL	121,037	45,305	202.81	0.45%	7,077.7

Table 6-10 Anthropogenic Disturbance by Watershed

Watershed Name	Area of Watershed in Region (km ²)	Total All Surface Disturbances (km ²)	Surface Disturbance (% of Watershed)	Total Linear Features (km)	Linear Feature Density (km/km ²)
Headwaters Porcupine	5,687.30	0.05	0.00	4.54	0.00
Lower Porcupine	352.02	0.00	0.00	0.00	0.00
Blackstone	1,374.42	0.83	0.06	49.82	0.04
Tatonduk River	7,831.95	0.11	0.00	37.14	0.00
Chandindu River	3,266.94	2.30	0.07	245.22	0.08
Klondike River	6,857.04	60.44	0.88	2,208.32	0.32
Indian River	3,457.72	77.06	2.23	1,664.94	0.48
Sixtymile River	5,887.56	32.04	0.54	1,519.58	0.26
Fortymile	1,187.18	6.41	0.54	332.13	0.28
Mt Stewart	11.17	0.01	0.13	2.49	0.22
Stewart River	2,809.47	13.61	0.48	377.94	0.13
Tanana	370.08	1.05	0.28	63.21	0.17
Lower White	4,477.23	3.64	0.08	461.24	0.10
Upper Yukon - White	1,731.92	5.39	0.31	109.89	0.06
TOTAL	45,302.00	202.96	0.45%	7,076.46	0.16%

6.6 Cumulative Effects

Existing levels of linear and surface disturbance are highest in the Goldfields, especially in the vicinity of gold-bearing creeks. Surface disturbance within Forest Management Units (FMU) in the Goldfields have levels of surface disturbance approaching four per cent. In contrast, the FMU in which hard rock mining is occurring around Brewery Creek has a relatively small footprint, less than 0.2 per cent.

The potential for cumulative effects of access would best be addressed at a regional level, rather than on a project basis. Private companies, with little or no coordination of activity, conduct exploration programs independently. Existing roads, trail or airstrips may be shared, but minimal planning is done prior to construction of new access.

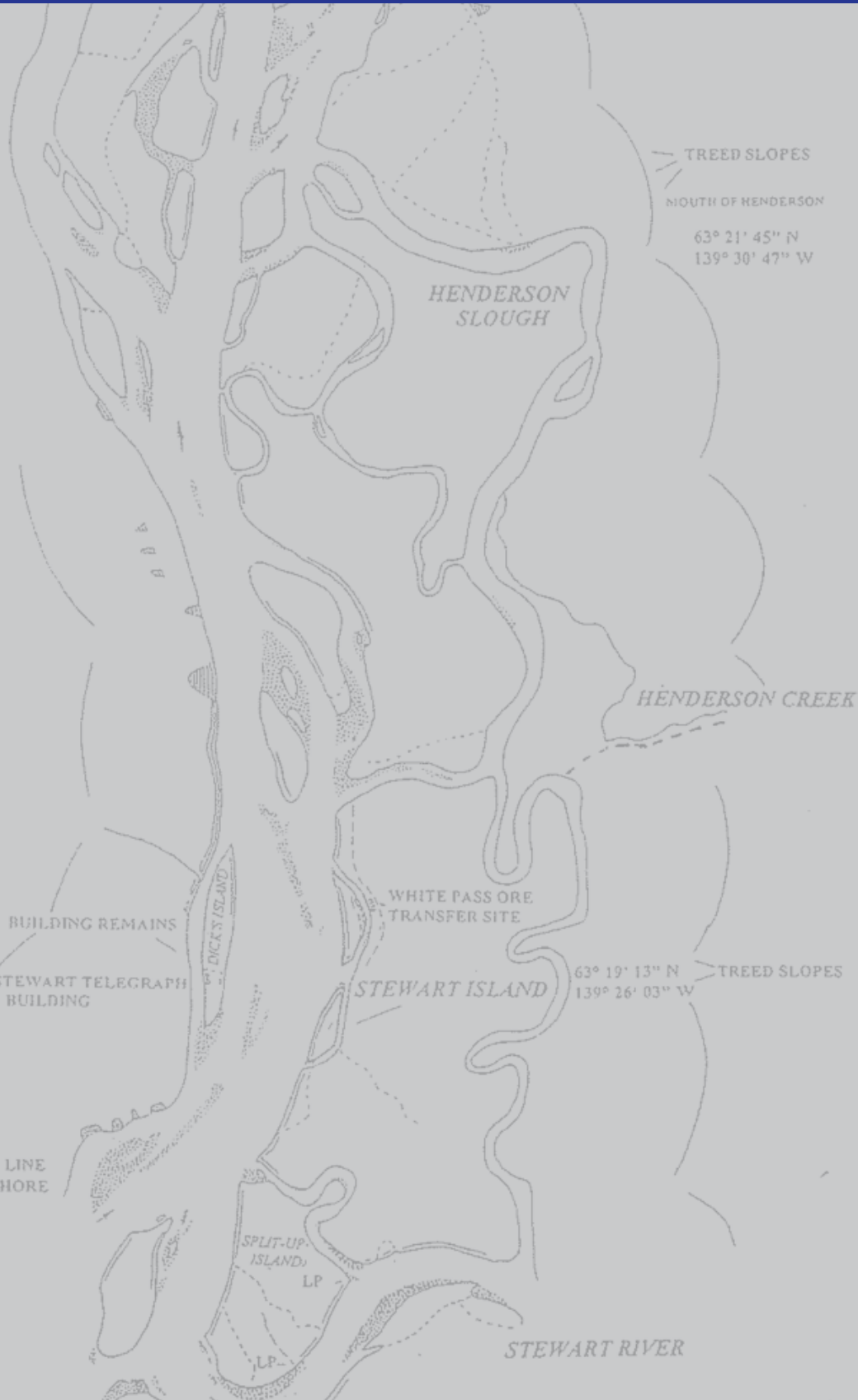
A stated goal for the Yukon Resource Access Roads Framework is to minimize negative environmental and cumulative impacts from mining and oil and gas access roads. The Framework looks to manage and minimize the public and ecological liability associated with unmaintained roads left behind by exploration and mining interests. The Framework is primarily implemented through extensive reviews of industry proposals by government departments prior to final decisions on major infrastructure development; no infrastructure corridor planning is associated with this Framework.

6.7 Chapter References

- Canadian Register of Historic Places. 2006. Dredge No. 4 National Historic Site Statement of Significance, Canadian Register of Historic Places; <http://www.historicplaces.ca/en/rep-reg/place-lieu.aspx?id=6280&pid=0> (accessed January 10, 2013)
- Canadian Register of Historic Places. 2007. Discovery Claim National Historic Site Statement of Significance, Canadian Register of Historic Places <http://www.historicplaces.ca/en/rep-reg/place-lieu.aspx?id=6310&pid=16548&h=Discovery,Claim> (accessed January 10, 2013)
- Government of Yukon. 2009. *Tombstone Territorial Park Management Plan*. Department of Environment. Whitehorse, Yukon, Canada.
- Government of Yukon. 2010. *Mapping of surface disturbance and linear features in the Dawson Land Use Planning Region*. Department of Environment. Mammoth Mapping, Dawson City Yukon January 2010.
- Parks Canada. 2012. <http://www.pc.gc.ca/lhn-nhs/yt/chilkoot/natcul/natcul4.aspx> (accessed Jan.10, 2013)
- Yukon Land Use Planning Council (YLUPC). 2009. *Terms of Reference for the Dawson Regional Planning Commission*. Yukon Land Use Planning Council Recommendation #08-001. Whitehorse, Yukon, Canada.
- Yukon Corporate Spatial Warehouse. 2013. <http://www.geomaticsyukon.ca/news/corporate-spatial-warehouse>
- Yukon Planning Atlas. 2012. <http://199.247.233.101:8080/atlas.php>.

Section 2

Regional Resource and Land Use Descriptions



7 RESOURCE VALUE

7.1 Sustainable Development

The Final Agreements set out the following definition for Sustainable Development (NND – DIAND 1993, VGFN – DIAND 1993, TH – DIAND 1998):

"Sustainable Development" means beneficial socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent.

Objectives of the Final Agreements for Land Use Planning include the following:

11.1.1 The objectives of this chapter are as follows:

11.1.1.3 to recognize and promote the cultural values of Yukon Indian People;

11.1.1.6 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.

The obligation to specifically consider First Nation traditional values and Sustainable Development is expressed in Chapter 11:

11.4.5 In developing a regional land use plan, a Regional Land Use Planning Commission:

11.4.5.7 shall 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;

11.4.5.9 shall promote Sustainable Development

The Commission must ultimately express a Draft Land Use Plan that represents an acceptable trade-off (i.e., equitable balance) of resource development, traditional cultural activity and ecosystem services having consideration for conflicting and competing interests, both intra- and inter-generational. These concurrent goals lie at the heart of most contemporary planning challenges. Indeed, Sustainable Development is not the endpoint for a land use plan, but rather a measure of its ongoing utility (Campbell 1996).

The total value of natural resources, ecosystem services and economic activity may include both direct and indirect use as well as non-use value. Direct values (or benefits) accrue from the use of natural resources as materials, energy or space to conduct human activities; indirect benefits are those derived from non-consumptive use of resources, like wildlife viewing or landscape appreciation. Non-use values include the benefit to current or future generations and/or the opportunity for new knowledge that may result from deferral of resource use that would otherwise result in irreversible environmental damage. Finally, some resources are valued simply because they are known to exist, such as rare plant species or unique ecosystems that may appear to have no value to humans.

Determination of resource value is necessarily subjective. The relative importance of different resources or prevalence of one perspective over another, or the equitable distribution of cost and benefit from resource use is a function of the emotional and political forces in society. Few would disagree that natural systems have intrinsic value, but this does not provide much insight on how to identify, describe and measure values for biodiversity and biological function. Some resources have very low economic value but high utility value. For example, water has a very low market price but very high use value. In contrast, diamonds have a very high market price but relatively low use value.

Spiritual values are especially difficult to quantify, such as the value of viewing wildlife in its natural state (Secretariat of the Convention on Biological Diversity 2007).

Trade-offs are often improperly characterized as being between “jobs” and the “environment,” rather than being viewed as an effort to achieve economic growth, fairly distribute the benefits, and maintain ecosystem integrity. What kind of jobs, who gets them, and who bears the costs (social, economic and environmental) are important considerations in the promotion of traditional cultural value and achieving Sustainable Development.

Each of the resources discussed in the following chapters are described in terms of their contribution to and/or impact on natural, traditional, socio-cultural and economic values, such that a more holistic view might be taken of how the Commission should consider balancing these aspects of Sustainable Development.

7.2 Natural Value

Natural value may be described in terms of the value of ecological functions provided, as well as in terms of the natural capital contained in forest, land, water and wildlife resources. The Canadian Boreal Initiative (CBI) provides a description for ecosystem services using a framework specific to the boreal region (CBI 2009):

- Habitat
- Atmospheric stabilization (oxygen, carbon dioxide and ozone balance)
- Climate stabilization (greenhouse gas absorption, cloud formation)
- Disturbance avoidance (storm protection, flood control)
- Water stabilization and water supply (water storage, water filtering)
- Erosion control and sediment retention (prevention of soil loss, storage of silt, drainage)
- Soil formation and nutrient cycling (weathering of rock, accumulation of organic material)
- Waste treatment
- Pollination (genetic diversity)
- Biological control (e.g., pest control by birds)

While no attempt is made in this Resource Assessment Report to assign monetary value to ecosystem services in the Dawson planning region, CBI’s systematic approach results in calculation of the dollar value of natural resources, ecological systems and processes (e.g., purifying water, regulating climate and producing oxygen) with a value termed the Ecological Services Product. This value can be compared to the Gross Domestic Product (GDP), which quantifies economic production of natural resource development (e.g., timber, minerals, hydro-electricity and oil and gas) but excludes the value of natural capital and ecosystem services. While it is possible to maintain a positive GDP while unsustainably depleting resources, consideration of the environmental costs (e.g., restoration of groundwater aquifers) would provide a more complete accounting of the costs for resource development. The CBI analysis of ecosystem services provided by boreal forests found them to be an order of magnitude (i.e., more than ten times) greater than the value of minerals and timber found within them.

7.3 Traditional Value

The land out there is our grocery store, our medicine store and clothing store, we need to look after it and protect it for our grandchildren. – Tr’ondëk Hwëch’in Elder

The Tr'ondëk Hwëch'in worldview considers people, the land and all resources to be interdependent components; parts of a system that cannot be managed separately, or by protecting site-specific resources; a cultural landscape that provided the basis for a traditional economic system. The cultural landscape extends to the fullest reach of traditional First Nation use and includes everything and everywhere (Tr'ondëk Hwëch'in 2012). As described by Sharp (2004) as cited in Tr'ondëk Hwëch'in (2012):

The use of the land is tied to knowledge of the land...people do come to know some areas of the land intensely, often in a detail staggering to those raised in more densely settled areas, but that is not the issue. Knowing a territory is not remembering where every rock is placed or where every species of plant grows; it is having a sound understanding of the nature of animate beings within the land and how those beings relate to each other and to particular kinds of local environments. [People] could not have survived through a detailed knowledge of place within a dynamic and constantly changing environment but have survived through a detailed understanding of how animate life relates to other forms of animate life and interacts with climate and environment. Knowing a territory is not memorizing where things are but understanding how things relate to each other.

Documented heritage resources within the planning region are dominated by archaeological or evidence-based anthropological research. Material remains are an important reminder of cultural values but places, areas, stories, traditional use and historic resource management practices together form a larger, cultural landscape: broad geographic areas reflecting patterns of human activity that have evolved over a long period of time, or where spiritual or aesthetic values are associated with the landscape.

The Yukon River is the central element of the Tr'ondëk Hwëch'in cultural landscape. Athapaskan stories include narratives about Tachokaii, the mythic river traveller who travelled from the origins of the river to its mouth and transformed the world from chaos to order. At the end of his trip he arrives at the ocean and vanishes, leaving responsibility for the world to humans (Neufeld 2011).

While stories are immaterial, these are often grounded in the physical landscape, linking events in stories with places on the land. For example, stories were told in the fall, during the move downriver from fishing camp to winter hunting. Some of those stories associated Tachokaii's experience to a particular place at a specific time of year, providing relevant seasonal subsistence knowledge and linking together places to form a cultural landscape.

Ancient landscapes, resource use and hunting patterns must be considered when (re)constructing historic and current land use patterns. Areas of higher traditional value and with higher potential for heritage resources may include:

- Vantage points on terraces and ridges;
- Proximity to water;
- Camping spots on level, elevated, well-drained ground such as knolls and benches;
- Islands;
- Sites near stream confluences, where slack eddies allow spearing and netting of fish; and
- Key habitat areas for wildlife species such as caribou and moose..

Steep slopes and poorly drained or swampy areas are less likely to contain heritage resources, although some of these areas were important for traditional uses like moose hunting. Traces of past human use are easily overlooked, including the stone chips, hunting blinds, meat caches and remains of camps that have lain undisturbed on the ground surface for thousands of years.

In Hän culture, heritage is characterized by intangible values attached to the landscape - values not necessarily tied to the presence of artifacts or human remains, but to spiritual connections with the

land. Interpreting stories and traditional knowledge, in an attempt to extract facts from them, severs them from their cultural context. Recognizing overlapping cultural landscapes facilitates an understanding of different perspectives on the relationship between people and the natural environment.

Important cultural landscapes include those associated with traditional and historic economic activity along the Yukon River; in the Tombstone, Blackstone and Ogilvie river headwaters; in the Gold Fields; and within the Klondike Valley.

Traditional value encompasses the broader concept of a traditional economy. The Tr'ondëk Hwëch'in traditional economy, based on the harvest of natural resources, includes development and care of efficient travel routes and harvest infrastructure, technological adaptations, governance systems, and stewardship of natural resources. The extensive trail and marine networks that enable the traditional economy also define a traditional territory - at some point locations are too far away to sustain use in any efficient or optimal way.

Over time, stewardship practices in the traditional economy influence the ecology. The goals for Conservation in Yukon First Nation Final Agreements provide insight on the traditional values associated with management of resources. For example, the Tr'ondëk Hwëch'in Final Agreement (TH-DIAND 1998) provides the following definition:

“Conservation” means the management of Fish and Wildlife populations and habitats and the regulation of users to ensure the quality, diversity and Long Term Optimum Productivity of Fish and Wildlife populations, with the primary goal of ensuring a sustainable harvest and its proper utilization.

The TH Final Agreement further states as an objective in Chapter 16 - Fish and Wildlife:

16.1.1.7 to integrate the relevant knowledge and experience both of Yukon Indian People and of the scientific communities in order to achieve Conservation.

A traditional economy can provide structure and on-the-ground capacity for monitoring, research, management, protection, enhancement and reclamation in a manner consistent with modern roles for stewardship in a sustainable resource economy. Traditional economic activity is also considered under the heading of Economic Value.

7.4 Socio-Cultural Value

The “social systems” aspect of Sustainable Development is understood to include “the relationships, networks and norms that facilitate collective action” or alternatively as “the shared knowledge, understandings, and patterns of interaction that a group of people bring to any productive activity” (Duxbury and Gillette 2007). Expressed in terms of “social capital,” social systems include local governance, community organization, capacity building, participatory planning, access to information, collaboration and partnerships.

According to the British Columbia Round Table on the Environment and Economy (1993) as cited in Duxbury and Gillette (2007), sustainable communities have sufficient social capital to:

- Achieve and maintain personal health: physical, mental and physiological;
- Provide adequate and appropriate shelter and food for themselves;
- Have opportunities for gainful and meaningful employment;
- Improve their knowledge and understanding of the world around them;
- Find opportunities to express creativity and enjoy recreation in ways that satisfy spiritual and psychological needs;

- Express and enjoy a sense of identity and belonging through heritage, art and culture;
- Be assured of mutual social support from their community;
- Enjoy freedom from discrimination and, for those who are physically challenged, move about a barrier-free community;
- Enjoy freedom from fear, and security of person; and
- Participate actively in civic affairs.

A distinction is made between “social systems” and culture, the latter of which may be defined as (Canadian International Aid Agency 1998):

A collection of distinctive traits, spiritual and material, intellectual and emotional, which characterize a society or a social group. It includes, besides the arts and letters, ways of life, fundamental human rights, value systems, traditions and beliefs.

Culture has traditionally been viewed as a part of the “social” dimension of sustainable development, but cultural capital (e.g., heritage, arts, food, music and literature), as distinct from social capital, has largely been ignored. Although not specifically included as a component of Sustainable Development, as defined by the Final Agreements, culture has come to be considered as a key element in the sustainable development framework.

For this report, social and cultural values are together considered to include aesthetic, educational, recreational, historical, and non-industrial resource use (e.g., fuelwood harvesting, hunting, fishing and berry gathering) as well as non-use value (e.g., wilderness, wildlife viewing and quiet enjoyment).

7.5 Economic Value

The total economic value of a resource comprises both use and non-use values associated with that resource (CBI 2009). Subsection 7.2 of this chapter described the economic value of natural resources, ecological systems and processes as well as the natural capital contained in forest, land, water and wildlife resources.

Modern and traditional activities both contribute value to the Yukon economy through primary resource production, wage labour, purchase of goods and services, and payment of taxes and royalties. Economic value may also be embedded in the infrastructure that enables economic activity, such as in trails, harvest sites and hunting camps in the traditional economy or roads, communication towers and airports in the modern economy.

Economic value may comprise measures of potential for production or consumption related to a resource value, or be inferred from indirect measures such as population growth/decline, building permits, border crossings or retail sales. Indications of economic potential include employment opportunity, availability of skilled workforce, resource inventory (e.g., minerals, forests, energy and water), intra and inter-sectoral diversity, local business development, competitiveness, innovation and attractiveness to investors.

Economic value may also be described in terms of ease of access and connection to communication networks, via infrastructure such as roads, ports, information, communication technology, transportation and energy. For example, the following statement may be found in an overview of the Yukon economy on the Government of Yukon’s investyukon.com website (accessed August 9, 2013):

Yukon boasts an extensive network of all-season roads, capable of carrying more than 675,000kg and a robust airport system. Yukon has a sole cable-delivered broadband network that provides high-speed internet to Yukon communities, mobile access and a telecommunications delivery system that ensures online access to the majority of Yukoners.

Consequently, Yukon businesses are able to effectively connect with partners around the globe.

Indications of economic value when considering public investment in roads for resource development include (Government of Yukon 2013):

- Estimates of mineral reserves
- Projections for development time and lead-up costs
- Production estimate and schedule
- Payments to government (e.g., taxes and royalties)
- Employment
- Wages and salaries
- Possibly affected communities and First Nations
- Estimates of possible impacts on Yukon population

7.6 Risks and Uncertainty

Planning and resource management cannot achieve Sustainable Development without consideration and management of risk and uncertainty. Some factors influencing economic, ecological and social values are either unpredictable or have uncertain outcomes:

- Climate change
- Anthropogenic disturbance
- Cumulative effect of human activity
- Invasive species
- External market forces
- Utility of mitigation technology

The Land Use Plan should identify acceptable levels of change to resource and cultural values. Adaptive management approaches that monitor variability of these key environmental and socio-economic performance indicators could be more responsive to changes in pace, intensity and extent of human activity.

7.7 Chapter References

- Campbell, S. 1996. *Green Cities, Growing Cities? Urban Planning and the Contradictions of Sustainable Development*. Journal of the American Planning Association, 62 (3) Summer 1996: 296-312.
- Canadian Boreal Initiative (CBI). 2009. *Counting Canada's Natural Capital: Assessing the Real Value of Canada's Boreal Ecosystems*. The Pembina Institute. Drayton Valley, Alberta, Canada.
- Canadian International Aid Agency. 1998. *Cultural Dimension of Sustainable Development: CIDA's Orientation and Initiatives*. Political and Social Policies Division. Ottawa, Ontario, Canada. Available at: [http://www.cida-ecco.org/CIDARoadMap/RoadMapEnvoy/documents/Cultural Dimensions of Sust Dev.pdf](http://www.cida-ecco.org/CIDARoadMap/RoadMapEnvoy/documents/Cultural%20Dimensions%20of%20Sust%20Dev.pdf)
- Duxbury, N. and E. Gillette. 2007. *Culture as a Key Dimension of Sustainability: Exploring Concepts, Themes and Models*. Working Paper No. 1. Creative City Network of Canada – Centre of Expertise on Culture and Communities. Simon Fraser University. Vancouver, British Columbia, Canada.

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- Government of Yukon. 2013. *Resource Roads Access Program*. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada.
- Government of Yukon. 2012. *Department of Economic Development Strategic Plan, 2012-2017*. Department of Economic Development. Whitehorse, Yukon, Canada. Available at: http://www.economicdevelopment.gov.yk.ca/pdf/EcDev_Strat_Plan_A_2012-2017_Final.pdf
- Neufeld, D. 2011. *Learning to Drive the Yukon River: Western Cartography and Athapaskan Story Maps*. Pages 16-43 in N. Klopfer et al. (editors) *Big Country, Big Issues: Canada's Environment, Culture and History*. Rachel Carson Center Perspectives 2011/4.
- NND – DIAND. 1993. *First Nation of Na-Cho Nyak Dun Final Agreement*. Department of Indian Affairs and Northern Development. Ottawa, Ontario, Canada.
- Secretariat of the Convention on Biological Diversity. 2007. *An Exploration Of Tools And Methodologies For Valuation Of Biodiversity And Biodiversity Resources And Functions*. Technical Series no. 28, Montreal, Quebec, Canada.
- TH – DIAND. 1998. *The Tr'ondëk Hwëch'in Final Agreement*. Department of Indian Affairs and Northern Development. Ottawa, Ontario, Canada.
- Tr'ondëk Hwëch'in. 2012. *Tr'ondëk Hwëch'in Resource Report*. Submitted to the Dawson Regional Planning Commission, May 2012.
- VGFN – DIAND. 1993. *Vuntut Gwitchin First Nation Final Agreement*. Department of Indian Affairs and Northern Development. Ottawa, Ontario, Canada.

8 HERITAGE

8.1 Highlights

- First Nations in the region have a broader interpretation of heritage resources than in Government of Yukon legislation, and view the cultural landscape as alive and changing
- Over 139 fossil localities are currently known in the Dawson area. Placer mining activity has been one of the principal sources of ice age fossil remains with exceptional preservation. Virtually every creek with intact frozen silts and gravels in the unglaciated parts of the planning region has potential for palaeontological resources
- Prehistoric and archaeological sites in the planning region span the period from the end of the last Ice Age to historic times
- Tr’ondëk Hwëch’in have traditionally occupied, travelled or harvested in virtually every corner of the planning region. In general, areas of increased archaeological resource potential are in proximity to water bodies; on hills, terraces, ridges and knolls with viewpoints; and in key habitat areas for wildlife
- The region holds the highest concentration of historic sites in the territory, relating to the goldfields from early 1900s to late 1960s as well as First Nations history
- In general, areas of increased potential for historic sites are adjacent to creek drainage systems and mountain valleys, and near major historic era communities, travel routes and utility corridors
- Heritage resources are an important attraction for the region and provide substantial economic benefits. The “Klondike” region is on Canada’s shortlist to be nominated as a UNESCO World Heritage Site
- Large areas of the planning region have not been surveyed for heritage resources. Increasing land access and human activities, particularly land clearing and disturbance of sediments, raises the potential for impacts. Heritage resource assessments and the use of best management practices help in mitigation
- Climate change has the potential to impact heritage resources through thawing of permafrost, rising water levels, accelerated erosion and sedimentation, and more frequent storms and wildfires

8.2 Description of Resource

8.2.1 Overview and Definitions

Heritage resources are defined and interpreted differently by the Government of Yukon and the First Nations governments of the region. Government of Yukon utilizes the term “historic resources” as defined by Section 2 of the *Historic Resources Act* (RSY 2002, c 109):

“Historic resource” includes

- (a) a historic site,
- (b) a historic object, and
- (c) any work or assembly of works of nature or human endeavor that is of value for its archaeological, palaeontological, pre-historic, historic, scientific, or aesthetic features.

The act further defines these terms as follows:

- ‘Historic sites’ are sites of historic significance that are designated by the Minister under Part 3 of the Act. In particular:
 - 15(1) The Minister may designate any site as a historic site when satisfied that the site is, whether in itself or because of historic resources or human remains discovered or believed to be at the site, an important illustration of
 - (a) the historic or pre-historic development of the Yukon or a specific locality in the Yukon, or of the peoples of the Yukon or locality and their respective cultures; or
 - (b) the natural history of the Yukon or a specific locality in the Yukon, and has sufficient historic significance to be so designated.
- ‘Historic object’ is any of the following, as per Section 61(1):
 - (a) an archaeological object that has been abandoned,
 - (b) a palaeontological object that has been abandoned,
 - (c) an abandoned object that is designated under subsection (2) as a historic object [on a recommendation by the Yukon Heritage Resources Board, the Commissioner in Executive Council may designate as a historic object any object more than 45 years old that is believed to have sufficient historic significance].
- ‘Archaeological object’, as per Section 61(1), means an object that
 - (a) is the product of human art, workmanship, or use, and it includes plant and animal remains that have been modified by or deposited in consequence of human activities,
 - (b) is of value for its archaeological significance, and
 - (c) is or has been discovered on or beneath land in the Yukon, or is or has been submerged or partially submerged beneath the surface of any watercourse or permanent body of water in the Yukon.
- ‘Palaeontological object’, as per Section 61(1), is the remains or a fossil or other object that indicates the existence of extinct or prehistoric plants or animals [not including human remains], and that
 - (a) is of value for its historic or palaeontological significance, and
 - (b) is or has been discovered on or beneath land in the Yukon, or is or has been submerged or partially submerged beneath the surface of any watercourse or permanent body of water in the Yukon.
- ‘Ethnographic object’, as per Section 61(1), means an item of material culture relating to the history and traditional culture of an ethnic group.
- ‘Human remains’, as per Section 61(1), means non-fossilized remains of human bodies that have historic significance and are found outside a recognized cemetery or burial site.

Human remains are managed under the *Guidelines Respecting the Discovery of Human Remains and First Nation Burial Sites in the Yukon* (Government of Yukon 1999).

The definitions contained in the *Historic Resources Act* (and what is considered by Government of Yukon to be heritage resources for management purposes) are clearly focused on “objects”, “sites”, “items of material culture”, and other physical remains.

Chapter 1 of the Tr’ondëk Hwëch’in (TH) Final Agreement provides the following definitions (TH – DIAND 1998):

- ‘Heritage Resources’ includes Moveable Heritage Resources, Heritage Sites and Documentary Heritage Resources.
- ‘Moveable Heritage Resources’ means moveable non-documentary works or assemblies of works of people or of nature that are of scientific or cultural value for their archaeological, palaeontological, ethnological, prehistoric, historic or aesthetic features, including moveable structures and objects.

- ‘Heritage Site’ means an area of land which contains Moveable Heritage Resources, or which is of value for aesthetic or cultural reasons.
- ‘Documentary Heritage Resources’ means Public Records or Non-Public Records, regardless of physical form or characteristics, that are of heritage significance, including correspondence, memoranda, books, plans, maps, drawings, diagrams, pictorial or graphic works, photographs, films, microforms, sound recordings, videotapes, machine- readable records, and any copy thereof.
- ‘Yukon First Nation Burial Site’ means a place outside a recognized cemetery where the remains of a cultural ancestor of a Yukon Indian Person have been interred, cremated or otherwise placed.

Chapter 13 (Heritage) provides additional definitions:

- ‘Public Records’ means records held by any department or agency or public office of any level of Government, and records which were formerly held by any such department, agency or public office.
- ‘Non-Public Records’ means all Documentary Heritage Resources other than Public Records.
- ‘Place Names’ includes Yukon Indian place names.

These definitions are focused on physical objects and material remains. However, as explained in *Tr’ondëk Hwëch’in Best Practices for Heritage Resources* (Tr’ondëk Hwëch’in 2011):

The Tr’ondëk Hwëch’in have a broad definition and perception of what heritage is and what it includes. Heritage is not something from the past, but a way of life reflected in the beliefs, values, knowledge, and practices passed from generation to generation. Heritage permeates all aspects of First Nation lives, communities, and governance. It includes much more than the material remains that are left behind. These heritage resources are understood as physical reminders of what is truly important.

The Tr’ondëk Hwëch’in Heritage Department uses the term *land-based heritage resources* (LBHR) as an overarching classification for heritage resources in the traditional territory that warrant protection, preservation and management. LBHR are defined as areas of particular heritage interest or value stemming from the traditional, cultural, or historic relationships to the land. These are usually non-moveable objects and can be either material or non-material in nature. LBHR also include the moveable heritage resources connected to, and in situ with, the non-moveable components. LBHR resources can include, but are not limited to, the following:

- Harvestable resources (e.g., wildlife, fish, and plants, and their habitats)
- Migration routes, waterways, salt licks, and calving areas
- Medicines
- Raw materials (e.g., bark, wood, stone, bone, fibres, and dyes)
- Place names (the stories and where they connect with the land)
- Camps, trails and caches
- Burial sites
- Sacred sites
- Traditional knowledge
- Archaeological and historic sites

Current activities on the land that are rooted in ancestral family practices (e.g., hunting, fishing, trapping and other subsistence activities) are also considered heritage resources (Tr'ondëk Hwëch'in 2012a,b).

For the Tr'ondëk Hwëch'in, heritage is rooted in the landscape, and heritage resources are all of those things that support or result from a people's connection to the land and to their place in the world. Recorded oral histories, archives, artifacts, songs, stories and cultural landscapes are therefore also included. Cultural landscapes are defined as “large intact tracts of land that allow for the continual practice of resource harvesting and associated land management activities, and for habitat conducive to healthy wildlife species” (Tr'ondëk Hwëch'in 2012a). Tangible resources on the land are considered indicators of larger areas with multiple values and uses (Tr'ondëk Hwëch'in 2012a):

For instance a cabin is not of value for the small piece of land on which it sits. Rather it indicates a greater scope of use in a larger area. People had many camps and cabins which were used as centre points for their larger individual and family hunting and trapping territories. This is true today as well. . . .tangible resources like cabins, hunting blinds, trails, caches, camps, and graves are all markers on the land that speak to traditional land use.

Stewardship of the land while conducting resource harvesting, travel and recreation activities ensures that heritage is kept alive and protected. These land use patterns reflect a consistently changing and evolving system of resources, and it is difficult to pinpoint areas on a map that have higher value than others. Maps showing specific locations of heritage resources “...are not comprehensive. They in no way reflect the scope or richness of heritage values on the land...the very nature of heritage – that it changes and evolves over time – means that no static report or map will truly reflect the community's values with any justice” (Tr'ondëk Hwëch'in 2012a).

TH considers the *Historic Resources Act* to be inconsistent with the Final Agreement (Tr'ondëk Hwëch'in 2013a). Much of what TH considers to be heritage resources would not be protected under the act (e.g., net fishing sites along the river, trails worn into side slopes of steep hills, or perennial snow patches).

Vuntut Gwitchin First Nation shares this broader perspective of heritage resources as being more than the material remains left behind, but rather as reflections of an entire way of life and an ongoing and active connection to the land. For example, “culturally significant areas” are defined as “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” (North Yukon Planning Commission 2007).

The following subsection 8.2.2 provides more information on the broader concept of a cultural landscape and a living culture and heritage. Subsections 8.2.3 to 8.2.5 provide detail on the material remains and artifact record for the paleontological, archaeological and historic periods.

8.2.2 Cultural Landscapes and Living Heritage

The later sections of this chapter emphasize heritage resources of the planning region in terms of material artifacts and visible remains. However, cultural landscapes and First Nations culture and heritage may or may not result in material remains or substantial modifications of the landscape. For example, frequently used traditional trail networks which linked resource harvesting opportunities, camping locations, important landscape features and gathering places would leave visible traces on the landscape but marine routes might not. Campsites and seasonal settlements typically had limited physical infrastructure developments, but some harvesting infrastructure was more extensive. For example, caribou fences were constructed to herd or corral animals into situations where they could more easily be killed, often along with snares that strangled the animals. These fences were constructed from poles and could run for distances of many kilometers. Deadfall traps constructed

of several large logs used a baited triggering mechanism that crushed the animal (Tr'ondëk Hwëch'in 2012a).

Where artifacts or visible remains of activities are present, they are more important as indicators of the broader relationship between culture and place. This relationship, as described by Prosper (2007):

...is constituted and sustained through a series of spatial practices and performances. These include such things as: the seasonal use of traditional hunting and fishing grounds, the transmission of traditional knowledge, the telling of stories and oral narratives embedded in place, annual gatherings and celebrations, and the daily inhabitation and negotiation of culturally significant spaces. Such spatial practices and performances transform largely unmodified wilderness into meaningful cultural spaces symbolizing a collective consciousness that is inextricably associated with a geographical territory. Aboriginal cultural landscapes remain relevant as long as they are continually reinvested with cultural meaning through practice and inhabitation, but revert back to wilderness, emptied of their cultural significance, if these cease. They are geographical territories whose cultural significance, and by consequence heritage value, stems from the continuity of a relationship between culture and place that is integral to cultural identity.

TH defines the cultural landscape as a component of the traditional economy. Cultural landscapes include intact tracts of natural landscape which allow traditional societies to practice their resource harvesting; transportation, shelter and harvest site infrastructure; management practices such as prescribed burning that enhance and protect ecological systems; seasonally shifting land and resource use patterns; and use of Aboriginal language place names (Tr'ondëk Hwëch'in 2012a).

Stories associated with place names tell us about where people have travelled, lived, gathered and hunted. Names are given to rivers, mountains, trails, lookout points and other important areas that signify the relationship between the community and the land. Elders tell stories about how a particular place came to be or about the people who spent time there, and about events that happened there in the distant past and in historical times. They locate a place not by means of a map, but by means of a story, and use places instead of dates to organize and focus their memories of the past (Tr'ondëk Hwëch'in 2012a).

Cultural landscapes are recognized on both a national and international level. For example, some National Historic Sites of Canada have been designated as cultural landscapes, including Nagwichoonjik. This "site" is actually a 175-km section of the Mackenzie River in the Northwest Territories, traversing the traditional homelands of the Gwichya Gwich'in of Tsiigehtchic. The heritage value as noted by the Canadian Register of Historic Places (2008):

...is reflected in the cultural landscape along the river that reflects the river's role as a principal repository of the stories (oral histories) that suffuse with meaning the history of the landscape as the Gwichya Gwich'in know it. The traditional lifestyle of the Gwichya Gwich'in has been shaped by their close connection with the land and the river, and many points along the river play an essential role in the transmission and survival of Gwich'in culture.

Key elements contributing to the heritage character of the site include the river valley itself, archaeological sites, burial places, sacred sites, ritual sites, "the health and wholeness of the riparian ecosystem (its water quality, quantity, rates of flow, sandbars and siltation, fish quality, the health of species such as inconnu and moose); the undisturbed land and unimpeded views of the river and along the valley from the river," and Gwich'in knowledge of traditional place names along the river (Canadian Register of Historic Places 2008).

Cultural landscapes are also recognized as one type of World Heritage Site designation by the United Nations Educational, Scientific and Cultural Organization (UNESCO). In 1992, the World Heritage

Convention became the first international legal instrument to recognize and protect cultural landscapes, defined as (UNESCO 2013):

...combined works of nature and humankind, they express a long and intimate relationship between peoples and their natural environment...Cultural landscapes often reflect specific techniques of sustainable land-use, considering the characteristics and limits of the natural environment they are established in, and a specific spiritual relation to nature. Protection of cultural landscapes can contribute to modern techniques of sustainable land-use and can maintain or enhance natural values in the landscape. The continued existence of traditional forms of land-use supports biological diversity in many regions of the world. The protection of traditional cultural landscapes is therefore helpful in maintaining biological diversity.

Cultural landscapes and First Nations heritage and culture are dynamic, constantly changing and adapting over time. They retain their value by being lived and practised. The relationship between culture and place is reinforced and given continuity by returning to sites or areas every year, telling stories connected to landscape features and place names, and passing information and knowledge to the next generation. This is in contrast to typical heritage resources management that focuses on “preserving” the snapshot in time or space, or identifying specific sites of importance on a map. However, “a culture can never be reduced to its artefacts while it is being lived” (Williams 1960 as cited in Prosper 2007).

Yukon First Nations heritage is (Peel Watershed Planning Commission 2008):

...intrinsically tied to the landscape, the environment and the wildlife that inhabit it...their heritage and culture is represented as much by expansive natural features – such as mountains, mountain ranges, lakes, and rivers and the stories embedded in these places – as it is by archaeological artifacts, fishing camps or tent rings.

It is also (Tr’ondëk Hwëch’in 2013a):

...a way of life in which knowledge and understanding of history, culture, and survival is passed on from generation to generation by parents and elders. The oral, cultural, experience-on-the-land basis of heritage makes it flexible, adaptive and evolving. It is a dynamic, living heritage and a culture based on traditions which are shaped by history and rooted in survival.

Heritage resources are inextricably linked to cultural survival and vitality, and Prosper (2007) notes that it is important to:

...move away from a material and artifactual notion of heritage toward one that privileges the relationships and practices that give rise to artifacts and other cultural expressions. In the case of cultural landscapes, this means focusing on human relationships with the land and the spatial practices through which they are formed.

8.2.3 The Paleontological Record

Most information in this section was provided by the Government of Yukon’s Department of Tourism and Culture, Heritage Resources Branch (Government of Yukon 2013a) unless otherwise noted. Sources cited in the text but not listed in the References section of this chapter may be obtained from the Heritage Resources Branch.

The planning region lies at the eastern limit of the ancient landscape of Beringia, which connected North America with Eurasia across the exposed Bering Land Bridge, and remained unglaciated for more than three million years (for more information on Beringia and the glacial history of the region see **Section 1 – Chapter 5, subsection 5.2** of this report). The region contains well-preserved fossil and geological evidence of a long history of environmental change and species evolution and adaptation. Palaeontological remains indicate a rich community of large mammals that is much more

diverse than it is today. During the late Ice Age around 20,000 years before present (BP), mammal species in the region included mammoth, steppe bison, horse, helmeted musk ox, musk ox, mountain sheep, saiga antelope, caribou, cave lion, grey wolf, black footed ferret, scimitar cat and short-faced bear. Around 14,000 BP the climate began to warm, the continental glaciers retreated, and the steppe-like habitat began to disappear. Populations of several of the large mammals that thrived throughout the Pleistocene era (the geological period spanning approximately 2.6 million to 11,700 years BP) began to decline and went extinct. At this time, in response to an increase in shrub and forest vegetation, other mammals such as moose and wapiti crossed the Bering Land Bridge from Asia into the Yukon for the first time. Some species surviving these extinctions and persisting into the Holocene era (after about 11,000 years ago) include bison, caribou, sheep, brown bears and wolves.

Over 139 fossil localities are currently known in the Dawson area, with many of the most important sites in the placer mining areas (e.g., Klondike Goldfields, lower Stewart River, Thistle Creek, Black Hills Creek, Henderson Creek, Fifteenmile Creek and Sixtymile River watersheds). Pre-Ice Age fossils are also likely to be found in outcrops in the Ogilvie Mountains, north of the Tintina Trench and in the Tatonduk River, Miner River and Ogilvie River areas. Virtually every creek with intact frozen silts and gravels in the unglaciated parts of the planning region has high potential to preserve fossils of Ice Age mammals (Government of Yukon 2013a).

In terms of ongoing research, the placer gold mines in the planning region are Canada's most significant and productive sources of newly discovered, permafrost preserved Ice Age fossils. Thousands of new fossils are uncovered annually and collected as part of management activities of the Yukon Palaeontology Program (Government of Yukon). This connection between placer gold mining and Ice Age fossils goes back to the Klondike Gold Rush over 100 years ago. As soon as frozen ground was moved, early gold miners found fossils of Ice Age mammals and spurred a "fossil rush" to the Klondike by several international museums and institutions. The region continues to attract scientists from all over the world annually to examine the internationally renowned Ice Age fossils and geology. Numerous distal volcanic ash beds (tephra) found in the frozen Ice Age sediments and soils provide a detailed chronological record for climate and environmental changes spanning the last three million years. Relic permafrost discovered on Dominion Creek is the oldest known ice in North America at over 750,000 years old. Placer gold mines in the planning region are North America's most significant source of ancient DNA preserved in Ice Age bones, plants and soils. A horse fossil discovered at a placer mine on Thistle Creek dating to over 750,000 years old recently yielded the world's most ancient genome, providing significant new information on horse evolution. A partial ancient horse carcass with mummified hide, hair and intestines dating to over 26,000 years BP was discovered on Last Chance Creek in 1992. The Klondike placer mines are also Canada's most productive source of fossil mammoth ivory, some of which is sold internationally on the commercial market (Zazula and Froese 2011, Froese et al. 2009).

Just north of the planning region, the Ni'inlii Njik/Fishing Branch area also has significant palaeontological resources. The caves associated with Bear Cave Mountain, as well as the surrounding limestone bedrock and karst (eroded limestone) topography of Ni'inlii Njik and the north Ogilvie Mountains, provide conditions for exceptionally well preserved palaeontological remains. Isolated bison and mammoth bones have been found on the cave floors and dated to more than 10,000 years old. Bear dung, possibly from the giant short-faced bear, was also found in a cave and dated to about 35,000 years ago (North Yukon Planning Commission 2007).

8.2.4 The Archaeological Record

Most information in this section was provided by the Government of Yukon's Department of Tourism and Culture, Heritage Resources Branch (Government of Yukon 2013a) unless otherwise noted. Sources cited in the text but not listed in the References section of this chapter may be obtained from the Heritage Resources Branch.

There are approximately 370 recorded archaeological sites in the planning region. These are predominantly prehistoric sites that span the period from the end of the last Ice Age to historic times. Known concentrations of archaeological sites and traditional patterns of land use by Tr'ondëk Hwëch'in indicate the upper Forty Mile, Upper Chandindu and Upper Blackstone River areas were a focus of seasonal caribou exploitation throughout the prehistoric period. The Yukon River, Klondike River and Chandindu River were major travel corridors to hunting territories and were themselves the focus of fishing, trapping, and moose hunting subsistence activities.

Inventory information is lacking for large portions of the planning region. However, the ancient terraces along the Yukon River have been identified as potentially preserving some of the earliest evidence of human populations in the unglaciated Beringian landscapes of the late Ice Age. A caribou antler punch, which would have been used as an implement to flake stone for stone tools, was recovered from site KIVi-1 along Hunker Creek in the Klondike district. This artifact provided a date of 11,350 radiocarbon years BP or about 13,000 calendar years old¹. The date of the caribou punch corresponds with the Nenana cultural complex identified at sites along the Tanana and Nenana Rivers in central Alaska, and also identified at the Little John site near Beaver Creek. This cultural horizon is seen by many North American archaeologists to represent one of the earliest populations to colonize North America in the late Ice Age.

A stone tool making technology with clear beginnings in the Northeast Asian cultures of the Last Glacial Maximum (ca. 25,000 to 15,000 BP) is present in the lowest levels of the Moosehide archaeological site dating back to about 8,000 radiocarbon years BP (ca. 9,000 calendar years), and occurs at some 30 other known sites within the planning region. The subsistence of the late Pleistocene and early Holocene inhabitants very likely focused on caribou and possibly also bison and other large species.

After 7,000 BP when the Yukon River attained present levels and the annual salmon run became established, subsistence activities begin to reflect a broader focus. At about 5,000 to 4,500 BP a clear change in technology is evident. The production of composite microlithic tools ceases and different technologies appear (e.g., notched points), suggesting new influences or new populations. This change is seen not only in the planning region but also throughout much of interior northwest North America. The mid-Holocene between about 6,000 and 4,000 BP was also a time of environmental change with a sharp decline in white spruce and an increase in black spruce, which may have played a role in the cultural changes represented in the archaeological record.

Although the environment has been more or less stable over the last 4,000 years, geological events outside of the region likely influenced human settlement patterns and therefore the archaeological record. Two major volcanic eruptions, originating at Mt. Bona near the Yukon-Alaska border, blanketed southwestern and west-central Yukon as well as eastern portions of Alaska with a layer of tephra (i.e., ash and volcanic fragments). This White River ash is evident throughout the affected areas today and is a convenient time marker for archaeologists. The earliest eruption, referred to as the north lobe, occurred approximately 1,900 BP and is evident in west-central Yukon and east-central Alaska. The eastern lobe, which was deposited 1,200 BP, extended southeast from its origin

¹ Carbon is found in various forms in living things, including the radioactive isotope carbon-14. Carbon is absorbed by plants through photosynthesis and passes indirectly to animals who eat plants or other animals. Once an organism dies, the carbon is no longer replaced and carbon-14 decays at a known rate. Radiocarbon dating measures the amount of carbon-14 remaining in organic materials such as wood, bone, or charcoal to estimate their age. Results are reported in years before present (BP). Willard Libby invented the method in 1949. His calculations assume that atmospheric radiocarbon concentration has always been the same as it was in 1950, and that the half-life of carbon-14 (the time it takes to decay to half its initial value) is 5568 years. Since then, however, studies of natural records such as tree rings and cave deposits show there have been variations in atmospheric carbon over time, and additional research showed the half-life of carbon-14 to be 5730 years. To maintain consistency with earlier results, the original figures are still used in the measurements, but the BP date is now also calibrated to give a more accurate calendar date.

and blanketed much of southern Yukon and even as far as the Northwest Territories (Clague et al. 1995; Lerbekmo et al. 1975; Workman 1972, 1978). A small amount of north lobe ash is evident within the Dawson region today. Evidence for the actual impact of the ash falls on the environment is not well understood. However, Workman (1972, 1978) suggests that the eruptions made areas with the greatest ash fall (up to a number of metres thick) uninhabitable for a time. This likely forced the abandonment of these areas and caused people to move to adjacent regions to the north or south (Workman 1972). Almost certainly, changes in subsistence and land use patterns in the Dawson region in the Late Prehistoric period are related to this event (Hammer 2001).

Archaeologists speculate that an intensified use of rivers in the late Holocene is tied to the technological innovation of fish traps and weirs, set in the shallow sloughs and tributaries of the Yukon River. Possibly at the same time, caribou surround technology was introduced and a similar intensification of seasonal caribou interception was established. These technological innovations both required and supported larger groupings of people, at least during the summer and fall/winter, and resulted in the pattern of large seasonal fish camps on the Yukon River which are known from the early Historic period (at the mouth of the Klondike River and at Nuclaco across from Fort Reliance). Contact with new groups or the appearance of new peoples in neighbouring regions likely brought about these and other technological innovations in the Late Prehistoric period. The arrival from the Bering Sea of Thule Eskimo in the coastal regions of Alaska and northern Yukon appears to be the source of some elements of new technology, such as the bow and arrow. The development or escalation of trading relationships with coastal groups centered around native copper may have seen the spread of innovations in fishing technology. The late prehistoric and contact period components of the Forty Mile and Tr'ochëk sites represent occupations in this dynamic period of Yukon prehistory.

The upper Miner River-Ogilvie River area has had little research but has high potential for archaeological resources, with cave sites similar to those in the Ni'iinlii Njik/Fishing Branch area to the north. Additional upland sites are also expected to occur in the Ogilvie Mountains (North Yukon Planning Commission 2007).

8.2.5 The Historic Record

Most information in this section was provided by the Government of Yukon's Department of Tourism and Culture, Heritage Resources Branch (Government of Yukon 2013a) unless otherwise noted. Sources cited in the text but not listed in the References section of this chapter may be obtained from the Heritage Resources Branch.

The Dawson area was one of the earliest areas to be settled by newcomers to the Yukon. Early prospecting discoveries along the Fortymile River gave rise to permanent settlement at the mouth of that river by 1887. During the legendary Klondike Gold Rush of 1898, thousands of stampeder flooded into the region to look for gold. This influx of newcomers opened up the development of Canada's north and transformed the land and peoples of the Yukon. Establishing Canadian sovereignty in the midst of numerous American prospectors and enforcing the "rule of law" had a profound impact on the lives of the First Nations people (Dobrowolsky 2003), as did the sudden depletion of their hunting, fishing and forest resources. First Nations people were involved in market hunting and commercial harvest for sale of meat to newcomers, and may have contributed to the depletion (Beaumont and Edwards, undated).

Systems of transportation, trading and communication grew up to service the needs of the newcomer population. Entire communities began, flourished and declined in tandem with the industry. New technology was developed to meet the challenge of the shallow rivers and frozen ground. Mining evolved as individual miners gave way to small operations with adjoining claims, which were in turn overtaken by large-scale corporations requiring large tracts of land, power and water. The corporate

industrial mining phase came to an end in 1966 when the stagnant price of gold made it no longer profitable (Hogan 1995).

Today, an astonishing wealth of historic remains is scattered over the landscape, and the region is recognized as having the highest concentration of historic resources in the territory. A field program to document these resources was initiated by the Government of Yukon's Historic Sites Branch in the 1980s, and a large portion of the known sites have been recorded in the Yukon Historic Sites Inventory (YHSI). To date, there are approximately 750 sites located in the planning region. The majority of these resources bear witness to the massive proliferation of economic activities in the goldfields from the early 1900s to the late 1960s. There is evidence of engineering works, industrial infrastructure such as power plants and dams for hydroelectric projects, transportation infrastructure (e.g., roads, roadhouses, railways), dredges, dredge camps, communities, gravesites, police posts, cabins, placer and quartz mining, trapping and farming. It is a multi-layered history, as many of these sites were used or occupied by both First Nations and newcomers.

In response to the recent increase in exploration, mining and development in the Dawson region, Government of Yukon Historic Sites staff are conducting a field inventory in 2012-13 and 2013-14 to research and update records of historic resources. Much progress has been made in ground-truthing the baseline information and gathering new information. Like archaeological sites, known historic resources are protected under the *Historic Resources Act* (RSY 2002, c 109), and initial investigations indicate that the majority of historic resources in the planning region are still in existence.

There are three types of management regimes that pertain to historic places in the Yukon: national or territorial designation as a historic site; sites identified under First Nation Final Agreements; and heritage reserves. See subsection 8.4.1 of this chapter for more detail on these various management strategies.

Within the planning region there are:

- Two National Historic Sites – Discovery Claim and Dredge No. 4
Note: Numerous other nationally significant historic sites are located within the Dawson area (e.g., Dawson Historical Complex, Bear Creek Compound and Tr'ochëk). However, because they are located within the municipal boundaries of Dawson City, they are managed under a separate regime and "excluded" from the regional land use plan.
- One Territorial Historic Site designation in progress – Forty Mile, Fort Cudahy and Fort Constantine (Chëdä Dëk) – this is also a Heritage Reserve and is jointly owned and managed by Tr'ondëk Hwëch'in and Government of Yukon.
- 15 other Heritage Reserves (these are described in **Section 1 – Chapter 6 – Land Status**)

The Dawson Historical Complex and other sites in the Dawson area related to the Klondike Gold Rush are also part of the Klondike Gold Rush International Historical Park. Collectively the sites in Washington, Alaska, British Columbia and Yukon tell the story of the great gold rush that transformed the face of the North, created a new Canadian territory and turned the American purchase of Alaska from folly to fortune (Parks Canada 2013a). This Park is described in **Section 1 – Chapter 6 – Land Status**.

The following sub-sections provide a brief description of the heritage values for these and other significant historic places within the planning region.

8.2.5.1 Discovery Claim National Historic Site

As described in the Canadian Register of Historic Places, Discovery Claim is a legally defined mining claim measuring some 152.4 by 609.6 m (500 by 2,000 feet) located on Bonanza Creek, a tributary of the Klondike River near the City of Dawson. It is significant as the site where gold was discovered on

the afternoon of August 16, 1896 – the event that triggered the Klondike Gold Rush. Economically and administratively, the site marks the beginning of the development of the Yukon. For the Aboriginal people, this piece of land is an affirmation of their cultural values and worldview; from a western perspective, the site affirms the 19th-century belief that through hard work and perseverance one could rise from poverty to riches.

The heritage value of Discovery Claim lies in its historical associations, in particular the place where Keish (“Skookum Jim” Mason) of Tagish and Tlingit descent discovered gold, and where George Carmack (an American married to Keish's sister) staked the mining claim that led to the Klondike Gold Rush. The site has been actively mined through the 20th century.

The claim is owned by the Klondyke Centennial Society and was developed in cooperation with the Government of Yukon and Parks Canada as an attraction, with a one-kilometre long walking trail, interpretive signs and mining exhibits.

See **Section 1 – Chapter 6, subsection 6.2.2.1** of this report for photos of the site.

8.2.5.2 Dredge No. 4 National Historic Site

Dredge No. 4 is a preserved bucketline sluice dredge used to mine placer gold. It is located at its last place of operation on Bonanza Creek in the Klondike Goldfields just outside of Dawson City. Dredge No. 4 is symbolic of the importance of dredging operations in Yukon (1899-1966), and aspects of the evolution of gold mining in the Klondike from early labour-intensive to later corporate industrial phases of gold extraction. Dredge No. 4 was constructed in 1912-13 by the Canadian Klondike Mining Co. to mine the gravels of the Klondike River Valley. From September 1941 to the fall of 1958 it mined Bonanza Creek and sank in 1959.

The heritage value of Dredge No. 4 lies in its association with Klondike gold mining and in its illustration of the process of bucketline sluice dredging used by corporations to mine placer gold in the Klondike Goldfields in the period from 1899 to 1966. It is linked to other regional corporate infrastructure such as Bear Creek camp, power plants, business office, dredge camps, transportation network, power and telephone lines and water management. These combine to tell the story of the development of the Yukon as a major mining region of Canada over the last century (Canadian Register of Historic Places 2006).

Managed by Parks Canada, the dredge was excavated, refloated and relocated to higher ground in 1991 and 1992. A major stabilization program is ongoing for Dredge No. 4. It is one of the Yukon's premier heritage tourism attractions.

See **Section 1 – Chapter 6, subsection 6.2.2.2** of this report for photos of the site.

8.2.5.3 Forty Mile, Fort Cudahy and Fort Constantine Historic Site (Ch'ädä Dëk)

This site is known simply as “Forty Mile” or as Ch'ädä Dëk in the Hän language (the name for the Fortymile River, meaning “creek of leaves”). Forty Mile/Ch'ädä Dëk is situated on islands and riverbank terraces comprising approximately 50 hectares at the mouth of the Fortymile River where it enters the Yukon River, 67 km upstream from the Alaska border and 88 km downriver from Dawson City (Government of Yukon and Tr'ondëk Hwëch'in 2011). The Fortymile River begins in Alaska and, with its great network of tributaries, drains an area of 1,830 km² (706 square miles). It got its name not because of its length, but because of its estimated distance downriver from the old trading post of Fort Reliance. First Nations people have gathered here at the confluence of these two major rivers for over 2,000 years to hunt, fish, trade and visit (Tr'ondëk Hwëch'in 2013*b*).

The site includes a significant material record of late prehistoric Hän use and occupation, dating back to more than 2,000 years ago. Long before Forty Mile/Ch'ädä Dëk was settled, First Nation people walked trails in the Fortymile River basin. During their seasonal rounds they travelled the river and

crossed the tributaries using rafts, birch bark canoes and skin boats. The Hän utilized the site as an interception point for the migrating Fortymile caribou herd and a spring grayling fish camp (Government of Yukon and Tr'ondëk Hwëch'in 2011).

Elder Mary McLeod has spoken of how people from the Forty Mile and Dawson areas hunted together in the fall. They met at a long caribou fence in the mountains near Chicken, Alaska, southwest of Forty Mile. While awaiting the animals, they repaired the fence. Caribou were driven into this structure where they would be trapped by snares set into the fence, then shot with bows and arrows or stabbed with spears. Other times, the caribou were driven into a ring of people, where the disoriented animals were easy prey for arrows. In spring, the Hän from the Forty Mile and Dawson areas also gathered here to catch fresh grayling, usually through the ice using a line and hooks. The Arctic grayling (*Thymallus arcticus*), called srejl in the Hän language, are present in significant numbers at the mouth of the Forty Mile River during spawning (Tr'ondëk Hwëch'in 2013b).

The site also has collapsed and standing structures from the historic period dating as far back as 1886. Included is evidence of two American trading posts, including Fort Cudahy, established in 1893; Yukon's first North-West Mounted Police post, Fort Constantine, built in 1895; an Anglican mission and church; and a dynamic mixed community predating the Klondike Gold Rush. It was the first substantive non-Aboriginal settlement in the Yukon, associated with a shift in commercial interests from furs to gold, as well as the establishment of the visible authority of the Canadian government. Canadian sovereignty in the Yukon enabled regulatory control over the Klondike Gold Rush and paved the way for the creation of the Yukon as a distinct territory of Canada (Campbell et al. 2006). This is a key site in Yukon history and was one of the first major contact points between First Nations people and the newcomers to the upper Yukon River valley (Tr'ondëk Hwëch'in 2013b).

Section 13.4.6.1 of the Tr'ondëk Hwëch'in Final Agreement (TH – DIAND 1998) requires that Forty Mile be established as a Designated Heritage Site, with specific provisions noted in Schedule A of Chapter 13 (Heritage), because of its cultural significance to the Tr'ondëk Hwëch'in and to all people of the Yukon. Today the Forty Mile, Fort Cudahy and Fort Constantine Historic Site is co-owned and co-managed by the Tr'ondëk Hwëch'in and the Government of Yukon, and will be designated as a Yukon Historic Site under the *Historic Resources Act* (Tr'ondëk Hwëch'in 2013b).

The following Tables 8-1 to 8-3 summarize the other major historic sites and resources in the Dawson planning region, with their main functions and dates of use. A more detailed description of these sites follows the tables.

Table 8-1 Major historic settlements, farms and graves in the planning region (also see Table 8-2 for communities associated with dredge camps and other industrial sites)

Name	Location	Date	Historic function
Fort Reliance	Yukon River	1874-1886*	Hän settlement and fur trading post
Forty Mile, Fort Cudahy and Fort Constantine	Confluence of Yukon and Fortymile rivers	1886-1930s*	Caribou and fish camp, fur trading post and police post, townsite and cemetery
Granville	Dominion Creek	1898-1966	Goldfields townsite and mining camp
Ogilvie/Sixtymile	Confluence of Yukon and Sixtymile rivers	1892-1925	Farming, settlement and police post
Grand Forks	Confluence of Bonanza and Eldorado creeks	1897-1910	Goldfields townsite and cemetery
Stewart/Fort Nelson	Confluence of Yukon and Stewart rivers	1884-1950s*	Na-Cho Nyäk Dun fish camp, fur-trading post, village, gardening and roadhouse
Sunnydale	Sunnydale Slough on Yukon River	Early 1900s	Agricultural community of ten homesteads and watchman's cabins for winter shipyards
Indian River Hay Farm	Indian River valley	1902-1950s	Hay farming for horses used by stages on Overland Trail
McKinnon Creek Farm	Indian River valley	1902-1920s*	Hay farming for horses used by stages on Overland Trail
Strachan/Fournier Farm	Klondike Highway near airport	Early 1900s-unknown	Commercial dairy operation, then a family farm
Gold Run Creek Cemetery	Gold Run Creek	Early 1900s-1920s*	Cemetery related to early goldfields miners
8 Below Pup, 21 Below Pup, and Remington Pup Cemeteries	Dominion Creek	1898-unknown	Cemeteries (3) related to goldfields miners, settlements and camps

*Approximate time period

Table 8-2 Major historic industrial sites in the planning region

Name	Location	Date	Historic function
Cliff Creek Mine and railway	Cliff Creek and Yukon River	1899-1903	Coal mining – for heating and electricity for Dawson City residents
Coal Creek Mine, railway and power house	Confluence of Coal Creek and Yukon River to Coal Creek Mine	1903-1915	Coal mining – for heating and electricity for Dawson City residents and power for dredges
Discovery Claim National Historic Site	Bonanza Creek	1896	Small-scale gold mining
Dredge No. 4 National Historic Site	Bonanza Creek	1913-1958	Large-scale gold mining/dredging
Yukon Ditch System – multiple sites including Shovel Camp, Dinner Gulch Maintenance Camp, and Twelve Mile Power Plant	Ogilvie Mountains to Bonanza Creek	1906-1933	Water diversion and hydroelectric power production for hydraulic gold mining/dredging
North Fork/South Fork Ditch System, multiple sites, including Power Plant and Lee Creek Maintenance Camp	North Fork of Klondike River to goldfields and Dawson	1908-1967	Hydroelectric power production for gold dredging and for use by Dawson City residents
Acklen Ditch	Moosehide Creek to Thomas Gulch	1907	Water diversion for hydraulic gold mining and dredging
Dredges No. 2,3,6,7,8,9,10,11 and 12	Various locations in the Klondike Goldfields	1910-1966	Large-scale gold mining/dredging
Holbrook Dredge	60 Mile River	1915-1941	Large-scale gold mining/dredging
Bruin Creek Dredge Camp	Fortymile River and Bruin Creek	1934-1938	Large-scale gold mining/dredging and community

Name	Location	Date	Historic function
Bear Creek Compound	Bear Creek	1905-1966	Large-scale gold mining/dredging and community
Miller Creek Dredge Camp	Miller Creek	1895-1970s*	Small and large-scale gold mining/dredging and community
Glacier Creek Dredge Camp	Glacier Creek	1940s to present*	Small and large-scale gold mining/dredging and community
Fortymile River Camp	Fortymile River	1900-1912	Large-scale gold mining/dredging and community
Henderson Creek Dredge Camp	Henderson Creek	1947-1956	Large-scale gold mining/dredging and community
No. 10 Dredge Camp	Dominion and Jensen creeks	1938-1964	Large-scale gold mining/dredging and community
Bonanza Creek Dredge Camp	Bonanza Creek and Mosquito Gulch	1910-1966	Large-scale gold mining/dredging and community
Readford	Quartz and Calder Creeks	1900-present	Small and large scale gold mining/dredging and community
Bonanza Dam	Bonanza Creek valley	1907-1967	Water supply for hydraulic mining
Adams Creek Dam	Bonanza Creek valley	1906-	Water supply for hydraulic mining
French Gulch Dam	Eldorado Creek	1908-1939	Water supply for hydraulic mining

*Approximate time period

Table 8-3 Major historic route-related resources in the planning region

Route/Resource	Date	Historic Function/Location
Overland Trail, including remains of roadhouses and related sites	1902-1920s	Winter route for mail/passenger and freight service from Dawson City to Whitehorse
Ridge Road, including remains of trail, roadhouses and related sites	1899-1902	Main supply route for miners in goldfields, from Klondike City/Dawson to Dominion/Sulphur creeks

Route/Resource	Date	Historic Function/Location
Glacier Creek Trail, including remains of roadhouses and related sites	Early 1900s	Trail connecting Dawson City via Swede Creek to Sixty Mile River mining area and communities
Klondike Mines Railway, including remains of railbed, stations and related sites	1906-1914	Transported freight and passengers to mines and dredge construction sites in goldfields, from Klondike City/Dawson to head of Sulphur Creek
Goldfields Road, including residences, roadhouses, and related sites	Early 1900s to present	Road “loop” connecting Dawson to various locations in the goldfields (e.g., Hunker, Bonanza, Sulphur and Dominion)
Yukon River “Sternwheeler Graveyard” site	Early 1900s	Repair depot for Dawson shipyards of British Yukon Navigation Company and sternwheeler remains

8.2.5.4 Bear Creek Compound

Bear Creek Compound was an industrial complex of over 80 structures, several landscape features and thousands of artifacts related to large-scale placer mining located approximately 12 km south of Dawson City. Bear Creek served as the administrative and repair depot for corporate dredge mining operations, the last of which was the Yukon Consolidated Gold Corporation. Constructed in 1905, the site was expanded in the 1930s and shut down in 1966 due to rising costs and the stagnant price of gold. The site includes a machine shop, gold processing facility, auto repair shop, offices and multiple warehouses as well as a bunkhouse and residences for the workers and their families. Bear Creek was acquired by Parks Canada in 1975, and 20 of these buildings have been designated as “Recognized” by the Federal Heritage Buildings Review Office for their historical, architectural, and environmental values (Parks Canada 2012a).

Bear Creek Complex is an excellent illustration of the corporate phase of Yukon’s gold mining history, and is closely linked with Dredge No. 4 National Historic Site. Bear Creek reflected the changing fortunes of the mining corporations over sixty years of operation (Great Plains Research Consultants and Parks Canada 1987). For many of the individuals who worked for the Yukon Consolidated Gold Corporation when Dawson was a “company town,” this was home.

Bear Creek is currently used by Parks Canada as a repair facility for Dredge No. 4 as well as for storage of lumber and artifact collections.

8.2.5.5 Fort Reliance

Fort Reliance is the site of a fur trading post which operated from 1874 to 1886 on the Yukon River, 11 km below the mouth of the Klondike River. There are no buildings left standing, but it was the first trading post to be built on the Yukon River. The location was chosen by Catseh, Chief of the Klondike Hän, because it was advantageous for fur trading for the Hän as well as for the Upper Tanana and Northern Tutchone people. The site is also associated with Yukon pioneers Jack McQuesten (who was once known as the “Father of the Yukon”), Alfred Mayo, Joseph Ladue and Arthur Harper. As the communication and service centre for the first prospectors in the Klondike-Fortymile region, Fort Reliance played a significant role in opening up the Yukon to prospecting and mining, which culminated in the discovery of gold in the Klondike.

Fort Reliance has also revealed archaeological evidence indicating it was a Hän Athapaskan settlement prior to and during the period of the trading post. The site is an important example of cultural accommodation and change (Clark 1995, Robinson 2012).

8.2.5.6 Other Dredges, Dredge Camps and Tailings

Corporations operated entire fleets of dredges to mine placer gold, as well as camps to maintain them. There are 32 known sites related to dredge remains within the planning region, including 14 dredges. These include Dredges No. 2, 3, 6, 7, 8, 9, 10, 11 and 12, with the highest concentration located on mining claims in the Klondike Goldfields south of Dawson, around Dominion Creek and Sulphur Creek. Sites range from the remains of the Bruin Creek dredge on the Fortymile River – a small prospecting type with 2.5 cubic foot buckets – to the remains of the large Dredge No. 3 with 16 cubic foot buckets near Quigley Creek. A relatively intact example of a later steel-hulled dredge is Dredge No. 12 on Dominion Creek, used from 1953 to 1965 (YHSI record: Dredge No. 12 per Green, L. (ibid.); Hogan 1979). The planning region also contains remnants of eight dredge camps dating from the early 1900s to 1940-65, which include steam equipment, boilers, a bunkhouse, gold room, workshop, sheds and other structures.

The dredges and camps represent the full spectrum of dredge mining technology throughout the corporate mining era. They provide important examples of the structures and equipment utilized by the various companies that existed prior to and after the merger that created Yukon Consolidated Gold Corporation. The landscape of ridged dredge tailings, which transformed the creek valleys of the goldfields, is another legacy that evokes fascination and continues to be an essential element in the interpretation of Klondike gold mining history. The most accessible and visible of these tailings are in the Klondike Valley from Hunker Creek to the confluence of the Yukon and Klondike rivers.

8.2.5.7 The Yukon Ditch System

The Yukon Ditch was a massive system of pipes, flumes (channels for water) and ditches. It was built to carry large amounts of water a distance of 70 miles from the Ogilvie Mountains to hydraulic mining operations on the hillsides of Bonanza Creek and the Klondike River. It was constructed from 1906 to 1909 and operated until 1933. There are 120 recorded remains of the Ditch, including the infrastructure and large artifacts used to construct and maintain the ditches (e.g., maintenance camps, syphons, pressure boxes, spillways, gate houses, tramways, winches and steam shovels). For example, Shovel Camp on Shovel Creek has a cookhouse, meat shed, bunkhouse, shop and barn where workers stayed and maintained the ditch, flumes, sandboxes and diversions (YHSI Records: Shovel Camp, per research material at Government of Yukon Heritage Branch Historic Sites Office; Klondike National Historic Sites YCGC Microfilm). A large portion of the ditch is within Tombstone Territorial Park, and one of the sites – the Dinner Gulch Maintenance Camp – is a Heritage Reserve.

The Little Twelve Mile hydroelectric plant at the confluence of the Little Twelve Mile and Chandindu rivers was built to aid in the construction of the rest of the ditch system and later supplied power to the dredges that worked on Bonanza Creek. The 24 buildings on the site include the power plant, transformer shed, sawmill, mess hall, bunkhouses, residences and tool sheds.

Built by the Yukon Gold Company and financed by the Guggenheim's of New York, the Yukon Ditch is symbolic of the evolution of mining from single claim individual miners to large lease corporate enterprise. It is significant as the first large-scale industrial project in Yukon, playing a critical role in the dredging and hydraulic mining of gold bearing gravel in the Klondike. In terms of scope of undertaking, the initiative has been compared to the Panama Canal. The Yukon Ditch is also unique in that it remains almost intact. It has high heritage value and, with interpretation, excellent potential as a tourist destination (Summary notes on Little Twelve Mile Power Plant, internal Yukon Government Historic Sites document; Hogan and Skuce 1992a).

8.2.5.8 The North Fork and South Fork Ditch System

Located 36 km east of Dawson City, the North Fork Ditch system diverted water from the North Fork of the Klondike River to provide power for the dredges in the Klondike Goldfields. The North Fork Ditch System and Power Plant was built from 1908-1911 by A.N.C. Treadgold and began operating in 1911. The ditch extended 10 km from the North Fork Intake on the Klondike River to the gatehouse above the power plant (YHSI Record: North Fork Ditch; Green 1977; Hogan and Skuce 1992*b*). The system used dams, diversions, spillways, pressure boxes and underground pipelines to convey water to the turbines in the power plant. There were also workshops, warehouses and cabins for workers, and roads for maintenance. The North Fork Ditch Spillway and Gate is a Heritage Reserve.

To increase capacity, an additional ditch and turbine was added to the North Fork Ditch system and Power Plant in 1935. This system of excavated ditch and dikes diverted water 26 km from the South Fork of the Klondike River. Lee Creek is the site of a ditch maintenance camp as well as a sawmill that supplied the Yukon Consolidated Gold Company with lumber (YHSI Record: Lee Creek YCGC Cabin per Hogan and Skuce 1992*b*; Interview with Newton Webster, Sept 1992; Interview with Ed Whitehouse, Dec 1992).

The North Fork Power Project provided electricity for all of the Yukon Consolidated Gold Company's mining operation as well as the City of Dawson until 1967 (YHSI Record: South Fork Ditch Discharge, per Interview with retired Power Plant Superintendent Newton Webster, Sept 1992, and Hogan and Skuce 1992*b*). As the cornerstone of an intricate network, it made a lasting contribution to the economic and community growth of the region.

8.2.5.9 The Acklen Ditch

The Acklen Ditch carried water from Moosehide Creek to a reservoir above a mine site in Thomas Gulch. Water rights were sold to the Yukon Gold Company, which constructed the flume and put it in operation in 1907. The site includes remains of the ditch, reservoir, flume and mine site, as well as hydraulic tailings. The ditch is still visible from the Klondike Highway and is part of the cultural landscape (YHSI Record: Acklen Ditch & Reservoir per Green 1977 and Dawson Daily News).

8.2.5.10 Bonanza, Adams Creek and French Gulf Dams

The Bonanza Dam is a large built-up earthen dam constructed by Guggenheim's Yukon Gold Company across the Bonanza Creek Valley in 1907. The dam provided a constant water supply for hydraulic mining on the hills and benches below Gold Hill, on Gold Hill, and on the hills and benches above Grand Forks (Electric Canadian 2013). The dam was neglected after the Yukon Consolidated Gold Corporation shut down operations in 1967. Its breaching in the early 1970s caused the sinking of Dredge No. 4, now a National Historic Site (YHSI Record: Bonanza Dam per Green 1977 and Interview with John Gould, 1990s (B. Hogan)).

The Adams Creek Dam is another early dam that was built on a tributary of Bonanza Creek by 1906, by the Matson Boyle Concession lessees (Hogan 1995). Water from the dam was used for hydraulic mining on the hills and benches of Bonanza Creek between the mouth of Adams and Boulder creeks (Electric Canadian 2013). There are four sites associated with this dam, including a gatehouse, steam shovel and syphon (YHSI record: Adams Creek Dam).

Adams Dam is an impressive example of construction and mining technology built by engineer and cartographer J.B. Tyrrell, who was designated a Person of National Historic Significance by the Historic Sites and Monuments Board (Parks Canada 2012*a*).

Fitted with stone and filled with earth, it displays superior workmanship compared to the Bonanza Dam. It is an excellent representation of the technology that supported early corporate hydraulic mining and has high interpretive potential for tourism (Hogan 1995).

There are also remains of a large dam at French Gulch, a tributary of Eldorado Creek, which fed the ditch system for French Hill (YHSI Record: French Gulf Dam).

These dams are representative of the extensive infrastructure that was needed to supply water for mining in the Klondike Goldfields.

8.2.5.11 The Whitehorse-Dawson Overland Trail

The Overland Trail was built in 1902 by the White Pass and Yukon Route as a winter route for mail, passenger and freight service between Dawson City and Whitehorse. This 330-mile long road was shorter and more reliable than travelling on the frozen Yukon River, and was often built on pre-established traditional First Nations trails. The Overland Trail used a system of relays, where horses were changed every 20 to 25 miles at roadhouses, and passengers stayed overnight and/or stopped for hot meals. The roadhouses also had barns and corrals, and farms sprung up along the trail to supply horse feed. The stage relay system was used until the 1920s, when the horses were replaced by Caterpillars and trucks. The Overland Trail continued to be used until the 1950s when new more direct highways were constructed. Within the planning region, there are remains of the trail – three roadhouses, two farms, two barns and a cabin. The Overland Trail connected Dawson with the outside world. It marked the beginning of a new era of transportation in the territory and reflects the growth of the territory over a span of fifty years (YHSI Record: Overland Trail, per Government of Yukon Heritage Branch. Research Files, Pamphlets, Maps, Brochures; Coutts 1980; Hogan and Skuce 1995).

8.2.5.12 The Ridge Road

The Ridge Road was an historic wagon trail that connected Klondike City/Dawson to most of the gold-bearing streams in the goldfields. It was the major supply route to the mines on Dominion and Sulphur Creeks from 1899 until 1902. The road has ten Heritage Reserves, including the northern portion of the heritage roadway and the spur to Grand Forks (see Table 6-5).

Forty miles long, the Ridge Road crossed the Klondike Valley to Jackson Gulch, followed the ridge between the Bonanza and Hunker Creek drainages to King Solomon Dome, and then continued on the ridge between Dominion and Sulphur Creeks to Granville. There were spur roads constructed down to the creeks, and entrepreneurs operated roadhouses, stores and freighting companies along the trail. The Ridge Road has the remains of 13 roadhouses and portions of the trail, as well as seven other associated sites.

The Ridge Road was the first government-built road in the territory. It played an important part in the early prosperity of the Klondike, and spurred development of the outlying mining area. It is representative of the transportation network that was developed to service the Gold Fields after the Klondike Gold Rush, which had a significant impact on the economic and administrative development of Yukon.

The Ridge Road Heritage Trail is a managed interpretive trail along the northern section of the old Ridge Road, and is popular with locals and visitors for hiking, bicycling and exploring heritage. It provides access to remains of the Trail Gulch diversion on the Yukon Ditch, and Soda Station on the abandoned Klondike Railway line (*Ridge Road Heritage Trail* pamphlet, Department of Tourism Heritage Branch; YHSI Record: 11 Mile Roadhouse; Robinson 1995).

8.2.5.13 Glacier Creek Trail and Sixty Mile

The Glacier Creek Trail connected Dawson to the Sixty Mile River mining area via Swede Creek. The Ogilvie/Sixty Mile area was another early mining region with associated roadhouses, cabins and informal communities. Existing resources have not been fully inventoried but preliminary work on Glacier and Miller Creeks has found approximately 25 sites including a dredge, dredge camp, small

community and North-West Mounted Police posts. The area has been mined continuously since 1894.

8.2.5.14 The Klondike Mines Railway

The Klondike Mines Railway (KMR) operated between 1906 and 1914, connecting Dawson City to Sulphur Springs, near the head of Sulphur Creek. This narrow gauge railway was 32 miles long and hauled mostly freight and some passengers, often hauling dredge parts to places where a dredge was being constructed (YHSI Record: 104 Below Discovery Station Site, per Johnson 1997; Hogan and Skuce 1992c).

The route crossed the Klondike River into Klondike City (Tr'ochëk) where the locomotive service shed, coal bunkers and sidings were located. From there it went up Bonanza Creek to Grand Forks, then via Carmacks Fork to Sulphur City. There were several stations or stops, water tanks, trestles and roadhouses along the route (YHSI Record: Dome YT, per *ibid*, and Robinson, Sally *History of Ridge Road*, Government of Yukon Heritage Branch, 1995). There are 33 sites associated with the KMR including remains of station buildings, a water tower, rails, rail beds, trestles, rail car trucks and flatcars, warehouse and roadhouse foundations, and boxcars. One site “Dome, Yukon” is a Heritage Reserve.

The KMR was built as an inexpensive freighting system to meet the need to move tons of supplies to the mines and dredge construction sites in the goldfields. The KMR ceased operations in 1914 when the dredges had been built and individual miners left as corporations took over the mining claims.

The KMR was the northernmost-chartered railway in Canada (Johnson 2012) and played an important role in the development of mining in the Klondike Goldfields (Hogan and Skuce 1992c). Although it operated for a mere eight years, its rise and fall reflected the change from individual to corporate mining. It is also representative of the larger transportation network that serviced the goldfields after the Klondike Gold Rush, which had a significant impact on the economic and administrative development of the Yukon.

8.2.5.15 Sternwheeler Graveyard

The repair depot for the Dawson shipyards of the British Yukon Navigation Company was located across the Yukon River. There are remains of seven sternwheelers and barges that were placed here during the early 1900s. This includes the sternwheelers Julia B., Schwatka, Seattle No. 3, Victoria, Tyrrell, and the Mary F. Graff. Most of the vessels have been stripped for salvage and all have deteriorated. The remains were studied by scientists from the Institute of Nautical Archaeology at Texas A&M University and have revealed surprising information about sternwheeler technology. For example, the Mary F. Graff is almost a classic Mississippi style, with a bank of three massive boilers running across the vessel; five of the boats were built in 1898, but two that were examined show very different hull configurations, and the steering on the Schwatka had been altered, likely to accommodate the strong currents and shallow waters of the Yukon (YHSI Record: Sternwheeler Graveyard per Koppel 2007).

The fleets of sternwheelers played a critical role in transporting people, goods and supplies in and out of the region and contributed to the economic prosperity and development of the Yukon. The site is part of the cultural landscape as viewed from Dawson and the river, and continues to be a resource for researchers and scientists as well as a destination for tourists and locals.

8.2.5.16 Cliff Creek and Coal Creek Mines and Railways

The Cliff Creek Coal Mine was located on Cliff Creek on the east side of the Yukon River, slightly downstream from the village of Forty Mile. The mine produced coal from 1899 to 1903. It was connected by a 1.75-mile railway along Cliff Creek to a shipping terminal on the Yukon River, where the coal was transferred from rail cars to chutes and then by barge to Dawson City. There are three

associated sites including remains of a landing cabin, foundations and the rail bed outline of a switchback system used for moving the railcars up the steep incline.

Enormous amounts of wood were cut in the years following the Klondike Gold Rush. As the population soared, trees were decimated to meet high demand for fuel for heating, electricity and steam generation. The Cliff Creek mine supplied local, much-needed fuel to provide electric light and power in Dawson. When these coal reserves were depleted in 1903, the owners developed the Coal Creek Coal Mine. This mine was connected by railway to the confluence of Coal Creek and the Yukon River, and produced coal for Dawson and the dredges until 1915. The site has remains of ten structures including a power house, three mine sites, railway bed, artifacts, soil piles and a water tank (YHSI: Coal Creek Mine, per Mitchell 1992).

The Cliff and Coal Creek Mines are representative of early resource extraction and the development of the power and transportation network that was needed for the rapidly increasing population of the Klondike region. Though not chartered, the Cliff Creek railway was the first railway in the Yukon Territory, and its locomotive was also the first to operate in the Yukon (Johnson 2012).

8.2.5.17 Grand Forks

The townsite of Grand Forks (Bonanza) was established at the confluence of Bonanza and Eldorado Creeks around 1897. Like other early communities that sprang up on gold-bearing creeks, it began with core services for small-scale miners (e.g., a roadhouse, general store, police station, post office and church). By 1900, Grand Forks had developed into a major centre including stores, hotels, blacksmith shops and freighting companies, and had its own hospital, school and library. When steam-powered technology started to boost gold production, a building boom occurred and telephones and electric lighting were added in 1902. Further expansion of Grand Forks occurred in 1905 at the start of corporate mining, but as the corporations developed their own infrastructure based in Dawson, businesses in Grand Forks declined and closed. The town site was mined in 1910 by electric elevator, and later by dredges and bulldozers. The site has remains of several cabins, collapsed buildings and foundations, and a cemetery.

Grand Forks was the earliest and largest community in the Klondike Goldfields, and the only one with its own municipal government. Its rapid rise and fall reflected the changes in the mining industry (Hogan 1995). One of the claims on which Grand Forks is situated is owned by the Klondike Visitors Association, which operates a “Free Claim” where tourists can pan for gold.

8.2.5.18 Granville

Granville (East) was another early settlement, located on Dominion near the mouth of Gold Run Creek. In 1900 it had roadhouses, a store, post office and North-West Mounted Police detachment, and by 1907 it had grown into a substantial community with telephones and many other amenities. When the corporations acquired the claims and small mining operations disappeared, the town went into decline and by 1913 was reduced to a few buildings. By the 1920s it had been replaced by a new community called Granville built by Treadgold at the mouth of Sulphur Creek. Granville (West) was a gold mining company camp that was later expanded by Treadgold’s Yukon Consolidated Gold Company to include new bunkhouses, machine shop, garage and superintendent’s residence, all linked by electrical and telephone lines to Dawson City. The community shut down with the company in 1966 (Hogan 1995).

There are 40 sites associated with Granville including foundations and remains of cabins, buildings, dredge parts and boilers (YHSI Record: Granville Central). Granville was occupied steadily for 60 years. It is representative of both the early settlements that served the miners and the later communities that were established around company camps to house the crews for the dredges. Granville is still within the memory of many Yukoners who worked or had connections there, and their descendants are part of our living communities today.

8.2.5.19 Stewart

The mouth of the Stewart River was the site of a traditional Na-Cho Nyäk Dun fish camp and an 1886 trading post. Stewart Island later gained importance as a trans-shipment point for the silver ore from Mayo, 250 km up the Stewart River (Government of Yukon 1996). The structures have been lost recently due to natural erosion of the riverbank, but there are remains of vessels in the slough.

In 1900, Stewart Island was a village of 30 people. It was used for gardening from 1909 to the 1940s, and in later years operated as a roadhouse and store. In the summer, Stewart was a centre for longshoremen for the sternwheeler Keno, trappers, woodcutters and miners who came by boat for supplies. The store closed down at the end of the sternwheeler era, when roads replaced river travel and fur prices dropped (YHSI Record: Stewart Island General).

Stewart Island is associated with inland river transportation in Yukon, and the development of Dawson and Mayo. It also reflects the continuing activities of trapping, gardening, trading and small-scale entrepreneurship that are integral to the economic life and identity of Yukoners.

8.2.5.20 Farms

As described in **Section 2 – Chapter 15 – Agriculture**, farming increased after the Klondike Gold Rush with the larger, stable population and more reliable network of roads and riverboats. Farming was concentrated around Dawson in the Klondike valley, on Klondike Island and the west side of the Yukon River. One of the largest farms was an agricultural settlement at Sunnydale Slough, which has remains including a log house, barn, outbuildings and wagon. Many farm remains have been impacted by roads or development (e.g., the Strachan/Fournier dairy and family farm near the current airport, which has eight associated sites). An early farm at Swede Creek was converted to an experimental station for grasses, grains and vegetables by the federal Department of Agriculture from 1917 to 1925, and then continued as a vegetable farm until 1945. This has not been inventoried but has potential for historic resources. There are also remains of two hay farms in the Indian River valley, which provided hay for the stages on the Overland Trail until the 1920s when the use of horses declined. These farms include a hay shed, bunkhouse, blacksmith shop, residences, horse barns and fields of brome grass (hay).

The growth and decline of farming reflected the importance of local agriculture in sustaining the newcomer population until the 1950s, when goods from the south became less expensive to obtain and most farms in the region shut down (Robinson 2010).

8.2.5.21 Graves and Cemeteries

Historic non-Aboriginal gravesites that have been identified within the planning region include a cemetery of approximately 17 graves at Gold Run Creek, with restored fence and markers (e.g., L. Siveltsen from Norway, dated 1903 and P. Hattiger, a member of the Yukon Order of Pioneers, dated 1927).

On Dominion Creek there is a fenced graveyard with approximately seven grave mounds at 8 Below Pup, which may be associated with the French-speaking miners of Little Quebec or Paris; a fenced graveyard near Remington Pup with an unknown number of graves associated with the Yukon Gold Company work camp and the Remington Roadhouse; and a small cemetery at 21 Below Pup with four graves with wooden markers and four mounds (one of the markers is for G. Hutton from Scotland who died in 1898).

There are also cemeteries at Forty Mile and Grand Forks. Individual gravesites with wooden crosses are located in the Indian River (C. Olsen, 1937) and Hunker Creek (H. Swalgrass from Wisconsin, 1899) areas. In the latter case, the grave is under Hunker Road with the marker on the road allowance; in 1999, the road was moved north one road width to protect the grave. Some of these graves have been decorated and maintained by family or friends.

8.2.5.22 Yukon River and White River

Areas along the Yukon River are also likely to contain historic resources related to transportation, trapping or farming. The Yukon River has not been inventoried and the likelihood of remaining historic resources is high, including the early settlement of Ogilvie (a Heritage Reserve), which is located on Ogilvie Island. The White River has also not been inventoried and is likely to contain roadhouses and wood camps related to sternwheeler traffic.

Heritage resources in more remote areas are not as thoroughly documented, but are less likely to be disturbed, and if intact are more likely to retain important information about their function and cultural context (Hogan 2003).

8.2.5.23 Heritage Routes and Sites identified in Tr'ondëk Hwëch'in Final Agreement

Sections 13.4.6.3 to 13.4.6.6 and Schedule C of the Tr'ondëk Hwëch'in Final Agreement (TH – DIAND 1998) specifically refer to several heritage routes and sites within TH Traditional Territory (also identified on maps in Appendix B of the Agreement). Many of the sites identified are also Settlement Land parcels.

Heritage Routes:

- Eagle to Old Crow
- Dawson to Fort McPherson
- Hän migration
- Dawson to Tetlin
- Dawson to Moosehide

Heritage Sites:

- Caribou fence areas in Blackstone Uplands/Chapman Lake area
- Old village site area at White River
- Traditional gathering site at Yukon River
- Archaeological/grave site at confluence of Stewart River and Yukon River
- Hän/Peel gravesites along Dempster Highway
- Traditional gathering site at Dempster Highway/Blackstone River
- Traditional food gathering/village sites at headwaters of Ogilvie River
- Traditional hunting/fishing village at Mission Island in Yukon River
- Billy Silas spiritual site at Rosebud Creek

8.2.5.24 Other Important Historic Areas and Routes

Due to the sheer volume of transient gold seekers that migrated to the Klondike during the gold rush period, historic era sites and artifacts are likely to be found nearly everywhere throughout the river and stream valleys of the region. This profusion of town sites, wood cutting camps and other supply stops for the freight boats and sternwheelers on the Yukon River, mine sites, railroads, and large hydro power generation facilities and infrastructure, was a substantially different type of land use than the previous subsistence and fur trade based economies (Thomas 2007).

Thomas (2007) notes some additional important areas throughout TH Traditional Territory that were utilized during the historic period, including:

- Black City and Calico Town (caribou camps in Blackstone uplands);
- Guggieville (an industrial site at the mouth of Bonanza Creek and Rabbit Creek, used from 1898-1930s);

- Halfway Creek town site, at the mouth of Halfway Creek (4 km down from Fifteenmile River), used from unknown times until the 1950s;
- Lee Creek (industrial site on Klondike River, 1911-1967);
- Seela Pass (used as a travel route and for caribou hunting; headwaters of Chandindu, Fifteenmile and Blackstone Rivers); and
- Tz'ii zhuu/Log Cabins Place (Ogilvie River; used as a winter camp 1890s-1930s).

Throughout the period of the Klondike Gold Rush and related industrial development, the region continued to be used for subsistence purposes and by people engaged in the fur trade. Many economic opportunities for the region's First Nations were created by the growing population of the Klondike. Aside from wage labour, the most significant demand created by the new population was a need for game meat. Because of this, traditional hunting areas were used more intensively, particularly in the North Klondike and Blackstone Uplands, and consequently site occupations were transformed from smaller camps to larger semi-permanent villages, such as Black City and Calico Town, where people would congregate to process larger quantities of game for resale in Dawson City and Fort McPherson (Thomas 2007).

For example, Tr'ondëk Hwëch'in note that while their Hän-speaking ancestors were known as "People of the River," their traditional territory also included the high mountain country to the north and south of the Yukon River valley. In the vast area that now includes Tombstone Territorial Park, they had close ties with the Gwich'in and both groups relied on two annual migrations of the Porcupine caribou herd to supply them with food, clothing and much else. After the Klondike Gold Rush, hunters sold tonnes of caribou meat in Dawson City and then returned to the Blackstone country to trap for fox, wolf and wolverine. Black City, also called Blackstone City, was one of the camps used as bases for hunting, trapping and travelling on the land by the Tr'ondëk Hwëch'in, Tukudh Gwich'in and Tet'it Gwich'in (Tr'ondëk Hwëch'in 2013*b*).

Other historic sites related to trapping activities are expected to be widely dispersed in the landscape, particularly as this became a specialized and highly lucrative pursuit in the decades preceding World War II. Land use patterns associated with harvesting of furs typically sees individuals or small groups distributing themselves widely across the land, establishing central camps from which many satellite camps are occupied for brief, but fairly regular time periods.

Associated with trapping are a variety of habitation types and improvised trapping features. Cabins were often used as central habitation types, but short-term habitations were often small, quickly constructed brush houses and lean-tos and wall tent camps. The distribution of late fur trade sites correlates with the known locations of historic era trap lines and trail networks, some of which may be of some antiquity. Records of trapping locations and trails may be found in government archives or in First Nations' lands offices (Thomas 2007).

As well, long before non-native traders visited the Upper Yukon River basin in the mid-19th century, the Hän were part of an extensive trade network with their neighbours to the north, south and west. They traded birchbark, red ochre, hides and salmon for native copper, obsidian and dentalium shells. When the first non-native traders visited Hän territory, they met people who had never seen a white person but were familiar with kettles, beads, tea and tobacco. Jack McQuesten of the Alaska Commercial Company set up a post at Fort Reliance in 1874. The Hän adjusted their way of life, trapping additional fur for trade and spending part of each year near the post (Tr'ondëk Hwëch'in 2013*b*).

About eight years later, prospectors began moving into the Yukon River basin seeking gold. McQuesten and his partners, Al Mayo and Arthur Harper, began stocking mining supplies and their posts made it possible for the miners to overwinter in the north. Soon after the rush to the new diggings, a bustling community of miners, merchants and entrepreneurs grew up at the mouth of the

river. First Nations people, attracted by the goods and services of the new settlement, helped build the new trading post and supplied meat to the miners. Women sold hide and fur clothing to the newcomers and in some cases married prospectors (Tr’ondëk Hwëch’in 2013*b*).

The following Table 8-4 shows other lands designated for the preservation of heritage resources. Many of them are located within the municipal boundary of Dawson City and are therefore “excluded” from regional plan recommendations, but are included here to note the wealth of significant heritage resources in the Dawson area.

Table 8-4 Lands designated for the preservation of heritage resources

Name	Location	Designation Date	Statute	Heritage Values
Tr'ochëk National Historic Site	Confluence of Yukon and Klondike rivers	November 2001	Historic Sites and Monuments Act, RSC, 1985, c H-4	Representative of the Hän cultural landscape of the middle Yukon River valley; speaks to the Hän people's use and understanding of their traditional territories and the land's role as source and carrier of their traditional knowledge ²
Dawson Historical Complex National Historic Site	Dawson City	1959; 1969	Historic Sites and Monuments Act, RSC, 1985, c H-4	Associated with the full extant (1896-1910) and impact of the Klondike Gold Rush ³
S.S. Keno National Historic Site	Dawson City	1958	Historic Sites and Monuments Act, RSC, 1985, c H-4	Representative of the riverboats used on lakes and rivers of Yukon; exhibits design and application of steam-powered sternwheeler technology ⁴
Former Territorial Courthouse National Historic Site	Dawson City	1980	Historic Sites and Monuments Act, RSC, 1985, c H-4	Representative of the judicial institution in Yukon; substantial frame building conveys air of dignity and stability within community ⁵
Old Territorial Administration Building National Historic Site	Dawson City	June 2001	Historic Sites and Monuments Act, RSC, 1985, c H-4	Symbol of establishment of first substantial, ongoing linkage with southern Canadian society; federal commitment to administration of north-western Canada; example of buildings produced under federal Public Works program at turn of century ⁶

² Tr'ochëk National Historic Site Commemorative Integrity Statement Review Draft, January 21, 2003, p.11.

³ Dawson Historical Complex National Historic Site Commemorative Integrity Statement, September 3, 1997, p. 3.

⁴ SS. Keno Commemorative Integrity Statement, July 7, 1997 p.3.

⁵ Former Territorial Courthouse National Historic Site Commemorative Integrity Statement, August 30, 2010, p.5.

⁶ Old Territorial Administration Building National Historic Site of Canada Commemorative Integrity Statement, July 2004, p.9.

Carnegie Library National Historic Site	Dawson City	1959; 1969	Historic Sites and Monuments Act, RSC, 1985, c H-4	Associated with full extant and impact of Klondike Gold Rush and its impact on Canadian history, and a rare surviving example of a metal clad building ⁷
St. Paul's Anglican Church National Historic Site	Dawson City	1959; 1969	Historic Sites and Monuments Act, RSC, 1985, c H-4	Served spiritual needs of miners; one of few Dawson buildings still used for original function ⁸
Canadian Bank of Commerce National Historic Site	Dawson City	1959; 1969	Historic Sites and Monuments Act, RSC, 1985, c H-4	Symbolizes role of financial institutions in Dawson's history from Klondike Gold Rush to 1989; image of stability; rare pressed metal façade ⁹
Yukon Hotel National Historic Site	Dawson City	1982	Historic Sites and Monuments Act, RSC, 1985, c H-4	Typical of commercial structures built at the height of the gold rush ¹⁰
Yukon Sawmill Yukon Historic Site	Dawson City	August 23, 2005	Historic Resources Act RSY 2002, Ch 109	Most extensive and longest operating early sawmill in Yukon; representative of role that lumber and mining industry played in the growth and development of Dawson City as supply centre and capital of Yukon ¹¹
Dawson Telegraph Office Yukon Historic Site	Dawson City	August 23, 2005	Historic Resources Act RSY 2002, Ch 109	First and only architecturally (Fuller) designed telegraph office in Yukon; represents development of major communications system connecting Dawson to the south ¹²
P. Denhardt Cabin Municipal Historic Site	Dawson City	Sept. 26, 2012	Historic Resources Act RSY 2002, Ch 109, Part 5: Sec 39	Architectural value -rustic style and functional design; and association with early development of Dawson City ¹³

⁷ Carnegie Library National Historic Site Commemorative Integrity Statement, April 2000, p.6

⁸ Dawson Historical Complex National Historic Site Commemorative Integrity Statement, September 3, 1997, p. 14.

⁹ Dawson Historical Complex National Historic Site Commemorative Integrity Statement, September 3, 1997, p. 14.

¹⁰ Dawson Historical Complex National Historic Site Commemorative Integrity Statement, September 3, 1997, p. 13.

¹¹ Yukon Sawmill Company Office Statement of Significance <http://www.historicplaces.ca/en/rep-reg/place-lieu.aspx?id=4832&pid=0> (accessed Feb. 5, 2013).

¹² Dawson City Telegraph Office Statement of Significance <http://www.historicplaces.ca/en/rep-reg/place-lieu.aspx?id=3920&pid=0> (accessed Feb. 5, 2013).

¹³ P.Denhardt Cabin Statement of Significance , Draft Feb. 4, 2013.

Two sites located within the municipal boundary, Tr'ochëk and Moosehide, are extremely important to Tr'ondëk Hwëch'in culture and heritage and TH citizens continue to have enduring ties to these special places. The descriptions below are written from a TH perspective (Tr'ondëk Hwëch'in 2013b):

Tr'ochëk – the point of land between the Klondike and Yukon Rivers – is the heart of Tr'ondëk Hwëch'in traditional territory. For hundreds of years, our people came here to fish for salmon, hunt moose up the Klondike Valley, and meet with neighbouring First Nations with whom our ancestors would feast, trade and intermarry.

During the Klondike Gold Rush years, a horde of newcomers displaced our people from Tr'ochëk. This place became known as Lousetown or Klondike City. At different times, Tr'ochëk hosted a bustling fishing camp, a gold rush log cabin settlement, an infamous red light district, a railway terminus, a sawmill, farming operations, a placer mine and now, once again, a seasonal fish camp.

Two years after the Hän move from Tr'ochëk, the site had changed beyond recognition. Gone were the fish racks, salmon traps and cooking hearths. Now there was a dense clutter of tents, cabins, caches, a sawmill, brewery, saloon, store, and the one-room cribs of prostitutes. Although local businessmen called the new community Klondike City, most people knew it best as the infamous red light district of Lousetown. The new settlement became the terminus for the Klondike Mines Railway, with the tracks running right up the main street and a railway bridge spanning the Klondike River.

The importance of Tr'ochëk in our history and culture is formally recognized through the Tr'ondëk Hwëch'in Final Agreement and more recently through its designation as a National Historic Site. Today, we seek to protect Tr'ochëk's cultural resources and create a peaceful place of natural beauty for relaxation and contemplation where our citizens and others can learn of Tr'ondëk Hwëch'in history and culture.

Under the Tr'ondëk Hwëch'in Final Agreement (Chapter 13, Schedule B), Tr'ochëk was designated a First Nation Heritage Site by the Tr'ondëk Hwëch'in with Canada and Yukon as of July 1998. The agreement states that the primary purpose of the site “is to recognize, protect, enhance and celebrate Hän culture and history.”

In November 2001, the Historic Sites and Monuments Board of Canada recommended that Tr'ochëk be designated as a national historic site. It was subsequently designated a National Historic Site of Canada by the Heritage Minister on July 19, 2002. Since that time, there have been numerous historic and planning studies of the site, archaeological work and a major community oral history project.

Moosehide, located five kilometres downriver from Dawson, is an excellent place for a settlement. It is on a high bench well above flood level. There are good views up and downriver, ideal for spotting game. Nearby Moosehide Creek provides fresh water. This site was our main home for over 50 years.

In the spring of 1897, our grandparents and great grandparents began building cabins at Moosehide as well as a church and mission house for resident Anglican missionaries. While the settlement was their base, they also travelled on the land, spending time at fish camps, trap lines, hunting camps and favourite berry patches.

Men took seasonal jobs with the sternwheelers, on the Dawson dock and at wood camps. Women had no trouble selling beadwork and hide clothing to Dawson residents. Children attended the day school but many were sent to the residential school at Carcross. The settlement became a lively place during festival times such as Christmas and Easter when

other First Nation people came to visit. The Gwich'in, Tanana, Northern Tutchone and other Hän stayed at Moosehide while they traded at Dawson.

When the sternwheeler era ended, the school closed and in the 1950s people gradually moved to Dawson to be closer to jobs and schools. Moosehide remains a special place to our people.

Numerous TH Settlement Land parcels were selected for their heritage resources values and importance for traditional economic pursuits. These include gathering sites for plants and medicines, traditional hunting and fishing camps, trapping areas, wood harvesting sites (some that supplied the sternwheelers), burial sites, village sites, resting places while travelling, and traditional gathering locations. Many of these parcels are used for educational purposes today (e.g., youth harvesting camps), and many also contain recorded archaeological sites and features (Tr'ondëk Hwëch'in 2012a).

8.3 Resource Values

8.3.1 Natural Value

Heritage resources, in the broader First Nations concept, are valued for their ability to maintain people's connection to the land. Stewardship of the land maintains ecological integrity and respects natural/ecosystem services.

The major drainage basins of unglaciated northern and central Yukon preserve exceptional evidence of Ice Age animals and environments. As modern rivers cut down through the sediments, the frozen silts containing bone and plant materials are exposed. Fossil bones that wash out of the silt bluffs along the rivers of the region may be found re-deposited on point bars on rivers. Fossils of invertebrate animals (e.g., shells, trilobites), vertebrates (e.g., fish) and plant impressions may be discovered in bedrock throughout the Yukon, especially in alpine areas with abundant outcrops.

8.3.2 Traditional Value

The Tr'ondëk Hwëch'in have traditionally occupied, travelled or harvested in virtually every corner of the planning region. Today this presence is reflected in many physical and non-physical indicators such as trails, name places and archaeological sites. Traditional use of medicinal plants, edible plants, fish, furbearers and big game continue to have strong cultural importance and help to maintain a strong connection between TH people and the land.

For the Tr'ondëk Hwëch'in, heritage is rooted in the landscape. Taking care of the land is critical as all the land's resources are a valuable part of this heritage. TH heritage is kept alive and protected when TH people hunt, fish and harvest. This stewardship protects the land and its resources (Tr'ondëk Hwëch'in 2012a).

The broader definition of heritage resources advocated by Tr'ondëk Hwëch'in also includes traditional economic activities (e.g., hunting, fishing, trapping, berry picking and harvesting medicinal plants). Increased levels of access could impact these culturally significant areas positively (e.g., making it easier to get to areas of importance) or negatively (e.g., also opens these areas to other land uses and users).

Section 2.2 of the *Tr'ondëk Hwëch'in Land and Resources Act* (Tr'ondëk Hwëch'in 2004) defines a "traditional activity" as "an activity undertaken by a citizen on a non-commercial basis for the purpose of obtaining food or providing for subsistence, or for a ceremonial, spiritual or cultural purpose, and any activity incidental thereto, and includes trapping." The heritage resources of the region are highly valued for their role in maintaining opportunities for traditional economic activities. The value of highest priority to TH Elders is the ability to be active stewards of the land in traditional ways (Tr'ondëk Hwëch'in 2012a). Continuing use of the land and its heritage resources maintains

knowledge systems, provides educational values, promotes social relations and maintains a sense of place.

Standard mitigation measures for protection of heritage resources include (Tr'ondëk Hwëch'in 2011):

- *Avoidance* – Complete avoidance of an area is often the most favourable mitigation if possible. This mitigation is recommended not only for heritage artifact sites, but also for places with spiritual importance, important harvest and wildlife areas, or other areas identified as having heritage importance to the First Nation.
- *Buffering* – This mitigation protects known heritage resources with a minimum 30-metre buffer. This is also the case for any found heritage resources.
- *Mitigation study* – This mitigation involves the collection and analysis of a systematic sample of the site prior to its partial or total destruction. Significant heritage sites located either in unavoidable conflict with a proposed development or exposed during construction will require an appropriate level of impact mitigation study.

8.3.3 Socio-Cultural Value

The Yukon's heritage sites and resources are a tangible record of the people, events and activities that have shaped our way of life and our environment. Historic sites represent the technologies, designs and ideas that are the framework of our society and the basis for our future. Many sites are landmarks within a community, are associated with remarkable people or historical events, or are places that have cultural, social, scientific or architectural significance (Government of Yukon 2013*b*).

Heritage resources are places of profound importance. For example, the Government of Canada describes National Historic Sites in this way (Parks Canada 2013*b*):

They bear witness to this nation's defining moments and illustrate its human creativity and cultural traditions. Each national historic site tells its own unique story, part of the greater story of Canada, contributing a sense of time, identity, and place to our understanding of Canada as a whole.

National historic sites, located in all provinces and territories, can be found in almost any setting - from urban and rural locales, to wilderness environments. They may be sacred spaces, battlefields, archaeological sites, buildings or streetscapes. They can range in size from a single structure to linear canals spanning great distances. Many national historic sites are still used today for work and worship, commerce and industry, habitation and leisure.

8.3.4 Economic Value

The heritage resources of the Dawson area are one of the main reasons for tourists to visit, and provide substantial economic benefits to the region's businesses and residents. People from across the world enjoy looking at the historic buildings, learning about the Klondike Gold Rush and participating in outdoor activities. First Nations culture and heritage is also an important attraction for the planning region.

The Dänojà Zho (Long Ago House) Cultural Centre in Dawson City is a dramatic exception to the town's gold rush theme by drawing on the much older traditions of the Tr'ondëk Hwëch'in. The contemporary architecture interprets salmon drying racks and winter shelter and is surrounded by Yukon wild flowers, berry bushes and trees. The Centre overlooks the Yukon River and provides a magnificent view downriver to Moosehide Village. Dänojà Zho officially opened in July 1998 and is an important visitor attraction as well as a community gathering place. Visitors have an opportunity to learn about TH culture and heritage from guided tours, displays, films, storytelling and other special events. The gift shop sells locally handcrafted clothing, footwear and jewellery (Klondike Visitors Association 2013). The centre is described by Olson (2009) in Tr'ondëk Hwëch'in (2013*b*) as:

...a symbol of our history, our perseverance, pride and hope. It rose from the desire to make a strong presence in the traditional territory of the Tr'ondëk Hwëch'in that would speak to and for us and would not be bound to the "gold rush" era. The Centre would show that we are a strong people.

The traditional economy produces a range of cultural products: snowshoes, clothing, footwear, harvesting gear (e.g., fish traps and snares), tools (e.g., knives, sewing implements, scrapers, twist drills and fire drills), weapons (e.g., bow and arrow, spears and clubs), boats (e.g., dugout canoe, birch bark canoe and moose skin boat), cooking ware, baskets, hide dome shelters and arts and crafts products. Many of these products require raw resources derived from traditional harvesting such as furs, hides, bones or antler. The knowledge, skills and abilities to produce these goods have their own value from a heritage resource value perspective. The market for authentic Aboriginal products such as these exists and continues to develop. There are opportunities to produce and sell these types of goods as well as develop markets through brand value (Tr'ondëk Hwëch'in 2012a).

This concept is not something new – First Nations people have always been flexible and able to adapt to changes in their environment. When newcomers arrived in the Yukon, people were able to take advantage of a number of new economic opportunities, including traditional crafts mixed with participation in a cash economy.

Furthermore, as described by Beaumont and Edwards (undated):

[First Nations people] also acted as guides and assisted foreign traders and new people moving into the country. During the Klondike Gold Rush many northern First Nations people hunted and sold meat in great quantities to the gold seekers. Trapping also became a way to make money as opposed to a method for harvesting food and furs for home use. When steamboats began to run on the Yukon River several people worked on the boats or in wood camps used to fuel the boats.

Employment in the cash economy meant that some people could not travel about as frequently as they had in the past. Resources that would have been gathered during the seasonal round were replaced by money and a need to purchase some goods. Most were still able to practice some level of traditional subsistence due to the seasonality of most of these jobs.

...the women of Moosehide had quickly mastered the knack of thriving in a market of shortages and high demand. In December 1897, they were earning \$20 to \$40 per day making moccasins and gloves for the miners. Within a few months, the price of native moosehide moccasins had escalated from 75 cents to seven dollars. Moosehide gloves now cost eight dollars.

The “Klondike” region is also one of eleven sites identified in Canada’s 2004 official Tentative List for World Heritage Sites as having strong potential to meet the high standards required for nomination under UNESCO. The site would emphasize both the First Nations cultural landscape and the mining landscape, as well as the region’s significant Ice Age palaeontology, history and fossils. The regional tourism industry identifies this designation as the primary opportunity for growth in the sector going forward, with potentially significant economic benefits. The *Regional Economic Development Plan for Tr'ondëk Hwëch'in Traditional Territory* (Klondike Development Organization 2013) identifies nomination advancement as a priority project for implementation. In 2013 to 2014, TH will lead development of the Klondike UNESCO World Heritage Site Feasibility Assessment and Strategic Plan, which will examine potential economic benefits of the designation as well as financial costs for the formal nomination process and future site management. Other project partners include the City of Dawson, Government of Yukon, Parks Canada, Klondike Visitors Association and private businesses. The final strategic plan will include a recommendation from the

Steering Committee to the regional governments on whether to proceed with pursuing the nomination (Klondike Development Organization 2013).

Other initiatives for heritage resources identified in the *Regional Economic Development Plan* (Klondike Development Organization 2013) include a pilot season of evening entertainment at the Palace Grand Theatre (part of the Dawson Historical Complex); expanded Dawson region tourism marketing strategy by the Klondike Visitors Association, specifically moving beyond the Klondike Gold Rush theme to include TH heritage, local arts and culture, and wilderness adventure; and a focused TH Heritage Tourism Initiative. Specifically, the plan notes that:

Tr’ochek National Historic Site of Canada, Forty Mile Heritage Site, Tombstone Territorial Park and Danoja Zho Cultural Centre combined have the critical mass to act as the foundation of a unique First Nation heritage tourism feature that will appeal to new and existing visitor markets, including the important cultural traveller segment.

Plans also include support for TH Citizen enterprises, which could deliver the key accommodation, transportation, interpretive guide and other experiential services required.

Recent federal budget cuts to Parks Canada resulted in the cancellation of guided tours for Dredge No. 4 and other Yukon historic sites. Parks Canada has now outsourced these tours to private companies or tour operators. Implications of budget cuts to the management of collections in Dawson are unclear.

The management and interpretation of heritage resources also creates direct employment opportunities such as heritage site caretakers, TH heritage department employees, summer student positions, Dänojà Zho Cultural Centre interpreters and staff, and archaeological fieldwork assistants.

8.4 Resource Management

8.4.1 Regulatory Framework

The following sections note legislation and regulations that specifically address protection of heritage resources. Determination of potential impacts of projects on heritage resources prior to land disposition decisions is accomplished through the *Yukon Environmental and Socio-economic Assessment Act* (YESAA) process described below. Additional protocols and requirements may also apply if work is being conducted on First Nation Settlement Land.

8.4.1.1 *Historic Sites and Monuments Act* (Canada)

The *Historic Sites and Monuments Act* (RSC 1985, c H-4) provides that sites which demonstrate nationally significant aspects of Canada’s history may be considered by the Historic Sites and Monuments Board of Canada (HSMBC), and recommended to the Minister of Environment for designation as a National Historic Site. More information on the HSMBC can be found below in subsection 8.4.2.4 Boards and Councils.

National designation does not provide formal protection to the site and is commemorative in nature only. Historic buildings that are owned by the federal government may also be designated by the Federal Heritage Buildings Review Office (FBHRO) as “Classified” or “Recognized” for their historical, architectural and environmental values (Government of Yukon 2013a).

8.4.1.2 Tr’ondëk Hwëch’in Final Agreement and *Tr’ondëk Hwëch’in Land and Resources Act*

Under Chapter 13 of the Tr’ondëk Hwëch’in Final Agreement (THFA), the First Nation owns and manages all heritage resources that reside on Settlement Land. Ethnographic heritage resources within TH Traditional Territory that are directly related to the culture and history of Yukon Indian

People are also owned and managed by the First Nation. Schedules A and B to Chapter 13 in the THFA identify certain sites (i.e., Tr'ochëk and Forty Mile/ Ch'ëdä Dëk) as specifically identified for designation as Historic Sites. The Forty Mile, Fort Cudahy and Fort Constantine site is in progress towards territorial designation, and is jointly owned and managed by TH and the Government of Yukon.

The *Tr'ondëk Hwëch'in Land and Resources Act* (Tr'ondëk Hwëch'in 2004) provides further protection of heritage resources from disturbance on Settlement Land. Section 9(d) states that no person shall disturb a burial site, a site of palaeontological or archaeological interest, a historic site or a heritage site unless permitted under a TH law. Section 54(c) specifies that every grant of a permit or land disposition is subject to the right of TH Council to vary the terms as required for the protection and preservation of burial sites, sites of palaeontological or archaeological interest, or of historic or heritage importance.

On non-Settlement Land, Tr'ondëk Hwëch'in government manages the protection of ethnographic moveable heritage resources within its Traditional Territory.

8.4.1.3 *Territorial Lands (Yukon) Act and Land Use Regulation*

Under Section 21 of the act, the Commissioner in Executive Council may set apart and appropriate territorial lands for the sites of places of burial grounds and historic sites. Pursuant to that section, the *Land Use Regulation* requires that no permittee shall conduct a land use operation within 30 m of a known monument or a known or suspected archaeological site or burial ground, unless expressly authorized in their permit or in writing by an inspector (Section 9). If a suspected archaeological site or burial ground is unearthed or otherwise discovered in the course of a land use operation, the permittee must immediately suspend the land use operation on the site and notify the engineer or an inspector of the site's location and nature of any unearthed materials, structures or artifacts (Section 15).

8.4.1.4 *Historic Resources Act (Yukon) and Archaeological Sites Regulation*

The purpose of the act is defined in Section 1(1) as:

...to promote appreciation of the Yukon's historic resources and to provide for the protection and preservation, the orderly development, and the study and interpretation of those resources.

Historic resources are defined in Section 2 as:

- (a) a historic site [i.e., one officially designated under Section 3];
- (b) a historic object [defined in Section 61 as an archaeological or palaeontological object that has been abandoned, or an abandoned object that is designated as a historic object by the Commissioner]; 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.

These historic resources are protected from disturbance under the act and the associated *Archaeological Site Regulation*. It is unlawful to actively search for, excavate, disturb, or alter a historic site or remove artifacts from a site without a permit issued under the regulation. The *Archaeological Sites Regulation* applies to all Crown lands and waters in Yukon other than those within the boundaries of a national park, lands set aside as a national historic site, or lands identified as exempt in the Schedule. The regulations define an archaeological site as “a site where an archaeological object is found” (Section 1), and no survey or documentation of archaeological sites may be conducted without a permit.

Some historic sites are officially designated as such. Historic resources not privately owned and on Commissioner's land are managed by the Government of Yukon, Heritage Branch, Historic Sites Unit on a case by case basis. There are also 15 Heritage Reserves within the planning region (see **Section 1 – Chapter 6, Table 6-5**) set aside by the Government of Yukon Lands Branch for an indefinite term for the use of a historic site, and managed jointly by the Lands Branch and Cultural Services Branch.

8.4.1.5 *Yukon Environmental and Socio-economic Assessment Act (YESAA)*

Under the act, socio-economic effects include effects on economies, health, culture, traditions, lifestyles and heritage resources and must be considered by the proponent, the assessor, and the decision body that determines whether to allow the project to proceed. YESAA Section 2(1) defines a heritage resource as:

- (a) a moveable work or assembly of works of people or of nature, other than a record only, that is of scientific or cultural value for its archaeological, palaeontological, ethnological, prehistoric, historic or aesthetic features;
- (b) a record, regardless of its physical form or characteristics, that is of scientific or cultural value for its archaeological, palaeontological, ethnological, prehistoric, historic or aesthetic features; or
- (c) an area of land that contains a work or assembly of works referred to in paragraph (a) or an area that is of aesthetic or cultural value, including a human burial site outside a recognized cemetery.

In addition, Section 42(1) of the act states that the assessor must take into consideration:

- (g) the need to protect the rights of Yukon Indian persons under final agreements, the special relationship between Yukon Indian persons and the wilderness environment of Yukon, and the cultures, traditions, health and lifestyles of Yukon Indian persons and other residents of Yukon.

Project proposals that require a disposition of land in order to be undertaken often include activities that may have longer term or even permanent effects on heritage resources (e.g., destruction of heritage resources from land clearing, reduced or lost access to heritage resources or sites, or changes to biophysical characteristics of project area that affect heritage resources). YESAB Operational Policy No. 2011-01 recognizes this and requires that a "heritage resource assessment" be included with any such proposal to ensure that the potential effects are identified and properly assessed. The policy notes that, generally, areas of increased heritage potential are in proximity to water bodies, creeks and rivers, wetlands, on terraces, ridges and knolls with viewpoints and recommends the proponent contact local First Nations to seek their input (YESAB 2011).

For projects where the assessment determines that significant adverse effects may occur on heritage resources, the proponent and/or YESAB may propose various mitigation measures to eliminate, reduce or control these adverse effects including (YESAB 2011):

- Avoidance measures such as realigning boundaries to establish a buffered area between the project activities and the heritage resources;
- Site protection where a heritage site may be protectively covered or stabilized to prevent site destruction; and
- Systematic data recovery, such as documenting heritage resources before disturbing or removing them.

8.4.1.6 *Quartz Mining Act and Placer Mining Act and Land Use Regulations*

Under the *Quartz Mining Act* (QMA) and the *Quartz Mining Land Use Regulation* a proponent is required to provide adequate information about potential significant adverse effects on heritage resources, as well as identify proposed mitigation measures for any Class 2, 3 or 4 program (see **Section 2 – Chapter 13 – Minerals** for a description of Program Classes under the QMA). New access road development is an example of an activity with high potential to impact heritage resources.

Under the *Placer Mining Act* and the *Placer Mining Land Use Regulation* a project proponent is required to provide information on any potential adverse effects to heritage resources as a result of the project. Areas that have not been previously mined or landscapes with known high archaeological values would be of particular concern for new projects.

Both of these regulations require that proponents avoid and protect known heritage resources. Activities must not be carried out within 30 m of a known archaeological or palaeontological site. Any new artifacts or sites discovered during the course of a project must be flagged and a 30 metre buffer zone established to protect the site from any further disturbance. The discovery must also be reported to Yukon and/or First Nations governments.

8.4.2 Policy Direction

8.4.2.1 Government of Canada

Parks Canada has an important role in the planning region given the wealth of officially designated historic sites and vast amount of heritage resources. Parks Canada's mandate includes protecting the commemorative integrity of the sites it administers and operates. This means preserving the site's cultural resources, communicating its heritage values and national significance, and kindling the respect of people whose decisions and actions affect the site. The *Standards and Guidelines for the Conservation of Historic Places in Canada* (Parks Canada 2010) is a guiding document and is based on internationally recognized conservation principles for preservation, rehabilitation and restoration. The guidelines address four types of resources (cultural landscapes, archaeological sites, buildings and engineering works) as well as materials, and provide practical advice for decision-making.

Some key definitions from this document include (Parks Canada 2010):

- *Historic Place*: a structure, building, group of buildings, district, landscape, archaeological site or other place in Canada that has been formally recognized for its heritage value.
- *Heritage Value*: the aesthetic, historic, scientific, cultural, social or spiritual importance or significance for past, present and future generations. The heritage value of a historic place is embodied in its character-defining materials, forms, location, spatial configurations, uses and cultural associations or meanings.
- *Character-defining Element*: the materials, forms, location, spatial configurations, uses and cultural associations or meanings that contribute to the heritage value of a historic place, which must be retained to preserve its heritage value.

Parks Canada has also developed guiding documents specifically for the Dawson Historical Complex, including design standards for buildings.

8.4.2.2 Government of Yukon

The Government of Yukon's management responsibilities for heritage resources under the provisions of the Umbrella Final Agreement (UFA) Chapter 13 and the *Historic Resources Act* are outlined in the *Operational Policy for Heritage Resources Management on Yukon Lands* (Government of Yukon 2010a). Under the UFA, ownership of heritage resources generally follows ownership of the land, with the exception of ethnographic moveable heritage resources directly related to the culture and history of Yukon Indian People, which are owned by the First Nation in whose traditional

territory the objects are found. Heritage sites designated under the *Historic Resources Act* or identified in First Nation Final Agreements are protected, and development and other activities are addressed in the Management Plans for those sites. Non-designated sites and non-moveable heritage resources not identified in the Final Agreements are managed under the *Historic Resources Act*.

The *Historic Resources Impact Assessment and Mitigation Requirements Relating to Land-Altering Developments* (Government of Yukon 2003) is another policy document to fulfill the mandate of preservation and protection of historic sites as identified by the Umbrella Final Agreement and the *Historic Resources Act*. The objective is to avoid unnecessary impacts on historic sites; preserve sites wherever possible; and to promote recovery of information and artifacts from sites that cannot be preserved (Government of Yukon 2011a). It outlines the responsibilities of developers, which include sufficiently detailed studies to enable preparation of an historic resource impact assessment report and all mitigation measures deemed appropriate, as well as responsibilities of the Government of Yukon's Historic Resources Unit including technical and professional services for impact assessments and recommendations for mitigation measures. The document also provides clarity on financial responsibilities of government and industry. Government of Yukon's Department of Tourism and Culture is responsible for the costs of past and ongoing baseline studies, administrative review, and routine surveillance and monitoring. Industry is responsible for studies specific to an individual project, provision of information required under environmental assessments (including costs of research that industry must buy from government if not available elsewhere), and inspection and reporting costs. Government and industry are to share the cost of accelerated baseline studies (Government of Yukon 2003).

Guidelines Respecting the Discovery of Human Remains and First Nation Burial Sites in the Yukon (Government of Yukon 1999) provides direction and information on the actions to take upon discovering a burial or grave site. Government agencies and First Nations maintain an inventory of these sites so that they are not disturbed. However, many undiscovered sites are unmarked and could be damaged or destroyed through land use activities (Government of Yukon 1999).

Historic sites and heritage resources are protected under the *Historic Resources Act*, and YESAA is used as a tool to ensure heritage resources are considered and any impacts mitigated for proposed development projects. Other than sites specifically identified for protection, there is a general recognition that not all heritage sites are known and that heritage resources can be discovered anytime at any place, in which case they are reported accordingly and dealt with on a case-by-case basis. The use of best management practices are encouraged, including avoiding or using extra caution in areas with known or inferred high potential for heritage resources and utilizing a 30 m buffer around any known resources. Government of Yukon staff may conduct heritage resource assessments for specific projects, with the goal of maximizing knowledge of heritage values in advance of landscape disturbance.

Since the proclamation of the *Historic Resources Act* and establishment of the Yukon Palaeontology Program in 1996, the Government of Yukon has the mandate to manage, collect and preserve fossils uncovered on Yukon lands during placer gold mining activities in the Klondike region. Prior to this, most of the fossil remains found in the region were collected by scientists and later archived by the Canadian Museum of Nature in Ottawa.

Due to the recent increase in exploration and mining in the Klondike region, the Yukon Palaeontology Program has made a concerted effort to increase its field site monitoring and fossil collecting activities in the region. In the summer of 2011, the Yukon Palaeontology program established a seasonal field office near Dawson City in order for program staff to better meet the demands of the placer mining industry and be readily available to collect recently discovered fossils. Placer miners that discover fossils at their mines are required to put these fossils aside and contact the Palaeontology Program. This recent focus on the Klondike has significantly increased the

abundance, quality and recognition of Ice Age fossils that are now part of the Government of Yukon's fossil collections. It is anticipated that there will be a significant increase in palaeontological resources discovered in the region with increased development in the placer mining sector. The Government of Yukon is further investigating options to increase its capacity for the management of palaeontological resources in the Klondike region.

8.4.2.3 Yukon First Nations

For Tr'ondëk Hwëch'in, protecting culture and heritage means (Tr'ondëk Hwëch'in 2012b):

- Recognizing, conserving, and promoting TH heritage and cultural resources and values, including traditional land use practices associated with fish and wildlife and other traditional harvesting;
- Ensuring Tr'ondëk Hwëch'in citizens connection to land is protected;
- Ensuring the continuation of First Nation culture and traditional economy; and
- Maintaining the integrity of, and access to, important community use areas [i.e., important locations for current subsistence harvest activities, cultural pursuits, and travel purposes...hunting, fishing, trapping, wood cutting, berry picking, and general travel].

Tr'ondëk Hwëch'in government has stated a desire to advance a broader definition of heritage resource management, such as citizen stewardship and usage of culturally important places and heritage resources (Tr'ondëk Hwëch'in 2012b). TH also note the complications of ownership and management issues related to heritage resources due to the differing definitions used between governments.

TH has developed their own suite of best management practices for heritage resources – these are described in Section 8.4.3 – Best Management Practices but include Heritage Resource Assessments as a standard tool for determining the heritage potential and the extent of heritage resources in a project area, assessing the impact a project will have on heritage resources, and recommending mitigations for the protection of identified resources (Tr'ondëk Hwëch'in 2011).

8.4.2.4 Boards and Councils

The Yukon Heritage Resources Board (YHRB) was established in 1995 under Chapter 13 of the Umbrella Final Agreement (UFA). Its duties and responsibilities are outlined in that chapter as well as in the *Historic Resources Act* (Part 1, Section 4). The Board's mandate is to provide advice to governments on issues that affect Yukon's heritage resources. Under the UFA, the Board may make recommendations to federal and territorial ministers and to Yukon First Nations regarding the management of Moveable Heritage Resources and Heritage Sites or any other related matter including traditional knowledge and languages. The Board may also be asked to make determinations pursuant to Section 13.3.2.1 (ownership of contested heritage resources) and 13.3.6 (management of ethnographic objects and palaeontological or archaeological objects). Under the *Historic Resources Act*, the Board is to advise the Minister on appropriate policies, guidelines and standards for designation of historic sites, care and custody of historic objects, and making regulations under the act as well as the use of the Yukon Historic Resources Fund. Also, sites that are nominated for designation are forwarded to Yukon government's Historic Sites Unit for review and then referred to the YHRB for evaluation and recommendations to the Minister.

The YHRB supports a broad view of heritage that encompasses not only objects, artifacts and buildings, but also trails and routes, oral and written history, and languages and works with a variety of groups to fulfill its mandate. The ten board members serve three-year terms. The Council of Yukon First Nations and Yukon government each nominate five appointees (one Yukon government appointee is chosen in concurrence with the Government of Canada). Appointments are made by the Yukon Minister of Tourism and Culture (YHRB 2006).

The Historic Sites and Monuments Board of Canada (HSMBC) was created in 1953 with the *Historic Sites and Monuments Act*. The HSMBC can recommend sites for designation as a national historic site. Sites can commemorate places, people and events linked to various aspects of Canada's political, economic and social history. To be considered, it must illustrate: a nationally important aspect of Canadian history; a cultural tradition or way of life important in the development of Canada; an exceptionally creative achievement in design or technology that was significant to the development of Canada; be most associated or identified with people or events deemed of national historic significance (Parks Canada 2012b).

The Board is composed of a representative from each province and territory (named by the Governor in Council for appointments of up to five years with the possibility of additional terms), as well as the Librarian and Archivist of Canada, an officer of the Canadian Museum of Civilization and the Director General of Parks Canada National Historic Sites Directorate, who also acts as the Board's Secretary. Parks Canada provides professional and administrative services to support the Board's work, including historical and archaeological research to evaluate applications.

8.4.2.5 Inter-Jurisdictional Initiatives

The Canadian Register of Historic Places (CRHP) provides a single source of information about all historic places recognized for their heritage value throughout Canada. Since 2001, federal, provincial and territorial governments have worked together to develop the CRHP and core programs such as conservation standards and guidelines (Parks Canada 2013b).

8.4.3 Current Best Management Practices

When best management practices (BMPs) are implemented (e.g., new discoveries are reported), the increased potential for finding heritage resources is viewed as positive by contributing to greater knowledge and promoting the region's history (e.g., placer miners finding mammoth bones has made the Dawson area a hotspot for palaeontological research). Conversely, heritage resources can be altered, disturbed or destroyed by different land use activities.

BMPs are intended to mitigate potential impacts to heritage resources as a result of human activities occurring on the landscape. These potential impacts include:

- Impacts to heritage resources on the surface from brushing or clearing for cut lines, construction of camps and other infrastructure, construction of airstrips or landing pads, or other activities; and
- Impacts to both surface and subsurface heritage resources from development of trails and access roads, stripping and trenching activities or other removal of vegetation and sediments.

BMPs have been developed to mitigate many of these potential impacts, provide guidance on the appropriate way to carry out development and land use activities, and promote a better appreciation for the importance of protecting heritage resources.

Recommended actions and mitigation measures include (where possible):

- Avoiding disturbance of surface and subsurface;
- Avoiding areas of high potential for heritage resources;
- Avoiding summer/all-season road construction (winter roads generally do not result in impacts on buried heritage sites and resources, but surface sites such as brush camps and graves are still vulnerable);
- Minimizing the number of, or eliminating, stream crossings;
- Informing staff of laws protecting heritage resources;
- Locating camps in existing clearings or former camp sites and more than 100 m from any water bodies; and

- Having trained environmental or heritage monitors on staff to recognize and avoid heritage sites and features.

The *Handbook for the Identification of Heritage Sites and Features* (Gotthardt and Thomas 2007) is a small booklet with colour pictures that was designed to be used in the field, to assist non-archaeologists in recognizing heritage resources they may encounter.

The Government of Yukon has developed a series of industry-specific BMPs:

- *Yukon Mineral Exploration Best Management Practices for Heritage Resources* (Government of Yukon 2010b)
- *Yukon Placer Mining Best Management Practices for Heritage Resources* (Government of Yukon 2010c)
- *Yukon Wilderness Tourism Best Management Practices for Heritage Resources* (Government of Yukon 2009)
- *Oil and Gas Best Management Practices for Historic Resources* (Government of Yukon 2006)

As well, the Yukon Chamber of Mines has produced the *Yukon Mineral and Coal Exploration Best Management Practices and Regulatory Guide* (Yukon Chamber of Mines 2010).

These BMPs note that heritage resources exist throughout the Yukon landscape and are vulnerable to unauthorized collection and/or damage and loss, especially when there is increased activity in a previously isolated area. They also note that many remote areas have never been surveyed and heritage resources are not adequately documented. Locations of known heritage sites and resources can be obtained from Government of Yukon's Heritage Resources Branch and from First Nations, although some coordinates obtained prior to the use of GPS are less precise and may vary by up to 200 m (Government of Yukon 2010b). Development activities are not permitted within 30 m of a known archaeological or historic site or a burial site. If a site or resource is discovered during the course of activities, work must be halted and the site marked or flagged and buffered from any further disturbance by at least 30 m.

Construction of stream crossings often requires the physical modification of stream banks, and can therefore result in significant disturbance of heritage sites since the majority occur within 100 m of water bodies such as streams, rivers, lakes and ponds (Government of Yukon 2006). High latitude and alpine and sub-alpine areas where little or no soil development has occurred are also particularly vulnerable to disturbance (Government of Yukon 2009).

Tr'ondëk Hwëch'in government has developed the *Tr'ondëk Hwëch'in Best Practices for Heritage Resources* (Tr'ondëk Hwëch'in 2011) with the objectives of protecting cultural, heritage and archaeological resources and First Nations burial sites in TH Traditional Territory; providing insight into First Nations concepts and values pertaining to heritage and culture; and sharing information with industries working within TH Traditional Territory to ensure cultural and heritage resources, as understood by First Nations people, are protected.

The main recommendation in this document is that early initial contact with the First Nation "is the best way to ensure proper protection of cultural or heritage resources in a project area," and that contact with the First Nation should be made regardless of whether the project is on Settlement or non-Settlement Land. As further described in the document, this early contact:

...can provide information on known heritage sites and resources so their location can be buffered immediately. Traditional knowledge can determine whether there are important spiritual, traditional use, or heritage resources in the area that may not be recognized by the Yukon Government Heritage Resources Branch. Early contact also helps determine if any

Tr'ondëk Hwëch'in land users will be impacted and allows for an early decision regarding the need for a heritage assessment in the project area.

Recommendations following discovery of a heritage or archaeological feature are generally similar to those of Government of Yukon. Work at the location must immediately cease and the site be marked and buffered from further activity by 30 m. Documentation of the site is encouraged and should include GPS location, estimated size or area of site/feature, description of setting and access to area, brief description of actual features, and photographs. However, one important difference is that “reporting directly to the First Nation is only legally required for projects on settlement land, but as a best practice we request the Tr'ondëk Hwëch'in Heritage Department be contacted in the event of any find within our traditional territory.” These guidelines also support the best management practices outlined in the industry-specific documents produced by Government of Yukon, and note that “a significant amount of protection can be achieved by following the recommended actions for each specific project activity.”

YESAB operational policies (discussed in the previous section) also recognize that public knowledge or information about the location of heritage resources may increase the risk of looting, disruption or vandalism, and recommend that information submitted to YESAB should exclude precise site location and other sensitive information (YESAB 2011).

8.5 Risks and Uncertainty

8.5.1 Heritage Resources and Climate Change

Climate change, particularly rising temperatures, has the potential to impact heritage resources through thawing of permafrost, rising water levels, accelerated erosion and sedimentation, and changing weather patterns (e.g., more frequent storms and wildfires). Damage to structures from ground instability could cause increases in maintenance and operational costs as well as engineering challenges.

The Canadian Register of Historic Places notes that “climate change is not simply a danger for the future, it also poses a significant threat to our past” and lists the Dawson Historical Complex as an example (Parks Canada 2013*b*):

Recent climate change makes it more and more likely that the permafrost upon which Dawson City was built will begin to thaw. The loss of the stable permafrost ground upon which the historic buildings of Dawson City stand will compromise the stability and architecture of the buildings, and result in the loss of an important historic site from an important page in Canadian history.

Also in the broader context of heritage resources, climate change can impact traditional harvesting activities through changes in fish and wildlife populations, changes in water quality and quantity, and/or changes in accessibility on land and rivers.

8.5.2 Other Risks and Uncertainties

Heritage resources are identified as a major area of concern in most project reviews under YESAA. The need to assess potential impacts on archaeological resources has grown with increasing mining and exploration activity in the planning region. Unauthorized collection and/or damage and loss are a greater possibility when there is increased activity in a previously isolated area.

While many heritage resources have been identified and their locations are known, there are large areas of the planning region where no inventories have been conducted or where little documentation exists. New resources and sites are discovered regularly, and increasing land cover

disturbance through increasing demand for land access and human activities raises the potential for additional discoveries and potential disturbance.

Specific areas were identified by the Government of Yukon as being at risk for loss of heritage resources (Government of Yukon 2011*b*):

- Areas along the Yukon River and the early settlement of Ogilvie located on Ogilvie Island
 - The Yukon River has not been inventoried and the likelihood of well-preserved historic resources related to transportation, trapping or farming is high.
- Areas south of Blackhills Creek, the Sixtymile drainage, Yukon River, and the Coffee Creek drainage
- Sites located along Hunker, Dominion, Bonanza, Eldorado, Quartz, Sulphur, and the Indian River
 - The last inventory project occurred in the early 1990s. The need to assess potential impacts on historic resources has grown as the exploration and development of placer and quartz mines increases
- Upper drainages of the Tatonduk, Miner, Whitestone, Eagle, Fifteenmile and Chandindu rivers
 - Although inventories are incomplete for large portions of the planning area, these areas are expected to have similar high concentrations of prehistoric site values (as those in and around Tombstone Park)
- Ancient river terraces along the Yukon River
 - Identified as potentially preserving some of the earliest evidence of human populations in the unglaciated Beringian landscapes of the late Ice Age
 - Due to intensive mining in the Klondike Goldfields over more than a century, the prehistoric archaeological record of this area is largely unknown
 - Additional evidence of late ice age human presence may yet be found preserved in the frozen mucks, much like the fossil palaeontological evidence

Government of Yukon has limited palaeontological resource inventory information for much of the planning region outside of the historical footprint of the Klondike Goldfields. Virtually every creek with intact frozen silts and gravels in the unglaciated parts of the planning region has high potential to preserve fossils of Ice Age mammals (Government of Yukon 2013*a*), and there is a need to assess potential impacts on fossil resources from increasing gold mining and other industry activity in the region. The lack of palaeontological regulations under the *Heritage Resources Act* makes it difficult to enforce industry compliance, and Government of Yukon submissions have noted there is a substantial unregulated commercial trade in fossils from the Klondike region (Government of Yukon 2011*b*).

Landforms and locations expected to have high potential for archaeological resources are generally known and can be used to infer areas of greater risk from disturbance (Table 8-5, Figure 8-1). These include areas in proximity to water bodies, stream courses and wetlands (including river islands); prominent lookout situations on ridges or ancient terraces; elevated, well-drained ground such as knolls and benches; and combinations of these landscape zones are considered to be of high site potential. Depending on the region, other high potential localities may include shorelines of pro-glacial and neo-glacial lakes, meltwater channels, ancient river terraces and abandoned drainages. In unglaciated northern Yukon, both ancient landscapes and possibly different species being hunted must be factored into reconstruction of past land use patterns.

Table 8-5 High potential locality types for archaeological sites (Thomas 2007)

High Potential Landform Type	Land Use Type	Season
Terrace of hill overlooking a major river	Seasonal camp, travel camp, fish camp, trade rendezvous	Spring, summer, fall
Terrace or hill overlooking the confluence of a creek with a major river	Salmon camp, village site, trade rendezvous	Summer
Terrace or hill overlooking an eddie in the river	Salmon camp, village site, trade rendezvous	Summer
Hill overlooking a pond or wetland	Game hunting lookout, water fowl hunting lookout, trapping area for beaver, muskrat, etc	Fall, winter, spring
Hill or terrace overlooking creek or confluence of two creeks	Fishing site, hunting site, travel camp	Fall, spring
Hill or terrace in an upland valley or plateau	Caribou hunting camp, sheep or goat hunting camp	Fall, winter
Hill or terrace in a wooded upland or mountain valley	Seasonal camp, hunting camp	Winter
Hill or terrace overlooking a lake	Water fowl hunting site, fishing site	Fall, winter, spring
River islands	Salmon fishing site, travel camp	Spring, summer, fall



Plate 1: River terrace.



Plate 2: Ponds and wetlands.



Plate 3: Upland streams.

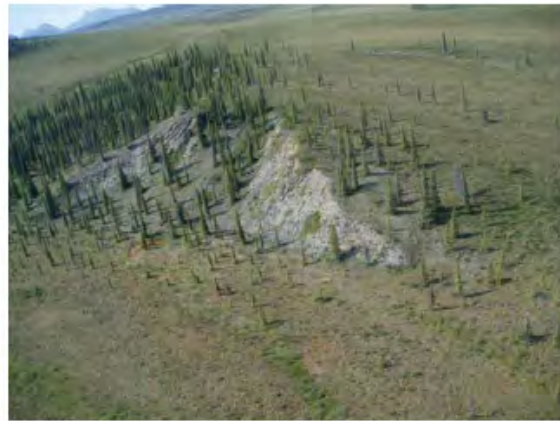


Plate 4: Upland tundra hills.



Plate 5: Paleo-river terraces.



Plate 6: Lake inlets and outlets.

Figure 8-1 Photos of some of the landform types described in Table 8-5 (Thomas 2007) (Photos: C. Thomas)

Based on the ethnographic record and seasonal land use patterns, archaeological sites are expected to be located on areas of level, well-drained ground near the Yukon River and its major tributaries. Rivers and streams were used as travel corridors to access resource areas such as moose habitat or salmon harvesting localities. The Ogilvie River, Blackstone Uplands, and North Klondike River basin

were the focus of traditional Tr'ondëk Hwëch'in winter subsistence activities and also likely locations for archaeological sites, with proximity to water expected to be less critical for winter sites (Thomas 2007).

Archaeological resources in high latitude and alpine and sub-alpine areas where little or no soil development has occurred are particularly vulnerable to disturbance. Traces of human activity may include stone tent rings, stone hunting blinds and meat caches, and remains of camps where stone tools and chips have remained on the ground surface for thousands of years. Disturbance of stone features and trampling of artifacts is a concern in these areas.

Historic era sites and artifacts associated with the Klondike Gold Rush and subsequent Euro-Canadian occupations and gold mining occur mostly in the area of Dawson City and the Gold Fields. However, Thomas (2007) notes:

Because of the sheer volume of transient gold seekers that migrated to the Klondike in this period, many if not all of the Klondike River and upper central Yukon River and in particular, the tributary streams were prospected and worked for minerals. As a result historic era sites and artifacts can be found nearly everywhere throughout the river and stream valleys of the region.

Areas with elevated potential for new discoveries are likely associated with a modern community or a documented historic community, such as Forty Mile or Stewart City, as well as historic travel routes and utility corridors. Historic sites not related to the Klondike Gold Rush or related industrial development will be associated with the continued use of the region for subsistence purposes or by people engaged in the fur trade (Table 8-6) (Thomas 2007).

Table 8-6 High potential locality types for historic era sites (Thomas 2007)

High Potential Land Form Type	Land Use Type	Season
Terrace hill adjacent to the confluence of a major river	Location of historic town sites, villages, stores and outfitters	Summer, winter, fall, spring
Terrace or hill adjacent to major river	Travel routes, historic fish camps, wood cutting camps, traplines	Summer, winter, fall, spring
Areas adjacent to creek drainage systems	Trails, trapline cabins, brush camps, mine sites, brush trap set features	Fall, winter
Areas adjacent to mountain valleys	Mines sites, prospecting cabins	Summer, winter, fall, spring
Unclassifiable	Historic roads, rail lines, hydro ditches	Summer, winter, fall, spring

Government of Yukon recognizes that the majority of known heritage resources are documented as a result of conducting heritage assessments for development projects (Friis-Baastad 2013):

“We have a sort of complex relationship with development,” says Yukon archaeologist Ruth Gotthardt. People are concerned with the impact that roads, staking, mining and other resource-based initiatives might have on heritage sites, she says. “But almost everything we

know comes as a result of getting out there and doing assessments for this work...if we didn't develop, we wouldn't learn half of what we do.”

The biggest challenge is trying to protect heritage resources that no one knows of. A new GIS-based predictive mapping tool may allow archaeologists to make educated guesses about where to search for evidence of ancient activity and where today's developers should be most careful. Using satellite photographs, archival reports and oral records can help determine where potential heritage sites may be located. Friis-Baastad (2013) goes on to explain:

In the Klondike area, valleys tend to be narrow and steep...Early people would have sought broader valleys and terraces: flattened areas along hillsides that are easier to walk on. Accurate digital elevation data can help pinpoint where those terraces are.

Determining the height of rivers in the past can also help identify areas likely to have been camping spots. Work in summer 2013 will gather additional data to feed into the model, followed by testing in the field to determine accuracy (Friis-Baastad 2013).

Some areas with high heritage value have been staked with quartz mining claims (Government of Yukon 2011*b*):

- Yukon Ditch System west of the Klondike River
 - Potential for hiking trails and interpretation of this monumental project is high, as it is likely one of a kind in Canada. It will be necessary to limit access roads across the ditch and to minimize mining impacts on the historic resources.
- Ridge Road Hiking Trail
 - Developed for cyclist and pedestrian use, it is a fragile trail system. It is necessary to restrict access to motorized vehicles due to trail maintenance reasons and public safety for trail users. The area has mineral claims and consideration will be required to ensure existing use is not negatively impacted.

Also, traditional economic activities in significant heritage and current community use areas, especially during important seasonal use periods, can overlap with industrial uses. “Conflicts between heritage, subsistence harvesting and industrial land uses are likely to occur wherever they overlap” (Tr’ondëk Hwëch’in 2012*b*). The location and level of use of all community use areas are not well documented, and use areas may change over time given availability of resources and travel conditions. New road or trail access may not be appropriate if it expands access to sensitive heritage areas, but other traditional trails could be more intensively used. “Many heritage resource trails are worthy of protection or intense management, while others may be incorporated into well-utilized transportation corridors” (Tr’ondëk Hwëch’in 2012*b*).

8.6 Chapter References

- Beaumont, J. and Edwards, M. Undated. *An Introduction to First Nations Heritage Along the Yukon River*. Available at: www.tc.gov.yk.ca/publications/First_Nations_Heritage.pdf.
- Campbell, J., E. Fletcher, and T.J. Hammer. 2006. *Forty Mile, Fort Cudahy and Fort Constantine Historic Site Management Plan*. Prepared for Tr’ondëk Hwëch’in and Government of Yukon.
- Canadian Register of Historic Places. 2006. Dredge No. 4 National Historic Site Statement of Significance, Canadian Register of Historic Places; <http://www.historicplaces.ca/en/rep-reg/place-lieu.aspx?id=6280&pid=0> (accessed January 10, 2013).
- Canadian Register of Historic Places. 2008. Nagwichoonjik (Mackenzie River) National Historic Site of Canada Statement of Significance, Canadian Register of Historic Places; <http://www.historicplaces.ca/en/rep-reg/place-lieu.aspx?id=9161>.

- Clark, D.W. 1995. *Fort Reliance, Yukon: An Archaeological Assessment*. Archaeological Survey of Canada Paper; no. 150. Canadian Museum of Civilization. Hull, Quebec, Canada.
- Coutts, R. 1980. *Yukon Places and Names*. Gray's Publishing. Sydney, Australia.
- Electric Canadian. 2013. Electric Canadian Website, History, The Yukon Territory, Chapter 4. Mining. Available at: <http://www.electriccanadian.com/history/yukon/territory/chapter4.htm> (accessed February 12, 2013).
- Friis-Baastad, E. 2013, May 3. *Models of the past guide us into the future*. Yukon News. Available at: http://www.yukoncollege.yk.ca/downloads/Your_Yukon_May_3_GIS_final.pdf.
- Froese, D.G., Zazula, G.D., Westgate, J.A., Preece, S.J., Sanborn, P.T., Reyes, A.V. and Pearce, N.J.G. 2009. The Klondike goldfields and Pleistocene environments of Beringia. *GSA Today*, 19(8): 4-10.
- Gotthardt, R. and C. Thomas. 2007. *Handbook for the identification of heritage sites and features*. First published 2005. Available at: http://www.tc.gov.yk.ca/pdf/Heritage_Handbook_2007.pdf.
- Government of Yukon and Tr'ondëk Hwëch'in. 2011. *Forty Mile/Ch'edä Dëk* (booklet).
- Government of Yukon. 1996. *Yukon River Heritage: an illustrated introduction for river travellers*. Map 15. Department of Tourism and Culture, Heritage Branch. Whitehorse, Yukon, Canada.
- Government of Yukon. 1999. *Guidelines Respecting the Discovery of Human Remains and First Nation Burial Sites in the Yukon*. Department of Tourism and Culture, Heritage Branch. Available at: http://www.tc.gov.yk.ca/heritage_guidelines.html.
- Government of Yukon. 2003. *Position Statement: Historic Resources Impact Assessment and Mitigation Requirements Related to Land Altering Developments*. Department of Tourism and Culture, Heritage Resources Branch. First published 1989. Available at: http://www.tc.gov.yk.ca/heritage_guidelines.html.
- Government of Yukon. 2006. *Oil and Gas Best Management Practices for Historic Resources*. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada.
- Government of Yukon. 2009. *Yukon Wilderness Tourism Best Management Practices for Heritage Resources*. Department of Tourism and Culture, Heritage Resources Branch. Whitehorse, Yukon, Canada. Available at: http://www.tc.gov.yk.ca/pdf/Wilderness_Tourism_BMP_for_Heritage_Resources.pdf.
- Government of Yukon. 2010a. *Operational Policy for Heritage Resource Management on Yukon Lands*. Department of Tourism and Culture, Heritage Resources Branch. Available at: http://www.tc.gov.yk.ca/heritage_guidelines.html.
- Government of Yukon. 2010b. *Yukon Mineral Exploration Best Management Practices for Heritage Resources*. Department of Tourism and Culture, Heritage Resources Branch. Whitehorse, Yukon, Canada. Available at: http://www.tc.gov.yk.ca/pdf/Mineral_Exploration_BMP_for_Heritage_Resources.pdf.
- Government of Yukon. 2010c. *Yukon Placer Mining Best Management Practices for Heritage Resources*. Edition 1. Department of Tourism and Culture, Heritage Resources Branch. Whitehorse, Yukon, Canada. Available at: http://www.tc.gov.yk.ca/pdf/Placer_Mining_BMP.pdf.
- Government of Yukon. 2011a. *Overview of Legislation and Policies Pertaining to Regional Land Use Plans in the Yukon*. Department of Energy, Mines and Resources.

- Government of Yukon. 2011*b*. *Dawson Planning Region: Technical Report on Issues and Interests*. Submitted to the Dawson Regional Planning Commission August 2011.
- Government of Yukon. 2013*a*. *Comments and suggested revisions for Draft Resource Assessment Report*. Submitted to the Dawson Regional Planning Commission by the Department of Tourism and Culture, Heritage Resources Branch.
- Government of Yukon. 2013*b*. Yukon Register of Historic Places Website. Available at: <http://register.yukonhistoricplaces.ca>.
- Great Plains Research Consultants and Parks Canada. 1987. *The Bear Creek Industrial Complex: A Functional and Corporate History, 1905-1966*.
- Green, L. 1977. *The Gold Hustlers*. Alaska Northwest Publishing Co.
- Hogan, B. 1995. *Thematic Analysis of the Klondike Goldfields*. Government of Yukon, Department of Tourism and Culture. Dawson City, Yukon, Canada.
- Hogan, B. 2003. *Dawson Area Inventory Project, 2002*. Government of Yukon, Department of Tourism and Culture, Historic Sites.
- Hogan, B. and G. Skuce. 1992*a*. *Report on Yukon Ditch Field Recording and Survey*. Dawson City Museum and Historical Society and Government of Yukon, Heritage Branch.
- Hogan, B. and G. Skuce. 1992*b*. *Preliminary Survey and Field Recording – North Fork Power Project*. Dawson City Museum and Historical Society and Government of Yukon, Heritage Branch.
- Hogan, B. and G. Skuce. 1992*c*. *Klondike Mines Railway: Preliminary Survey and Field Recording Project*. Dawson City Museum and Historical Society and Government of Yukon, Heritage Branch.
- Hogan, B. and G. Skuce. 1995. *Historic Resource Inventory and Assessment of the Northern Section of the Dawson-Whitehorse Overland Trail*. Northern Research Institute, Yukon College and Dawson City Museum and Historical Society.
- Johnson, E. 2012. *The Iron Horse Comes to the Klondike: Three Mines on Three Creeks Bring Railways to the Yukon*. Friesens Corporation. Canada.
- Johnson, E.L. 1997. *The Bonanza Narrow Gauge Railway: The Story of the Klondike Mines Railway*. Rusty Spike Publishing.
- Klondike Development Organization. 2013. *Regional Economic Development Plan Traditional Territory of the Tr'ondëk Hwëch'in: Community based projects implementation 2013-14*. Dawson City, Yukon, Canada.
- Klondike Visitors Association. 2013. Klondike Visitors Association Website, Things to Do, Attractions, Dänojà Zho Cultural Centre. Available at: <http://www.dawsoncity.ca/klondikeattractions/dänojähoculturalcentre/> (accessed March 15, 2013).
- Koppel, T. 2007. *Steamboats of the Yukon*. Archaeology Volume 60 Number 6, November/December 2007.
- Mitchell, B. 1992. *Report on the Cultural Resources at Coal Creek*. Prepared for Government of Yukon, Department of Tourism and Culture, Heritage Branch.
- North Yukon Planning Commission. 2007. *North Yukon Planning Region Resource Assessment Report*. Whitehorse, Yukon, Canada. Available at: http://www.planyukon.ca/index.php/documents/cat_view/81-north-yukon-planning-commission-documents/99-resource-assessment-report-maps-a-posters.html.

-
- Parks Canada. 2010. *Standards and Guidelines for the conservation of Historic Places in Canada*. Government of Canada, Ottawa, Ontario, Canada.
- Parks Canada. 2012a. Directory of Federal Heritage Designations Website. Available at: http://www.pc.gc.ca/apps/dfhd/default_eng.aspx.
- Parks Canada. 2012b. Historic Sites and Monuments Board of Canada Website. Available at: <http://www.pc.gc.ca/clmhc-hsmbc/index.aspx>.
- Parks Canada. 2013a. National Historic Sites Website, Chilkoot Trail National Historic Site of Canada, Natural Wonders & Cultural Treasures, Klondike Gold Rush International Historical Park. Available at: <http://www.pc.gc.ca/eng/lhn-nhs/yt/chilkoot/natcul/natcul4.aspx>.
- Parks Canada. 2013b. Canada's Historic Places Website. Available at: www.historicplaces.ca.
- Peel Watershed Planning Commission (PWPC). 2008. *Conservation Priorities Assessment and Resource Assessment Reports*.
- Prosper, L. 2007. *Wherein lies the heritage value? Rethinking the heritage value of cultural landscapes from an aboriginal perspective*. The George Wright Forum 24(2):117-124.
- Robinson, S. 1995. *The Ridge Road: The First Territorial Road in the Yukon*. Unpublished report, Government of Yukon Heritage Branch.
- Robinson, S. 2012. Speaking notes. Regional Land Use Planning Interdepartmental Working Group Presentation, February 9, 2012.
- Robinson, S. *Humble Dreams: An Historical Perspective on Yukon Agriculture Since 1846*. The Northern Review 32:135-167.
- TH – DIAND. 1998. *The Tr'ondëk Hwëch'in Final Agreement*. Department of Indian Affairs and Northern Development. Ottawa, Ontario, Canada.
- Thomas, C. 2007. *Historic Resources Potential Overview Study: Tr'ondëk Hwëch'in Traditional Territory Forest Management Planning Area*. Government of Yukon, Department of Tourism and Culture, Heritage Resources Branch.
- Tr'ondëk Hwëch'in. 2004. *Tr'ondëk Hwëch'in Land and Resources Act*.
- Tr'ondëk Hwëch'in. 2011. *Tr'ondëk Hwëch'in Best Practices for Heritage Resources*. Tr'ondëk Hwëch'in Heritage Department. Dawson City, Yukon, Canada. Available at: <http://www.trondek.ca/gallery.php>.
- Tr'ondëk Hwëch'in. 2012a. *Tr'ondëk Hwëch'in Resource Report*. Submitted to the Dawson Regional Land Use Planning Commission, May 2012. Dawson City, Yukon, Canada.
- Tr'ondëk Hwëch'in. 2012b. *Dawson Regional Land Use Plan Preliminary Report on Issues and Interests, Tr'ondëk Hwëch'in*. Submitted to the Dawson Regional Planning Commission. Dawson City, Yukon, Canada.
- Tr'ondëk Hwëch'in. 2013a. *Tr'ondëk Hwëch'in Comments on the August 2013 Draft Resource Assessment Report*. Submitted to the Dawson Regional Planning Commission, September 2013.
- Tr'ondëk Hwëch'in. 2013b. Heritage Department Website. Available at: <http://trondekheritage.com/>
- United Nations Educational, Scientific and Cultural Organization (UNESCO). 2013. World Heritage Centre Website. Available at: <http://whc.unesco.org/en/culturallandscape>.
-

Yukon Chamber of Mines. 2010. *Yukon Mineral and Coal Exploration Best Management Practices and Regulatory Guide*. Whitehorse, Yukon, Canada.

Yukon Environmental and Socio-economic Assessment Board (YESAB). 2011. *Heritage resource information requirements for land application proposals policy*. Operational Policy No. 2011-01, August 23, 2011.

Yukon Heritage Resources Board (YHRB). 2006. Yukon Heritage Resources Board Website, About, Creation and Mandate. Available at: <http://www.yhrb.ca>.

Zazula, G. and Froese, D. 2011. *Ice Age Klondike: Fossil Treasures from the Frozen Ground*. Government of Yukon.

9 WATER

9.1 Highlights

- The Yukon River is a major contributor of water and solutes to the Bering Sea and Arctic Ocean ecosystems
- Permafrost has a significant influence on groundwater and runoff
- Groundwater is a significant source of winter flows, and its contribution to winter flow is increasing
- Limited or zero flow may occur during winter due to low temperatures
- Snowmelt results in rapid increase in stream discharge in spring
- River ice jams play a dominant role in flooding; six major floods have occurred in Dawson within the last century
- Water is highly valued for habitat, sustenance, transportation, economic activity, recreation and spiritual qualities
- Future industrial demand for water is expected to increase
- Few lakes or large wetlands exist in the region, all are significant to waterfowl
- 27 monitoring networks in Yukon gather information on water resources, but the Dawson region is considered data sparse; the region has three active hydrometric stations, three active snow survey courses and one water quality monitoring station managed by Water Resources Branch
- Changes to soil moisture and runoff regimes may result from lengthened growing seasons, shifts in vegetation, changing drainage from permafrost loss and altered fire cycles associated with climate change

9.2 Description of Resource

Water moves constantly through the hydrologic cycle as surface water, ground water and atmospheric water (Figure 9-1). Water condenses in the atmosphere and falls to earth as precipitation; drains across and beneath the land, pooling into lakes and wetland complexes; and evaporates back into the atmosphere where the cycle begins again.

Water's location and availability are never static and each phase of the hydrologic cycle plays an important role in supporting ecosystems. Aquatic ecosystems change and adapt in response to complex chemical, biological and physical interactions within each phase; it is this ability to adapt that makes aquatic ecosystems resilient (Government of Yukon 2011a).

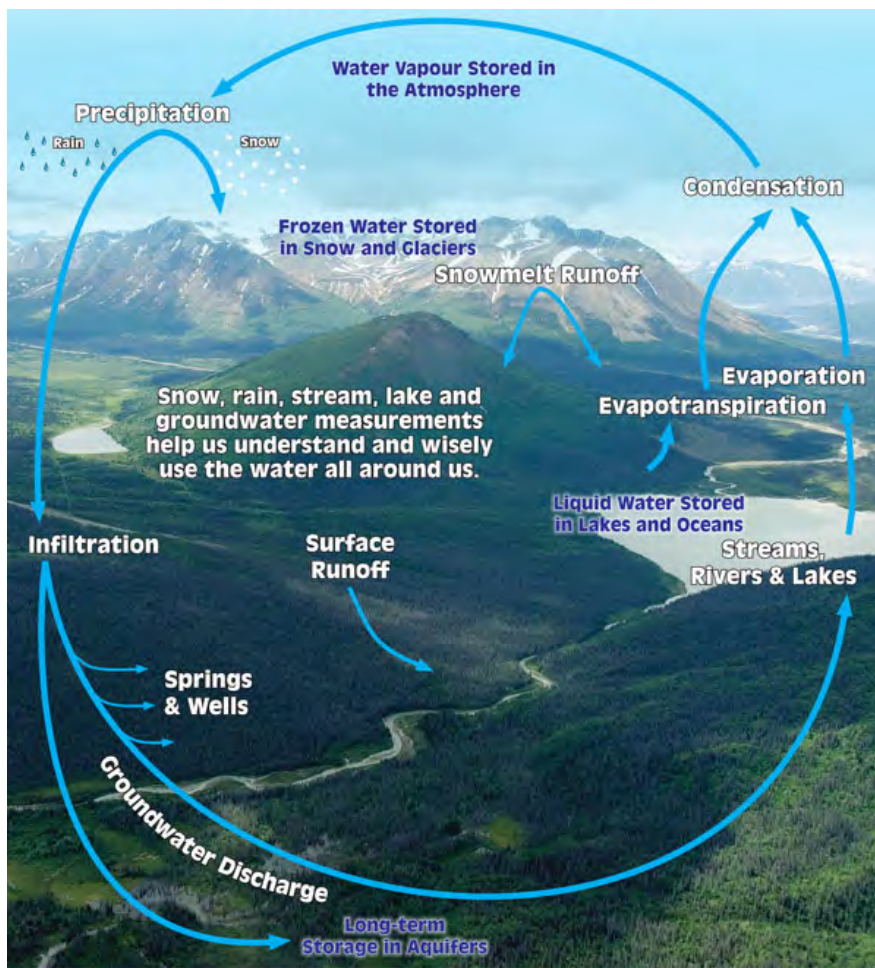


Figure 9-1 The Hydrologic Cycle (Image: Government of Yukon)

9.2.1 Atmospheric Water

Atmospheric water is water present in the atmosphere either as a solid (snow or hail), liquid (rain) or gas (fog or mist). Clouds are the most visible manifestation of atmospheric water, but even clear air contains water in particles that are too small to be seen. Water vapour accounts for the largest portion of the greenhouse effect, but human activities do not significantly affect it at a regional scale.

Strong shallow temperature inversions of several degrees Celsius per hundred feet are common in the Central Yukon River Basin in the fall and throughout the winter. These inversions trap moisture in the lower elevations and often result in areas of fog or low stratus cloud. This is most pronounced over and around the open water of lakes and rivers prior to freeze up, which usually takes place between late November and early December. The worst area for fog is described by pilots as that along the Yukon River, between the confluence of the White and Stewart Rivers (Klock et al. 2001).

Mean annual precipitation throughout the region ranged from 200 to 500 mm during the period from 1961 to 1990. The northeastern part of the region experiences higher precipitation, ranging from 400 to 800 mm per year (Hennessey et al. 2011). Local trends in precipitation vary considerably from station to station, with precipitation falling mainly during convective showers from June through August. Convective cloud and thunderstorms will often persist well into the evening due to the long hours of sunshine (Klock et al. 2001).

9.2.2 Groundwater and Aquifers

Groundwater is water located beneath the earth's surface in the spaces (i.e., pores) between soil particles and in the fractures of rock formations. Technically, groundwater is the water below the saturated zone or water table - in other words, the depth at which soil pores or fractures and voids in rock are completely saturated with water. Above the water table, pores in rock and soil contain both air and water, and water is found as soil moisture.

Groundwater usually flows downhill with the slope of the water table, but does not necessarily move in the same direction underground as the water flowing on the surface. Groundwater is recharged when precipitation falls on the land surface and seeps into the soil, and from other surface water sources. It also drains steadily towards discharge points in streams, rivers, marshes, lakes and oceans or in the form of springs and flowing wells. The nature of groundwater formations has a major effect on the volume of surface runoff (i.e., when there is more water on the surface than the underground materials can absorb) and in dry periods the flow of some streams may be supplied entirely by groundwater.

During the late winter in the Yukon, streamflow consists almost entirely of groundwater. Throughout the Yukon River Basin, estimated groundwater contribution to total annual flow can be as high as 50 per cent, although this is largely dependent on geology and permafrost coverage. Trends in streamflow investigated over 20 to 50 year periods in the Yukon River Basin showed significant increases in estimated groundwater flow and minimal change in annual flow. Walvoord and Stiegl (2007) note that the increasing winter flow is thought to be due mainly to greater groundwater input to streams (as cited in Government of Yukon 2011a).

Permafrost inhibits the flow of groundwater unless soils, fractured rock and glacial debris (e.g., in the Mackenzie Mountains of eastern Yukon) provide material that can store and release groundwater. The seasonal development of a thawed "active layer" above the permafrost can also provide permeable pathways for the subsurface movement of water. Changes in permafrost affect groundwater flow, chemical composition, temperature and seasonal ice thickness.

9.2.3 Surface Water

Surface water consists of all rainfall, snowmelt and groundwater draining into a particular water body such as a river, lake or ocean. In the absence of glacial "scouring" and glacial deposits, few lakes are found relative to other parts of Yukon. Much of the open water, floodplains and wetlands lie in the Boreal Low bioclimate zone (Grods et al. 2012).

Surface flow varies seasonally and annually. Three basic patterns of runoff are exhibited throughout the Yukon River Basin: lake runoff, snowmelt runoff and glacier runoff. Most runoff occurs from May to September and, in general, from October until late April to mid-May runoff is minimal and streamflow gradually decreases (although the timing and characteristics of runoff differ for each sub-watershed).

In the Taiga Cordillera ecozone, the underlying permafrost largely controls streamflow characteristics. Runoff is large relative to precipitation because of limited infiltration through the underlying permafrost and low rates of evapotranspiration. Peak flows generally occur in June, although summer rain events can produce secondary peaks and occasionally annual peaks on smaller streams, especially in mountainous areas. Minimum flows generally occur in March and tend to be lower than ecozones to the south, because of the effect of lower winter temperatures on groundwater flow. Small streams within this ecoregion frequently experience zero flows while some intermediate-sized streams may occasionally experience zero winter flows (Smith et al. 2004).

In the Boreal Cordillera ecozone, rapid increase in streamflow discharge occurs in May due to snowmelt, with high flow continuing for a few weeks maintained by summer rainfall. Streams in the

southwest can have peak flows in July or August due to snowfield and glacier melt. Because this ecozone lies south of the continuous permafrost zone, there is more groundwater flow than in the Taiga Cordillera and groundwater discharge generally continues throughout winter (Smith et al. 2004).

Wetlands are areas submerged or permeated by water, either permanently or temporarily, for long enough that excess water and low oxygen levels produce conditions for aquatic plant growth and other biological activity. Wetlands often have very close connections with the groundwater system as important recharge areas or as receivers of significant discharge. They absorb the impact of hydrologic events such as floods; filter sediments and toxic substances; supply food and habitat for many species; and are valuable recreational areas. There are no large wetland complexes in the planning region, but there are several small wetland areas (see **Section 1 – Chapter 5, subsection 5.5.5** for more information).

9.2.4 Cryosphere (Frozen Water)

The cryosphere is the portion of the hydrologic system that comprises frozen water, including snow cover, ice cover on lakes and rivers, glaciers, ice caps, frozen ground (i.e., permafrost), and sea ice. In the Yukon, elements of the cryosphere influence the timing, magnitude and character of surface water flows.

While the extent of permanent ice and snow within the region is very limited, generally confined to north facing cirques in the Ogilvie Mountains, glaciers in northern British Columbia influence flows on the Yukon River. These flows tend to increase rapidly in springtime in response to snowmelt and peak later in the summer from high elevation snow and glacier melt inputs.

Permafrost distribution, thickness, and the thickness of the active layer (i.e., the surface layer that thaws annually) play an important role in influencing the movement of water. Ice-rich permafrost (Figure 9-2) restricts rain or snowmelt infiltration to subsurface zones, resulting in surface storage in the form of ponds or wetlands, but a thicker active layer will result in greater recharge of groundwater. The highest moisture content of permafrost occurs in the active layer.

Snow is precipitation in the form of ice crystals and it exerts a major effect on the distribution of streamflow throughout the year. Instead of immediately infiltrating the soil or running off into stream channels as rainfall does, this water is stored in the winter snowpack. When it melts in the spring, it becomes a significant portion of the water available for streamflow and provides soil moisture recharge.



Figure 9-2 Ice-rich permafrost, northern Dawson ranges (*Photo: Yukon Permafrost Network*)

River ice plays a dominant role in controlling extreme hydrologic events in cold regions. The river ice break-up period is particularly influential, since it often coincides with the arrival of the spring freshet. Backwater produced by broken and jammed ice can augment water levels on rivers already receiving large amounts of discharge from snowmelt runoff, and the resulting high water often floods riverside communities.

There is an excellent record of break-up dates for the Yukon River at Dawson (Figure 9-3) (Government of Yukon 2011a). Over the period from 1896 to 2009, break-up has occurred as early as April 28 and as late as May 29, with a mean date of May 9. The break-up date has advanced approximately five days per century, with notable advances in the last two decades. A similar trend is seen on the Porcupine River at Old Crow.

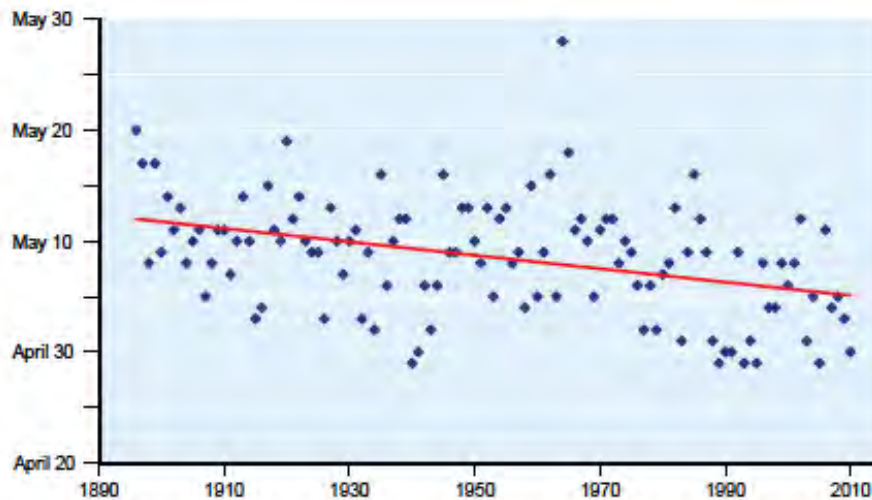


Figure 9-3 Yukon River at Dawson break-up dates 1896-2009 (Government of Yukon 2011a)

9.3 Resource Values

9.3.1 Natural Value

Water is an essential component of the ecosystem and plays a role in all ecosystem services:

- Provisioning services – fresh water
- Regulating services – water regulation, water purification, waste treatment and storm protection
- Supporting services – soil formation and retention, nutrient cycling, water cycling and provision of habitat

Rivers play a vital role in the hydrologic cycle by acting as drainage channels for surface water and providing opportunities for recharge of water. Rivers provide habitat, nourishment and a means of transportation for numerous species. Rivers shape the surrounding landscape and how people can use its waters.

Riverside cliffs, wetlands, marshes and muskeg areas provide suitable nesting sites and plenty of food for many bird species, particularly those using the Tintina Trench as a migration corridor. The numerous river tributaries that drain into the trench provide migration routes and spawning grounds for salmon; many other wildlife species utilize the rivers, lakes, wetlands and riparian areas as important habitat areas.

The river provides an important source of nutrient-rich sediments to the land it passes through. Each year about 20 million tons of sediment is deposited on flood plains and in braided reaches of the Yukon River as alluvial sediments (Brabets et al. 2000).

The Yukon River watershed is fundamental to the Bering Sea ecosystem, providing most of the freshwater runoff, sediments and dissolved solutes in the eastern part of the sea. At its mouth, the average annual discharge of the river is 227,000 cubic feet per second and it transports about 60 million tons of suspended sediment annually into the Bering Sea (Brabets et al. 2000). The waters of the Bering Sea also move northward to the Arctic Ocean; of the 10 largest inputs into the Arctic Ocean, the Yukon River ranks fifth and contributes eight per cent of the total discharge (Brabets et al. 2000).

Humans rely heavily on these ecosystem services. Stresses on watersheds from increased development pressure and climate change can compromise the health and productivity of aquatic ecosystems and affect their ability to provide these services. Without adequate water, natural systems cannot be sustained unless nature's water needs are satisfied before water is allocated for other needs (Government of Yukon 2011a).

9.3.2 Traditional Value

Tr'ondëk Hwëch'in citizen comments (Tr'ondëk Hwëch'in 2012):

We need to limit what we do on the land in order to protect the water.

Water must be protected because everything depends on it.

Our watershed is our most important resource. The mountains to the north feed our watershed.

The smallest creeks feed our rivers. We need to protect them too.

The water resources of the region (e.g., rivers, lakes and wetlands) are highly valued for their role in providing important fish and wildlife habitat, food, drinking water, nutrient-rich sediments, transportation connections, opportunities for traditional economic activities, and as landscapes with spiritual and aesthetic value.

Chinook and Chum salmon migrate the entire length of the Yukon River to spawn and are an important staple food. Tr'ondëk Hwëch'in (TH) families continue to rely on summer fish camps to supply much of their subsistence needs. Traditional family camp locations help reinforce connections to history, culture and language. Commercial salmon fishing is an important economic activity on the river when there are healthy numbers of returning stocks. Wildlife such as moose rely heavily on the rich habitat of wetlands, river valleys and lakes, creating opportunities for subsistence hunting. Rivers allow for ease of movement through the landscape, using watercraft during summer months and by snowshoes and dog teams in winter.

Access to many TH Settlement Land parcels is via the Yukon River, and these lands have importance for heritage resources, agricultural potential and traditional economic resource pursuits.

The community is particularly concerned about the cumulative impacts of activities on water and the potential for activities in specific locations to impact the entire watershed. The Elders stress that water is part of a system, not a single resource. Any damage to water will eventually be seen in deteriorating health of the land, fish and wildlife, plants, and people. Elders have also observed an increase in the pollution of water and in the damage to spawning streams by mechanized industrial activities that occur alongside creeks, which in turn affect subsistence-harvesting activities (Tr'ondëk Hwëch'in 2012).

9.3.3 Socio-Cultural Value

Access to water is highly valued for both aesthetic and practical purposes. Most Yukon communities began along the water's edge, as rivers provided travel routes in the early days. The Yukon and Klondike rivers as well as others in the region continue to be important year-round access corridors for hunting, fishing and recreational opportunities.

The Yukon River corridor has recreational, historical and educational value and provides opportunities for angling and wildlife viewing as well as the aesthetic qualities of a northern wilderness river. The Yukon River Quest is the longest annual canoe and kayak race in the world and consistently attracts hundreds of paddlers every year.

“Water for people” is a stated goal of the Draft Yukon Water Strategy (Government of Yukon 2013):

Ensure accessible, safe and sufficient water for drinking and other purposes, including industrial, recreational, heritage, cultural and spiritual uses and values. Promote sustainable and valuable use of water for communities and economies for key business sectors.

Snow is important for recreational and tourism activities, including snowmobiling, dog mushing and cross-country skiing.

9.3.4 Economic Value

Water in the region represents a range of economic value. Rivers provide a means of transportation for exploration and commerce; rivers and streams may be harnessed to provide power for electrical energy; and water may be drawn from a watercourse or waterbody for domestic, agricultural or industrial use.

The total economic value of water may be approached holistically. For example, the Canadian Council of Ministers of the Environment recently prepared a Water Valuation Guidance Document (2010) to help establish how water valuation can assist in addressing water management issues, particularly in relation to conservation actions, infrastructure investment, water quality standard setting, water pricing, water allocation and compensation for use or damage. The total economic value of water considering all types of “value” (i.e., economic, cultural, spiritual and intrinsic value) may more fully account for both the use of water (e.g., household water supply or irrigation for agriculture) and the ecosystem services provided or supported by water resources (e.g., nutrient cycling, habitat provision and recreation) (Figure 9-4).

A large number of industries in the region utilize water, rely on the availability of water for their operations and have the potential to impact water resources.

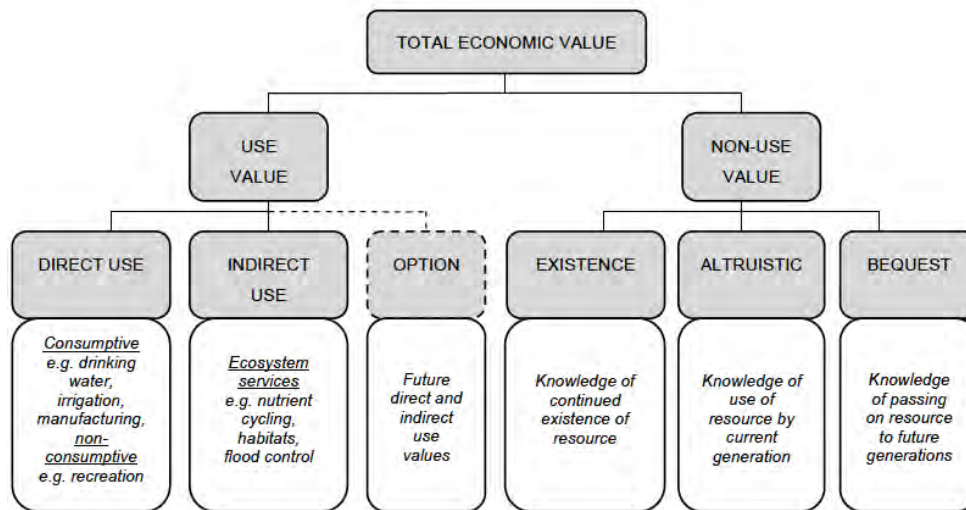


Figure 9-4 Total Economic Value of Water (Canadian Council of Ministers of the Environment 2010)

9.3.4.1 Transportation

Prior to construction and upgrading of the Klondike Highway in the 1950s and 1960s, the Yukon River was the major commercial highway in the region: from the 1840s when posts were established at Fort Selkirk and Fort Yukon to facilitate the fur trade through an era that saw steam-powered riverboats dominate commercial transport. Today, barge transportation of fuel and supplies provides an economical alternative for seasonal resource industry activity and a ferry provides service across the Yukon River, linking the City of Dawson with the Top of the World Highway and, eventually, Alaska. Numerous small landings provide access to a network of exploration trails and roads. Lake and river ice is also important in the region for winter transportation.

First Nations used water corridors for travel to areas of harvesting opportunities, camping spots, gathering places and other significant locations. Types of watercraft included birch bark canoes, dugout canoes, moose skin boats, and rafts (Tr'ondëk Hwëch'in 2012).

9.3.4.2 Domestic Use

Water is used in communities and residences for drinking, cooking, bathing, laundry, cleaning, sewage disposal and treatment, and other household needs such as watering lawns and gardens and washing vehicles.

More than 97 per cent of Yukoners rely on groundwater for their domestic needs (Government of Yukon 2011a). In the City of Dawson, the municipal government undertakes supply and distribution of domestic water; private wells are used in areas not serviced by the piped infrastructure or truck delivery systems. A summary of Yukon water wells compiled in May 2006 shows one domestic well in the Dawson City-Bear Creek area as well as 10 wells in the Dawson City-General Area. Of these 10, three are municipal wells; three are commercial (highway maintenance, Dawson airport and Klondike Valley fire hall); and four are recreation wells for the Yukon River campground (Government of Yukon 2006).

Water use surveys conducted by Environment Canada over the past number of years indicate that Yukoners use consistently more water per person than the average Canadian does for residential use,

due in part to the use of bleeder systems to prevent freezing of pipes in the winter (Government of Yukon 2012).

9.3.4.3 Hydroelectric Power

Hydroelectric power is the main form of electricity production in Yukon, ranging from the large four-turbine plant at Whitehorse Rapids to small, in-stream micro-hydro installations serving only one user. The Mayo Hydro Facility services the Dawson region. Built in 1951, it produces five megawatts (MW) and the addition of Mayo B in 2012 added another 10 MW of power. Water Use Licence HY99-012, expiring in 2025, requires a minimum flow of 2.8 m³/s to pass through the Mayo and Wareham dams (Government of Yukon 2011a). Yukon Energy continues to assess potential hydro project options to meet growing energy demand. Secure access to water is critical for existing and new hydroelectric power generation, and there is concern about long-term climate change impacts and extreme events that could affect hydro systems in the future.

9.3.4.4 Quartz Mining

Quartz (i.e., hard rock) mining is not a significant water user, but all phases of mining activities from exploration to closure can affect water resources. Water is used for drilling, dust control, ore excavation and production, including the milling process. Water that comes in contact with ore or waste rock requires treatment before being discharged. While water quality is often the most important management consideration in hard rock mining, water supply can also be a significant issue, such as in the management of inflows of storm water and runoff. To the extent possible, mining operations maximize recycling of water in order to minimize both their freshwater make-up requirements from surface or groundwater sources and their wastewater treatment requirements.

9.3.4.5 Placer Mining

Water is critical to every stage of placer mining. Placer mining operations extract soil and gravel, typically in creek and river valley bottoms, to uncover the gold-bearing gravels concentrated just above bedrock. This may require the diversion of existing watercourses while mining takes place. If permafrost overlies the deposit, water is used to thaw the frozen ground, wash the gold loose, and carry the slurry of gold, sand and gravel to the sluice box. In the sluicing process, gravels are washed in flowing water and the heaviest particles, including gold, settle to the bottom. Many other fine materials are washed away, resulting in high concentrations of suspended sediments in the sluicing water. Settling ponds are used to reduce the turbidity of the water before it is discharged back into the stream.

9.3.4.6 Tourism

Water resources are highly valued in the tourism and recreation sectors. The Yukon River is a major asset for the region's wilderness tourism operators (e.g., canoeing, motorboat tours and rafting are some of the most popular trip activities) as well as for private businesses such as the Klondike Spirit boat excursion and for independent recreational travellers. Various landing sites and docks are also associated with water access.

9.3.4.7 Forestry

Sustainable forest management has a critical influence on the hydrology and water quality of watersheds. Forests play an important role in regulating water quantity and forest land management can have a critical impact on the timing of surface flows, water quality, groundwater recharge and floodplain maintenance. The main forest management activities affecting water resources include construction of access roads, harvesting, replanting and pesticide application.

9.3.4.8 Agriculture

Most of the two per cent of land suitable for agriculture in the Yukon is restricted to the major river valleys. Yukon farmers need water for four principal uses: irrigation water for crops, potable water for crop washing, potable water for livestock and potable water for home use. Access to irrigation water is necessary for reliable production in most areas. As elsewhere in Canada, irrigation of crops represents the largest water use by agriculture sector. The amount of water required for irrigation ranges from 100 m³/acre/year for hay to 1,700 m³/acre/year for vegetable crops (Government of Yukon 2011*a*).

One of the biggest constraints on growth of the agricultural sector in Yukon is the accessibility of water; the amount of agricultural land adjacent to watercourses is limited. River access or the availability of surface water in nearby creeks or ponds directly influences the type of crops that can be grown. Many current agriculture leases are under-utilized, at least in part because of lack of access to water or limited irrigation infrastructure (Government of Yukon 2011*a*).

9.3.4.9 Oil and Gas

There are no producing oil and gas wells in the Dawson area. However, exploration activity is increasing in the Eagle Plains area immediately to the north and east of the planning region, for both conventional and unconventional oil and gas plays.

Conventional oil and gas operations use water for three main purposes (Government of Yukon 2011*a*):

- Drilling muds – Mud is composed of 92 per cent water, seven per cent bentonite clay, and one per cent polymers and bactericides. In permafrost regions, salts such as calcium or gypsum are added to reduce the risk of freezing. A typical Eagle Plains well would not require these additions since consolidated bedrock is near the surface, but would require 200 to 500 m³ of water per month. Replacing the water with mineral oil can reduce water use, although oil-based muds have very different cost and waste considerations.
- Water flooding – The secondary recovery of oil requires the addition of water. For every litre per barrel of oil extracted, the equivalent amount of water must be re-injected. Water extracted along with the oil can be re-injected as flood water.
- Ice roads – The construction of ice roads to gain access to oil and gas wells requires approximately one million gallons per mile or 2,352 m³/km. It would require 100 to 300 m³ per day to build an ice road in the Eagle Plains area. One road, built in 2005 by Devon Canada, was 15 km long.

Campbell and Horne (2011) described shale gas as “an unconventional type of gas, with reserves trapped in geological formations that make it difficult to extract.” They note that unconventional gas extraction relies upon:

- Hydraulic fracturing, which involves injecting pressurized water, gases, chemicals and sand into gas wells to break apart the rock and allow the gas to flow more easily; and
- Directional drilling, which allows multiple wells to be drilled from a single well pad.

Hydraulic fracturing for shale gas extraction typically requires large volumes of water, which is contaminated through the process and cannot be returned to fresh water systems (Campbell and Horne 2011). Depletion of fresh water or groundwater resources may lead to potential conflict with other human use or cause negative ecological impacts.

Excluding the construction of ice roads, water use in oil and gas production is consumptive, as the water is injected into sub-surface formations or disposed of in deep wells and not returned to the source. Industry concern about water availability in Yukon centers on the large water use requirement

for ice roads. Industry is increasingly reducing its use of surface water, using deep sources that are typically saline or brackish; this would be the only practical water source in the Eagle Plains area for a water intensive operation. Fresh water is essential for ice roads and drilling muds and there may be constraints in winter during periods of low flow.

9.3.4.10 Fisheries

Yukon's freshwater fishery is dominated by recreational angling, with a small component of commercial, domestic and First Nations fisheries concentrated on lake trout and lake whitefish (Government of Yukon 2011a).

9.4 Resource Management

The following sections note legislation and regulations that specifically address water protection. Other acts and regulations dealing with mining, land development, forestry, pesticide use, hazardous materials handling, or other industrial activities may also include measures to safeguard water. Additional protocols and requirements may also apply if work is being conducted on Settlement Land.

9.4.1 Regulatory Framework

9.4.1.1 First Nations Final Agreements

Chapter 14 - Water Management, Section 14.8.1 of the Tr'ondëk Hwëch'in Final Agreement (TH – DIAND 1998) states:

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.

Chapter 14 also establishes a compensation system, which complements the statutory compensation provisions of the *Waters Act*. Consistent with the principle of prior allocation, it protects Yukon First Nations and Yukon Indian People who may suffer adverse effects, loss or damage from new use of water licensed under the act or from other water uses.

Chapter 5, Section 5.8.0 notes that the bed of a waterbody that lies entirely within a parcel of Settlement Land is also considered Settlement Land.

9.4.1.2 *Fisheries Act*

Watershed-based authorizations from Fisheries and Oceans Canada (DFO) are in place for placer mining activities in Yukon River North, Fortymile River, Indian River, Klondike River, Sixtymile River, Stewart River and White River. The authorizations extend to individuals or companies conducting placer mining in the watershed that hold a valid Water Use Licence pursuant to the Yukon *Waters Act* and include undertakings such as the construction of diversion channels, in-stream works, water acquisition and discharge of sediment from settling facilities.

9.4.1.3 *Navigable Waters Protection Act*

All construction of works built or placed in, over, through or across navigable waterways must be licensed by the federal Navigable Waters Protection Program. Licences are issued with conditional uses and construction requirements so that the water body remains navigable, even during construction. While recent legislative changes (Bill C-45) restrict application of the act, the portion of the Yukon River within the Dawson planning region remains subject to its provisions.

9.4.1.4 *Environment Act*

The *Environment Act* has a number of associated regulations that provide for water monitoring and protection. These include the *Special Waste Regulations*, *Spills Regulations*, *Storage Tank Regulations*, *Solid Waste Regulations*, and *Contaminated Sites Regulation*.

Permits are issued primarily by the Environmental Programs Branch of the Government of Yukon's Department of Environment. For example, solid waste permits are issued to all operators of public waste disposal facilities where waste is being or has been disposed on site. Permits require the installation of groundwater wells and regular monitoring of water quality in the wells and surface water around the facility, both while the facility is in operation and afterward.

9.4.1.5 *Public Health and Safety Act*

Drinking water standards for large public systems are set out in the *Drinking Water Regulation* including source selection and protection, system maintenance and upgrades, permits and reporting, operations, and sampling. Almost all Yukon communities, including the City of Dawson, rely on groundwater wells for their drinking water. Groundwater wells must meet strict criteria for siting, construction and operation. Performance tests are done to determine the yield of the well as well as the characteristics of the aquifer it draws from and the influence of surface water. Wells are tested for bacteria and other health-related parameters.

Drinking water permits and sewage disposal permits are issued by the Government of Yukon's Department of Environment, Environmental Health Services Branch.

9.4.1.6 *Waters Act*

The *Waters Act* (2003) regulates surface and ground water use from water bodies, alterations to watercourses and deposition of waste into water bodies. Schedules 5 through 10 of the *Waters Regulation* define the activities and uses that trigger the need to obtain a water licence. In summary, they are:

- Direct water use of 100 or 300 m³/day or more, depending on the type of undertaking;
- Watercourse crossings, including pipelines, bridges and roads, if the watercourse is over 5 m in width at ordinary high water mark at the point of construction (unless it is placer mining, in which case all watercourse crossings require a licence);
- Altering the flow or direction (“watercourse training”) of a non-intermittent watercourse over 5 m in width by making changes to the channel or bank, or by placement of infill, docks, culverts, or erosion control materials (unless it is placer mining, in which case all alterations require a licence);
- Alteration of flow or storage of a watercourse by constructing dams or dikes, when they exceed a certain size (unless it is placer mining, in which case all alterations require a licence);
- Depositing waste into water bodies;
- Constructing permanent flood control structures (some temporary structures also require a water licence);
- Diverting a watercourse that is 2 m in width or greater at ordinary high water mark (unless it is placer mining, in which case all watercourse crossings require a licence);
- Any other use that would have significant environmental effects; and
- Any use that would interfere with the rights of other licensed water users.

Water licences are issued by an independent administrative tribunal, the Yukon Water Board. The objectives of the Board are to “provide for the conservation, development and utilization of waters in a manner that will provide the optimum benefit from them for all Canadians and for the residents

of Yukon in particular” (Yukon Water Board 2012). The Board is identified as an Umbrella Final Agreement Board and has specific responsibilities under Chapter 14 of the First Nations Final Agreements. It also has specific responsibilities under the *Yukon Environmental and Socio-economic Assessment Act* (YESAA) in that the Board cannot issue a water use licence or set terms of a licence that are contrary to a decision document issued under that legislation. Applications for water licences are not considered adequate until a YESAA decision document is issued. The Yukon Water Board also has delegated authority for the approval of Class 4 placer mining land use permits.

Schedule 2 of the *Waters Regulation* provides a classification of undertakings falling into nine different categories of activity in which a water licence can be issued. These are Industrial, Placer Mining, Quartz Mining, Municipal, Power, Agricultural, Conservation, Recreational and Miscellaneous. Licences may be Class A or Class B depending on the amount of water use per day applied for, whether waste is being deposited, and if other activities are being undertaken that involve water uses or changes to a watercourse. Triggers are identified in the *Waters Regulation*. Licences always have specific terms and conditions (e.g., maximum amount of water that may be pumped per day; season that activity is permitted or prohibited) and a list of monitoring requirements incumbent upon the licence holder (e.g., monitoring daily water use and submitting an annual report). For every accepted or rejected licence application, the Yukon Water Board issues a “reasons for decision” document. The Government of Yukon’s Department of Environment and Department of Energy, Mines and Resources share the duty of enforcing the conditions of a water licence.

Water licences follow a “First in Time, First in Right” framework, meaning that licensees are granted rights to use water based on the age and order of licences granted. Licensees are required to report yearly (or with greater frequency depending on the licence) on water use operations and deposit of water. Industrial, placer mining and quartz mining projects that use water or deposit waste without a licence are still required to submit a notification of water use to the Yukon Water Board. Many other forms of water use do not require a licence, including homeowners or businesses that have no access to municipal water services and use a well or trucked water delivery for domestic potable water (Government of Yukon 2011a).

Table 9-1 shows the minimum water use that triggers the requirement for each type of licence and the associated annual fees. For reference, two large Yukon quartz mining projects, Minto and Bellekeno, pay a \$30 licence fee for their annual water use.

The allowable water use limits set out under those licences provide a broad picture of how water use is divided in Yukon. As shown in Figure 9-5, mining dominates the allowable licensed use by a substantial margin, with placer mining accounting for 93 per cent of the gross allowable water use.

Table 9-1 Water use threshold to licence requirements (Government of Yukon 2011a)

Licence Type	Water use threshold to licence requirement (m ³ /day)	Fee
Agricultural	300	Greater of \$30 and \$0.15/1000m ³
Conservation	300	--
Hydro Power	None	Class 1 - \$1500; Class 2 - \$4000; Class 3 - \$10,000; Class 4 - \$30,000; Class 5 - \$80,000; Class 6 - \$90,000 up to 100,000 kW and \$1000 per additional 1000kW
Industrial	100	Greater of \$30 and the sum of \$1/100m ³ up to 2000m ³ /day; \$1.5/100m ³ from 2000 - 4000m ³ /day; and \$2/100m ³ above 4000m ³ /day
Municipal	100	--
Miscellaneous	100	Greater of \$30 and the sum of \$1/100m ³ up to 2000m ³ /day; \$1.5/100m ³ from 2000-4000m ³ /day; and \$2/100m ³ above 4000m ³ /day
Placer Mining	300	Greater of \$30 and the sum of \$0.5/100m ³ up to 2000m ³ /day; \$0.75/100m ³ from 2000-4000m ³ /day; and \$1/100m ³ above 4000m ³ /day
Quartz Mining	300	Greater of \$30 and the sum of \$1/100m ³ up to 2000m ³ /day; \$1.5/100m ³ from 2000-4000m ³ /day; and \$2/100m ³ above 4000m ³ /day
Recreation	300	--

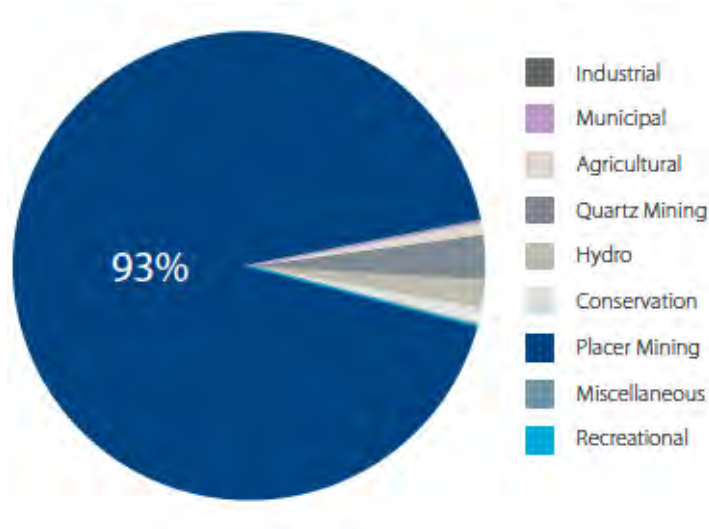


Figure 9-5 Yukon water licence use allowances by licence type per cent, September 2010 (Government of Yukon 2011a)

As of September 2010, total allowable water use under all active water licences in Yukon was 2,844,000 m³/day. Totals by licence type vary widely from less than 2,000 m³/day for conservation to over 2,600,000 m³/day for placer mining (Figure 9-6).

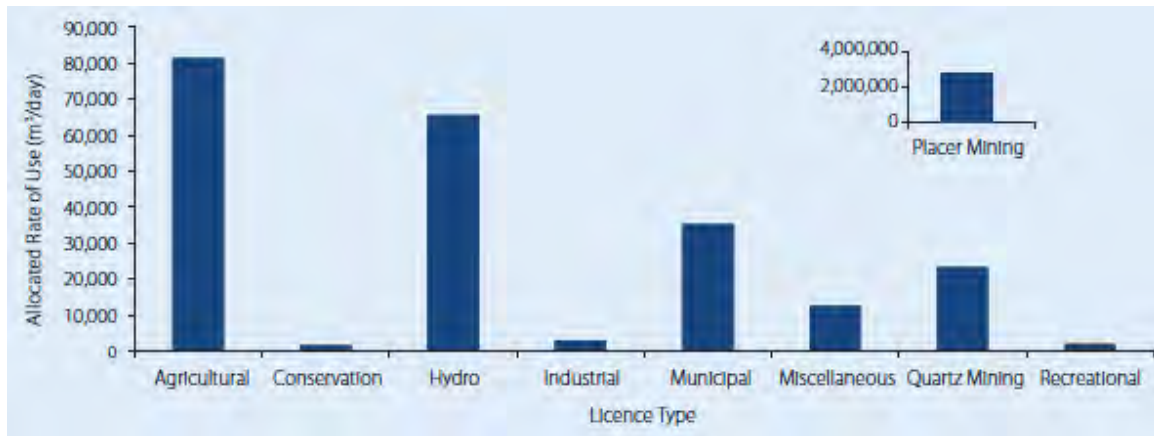


Figure 9-6 Yukon water licence use allowances by licence type amount, September 2010 (Government of Yukon 2011a)

These values represent only the amount of water that could be used by licensees. Actual water use varies by year given the extent of activities (e.g., for placer mining), climatic conditions (e.g., for agriculture irrigation) and population size (e.g., for municipal). In the Government of Yukon’s 2011 assessment of water and climate change vulnerabilities (Government of Yukon 2011a) it is noted that:

Annual reporting of water use is required for licensees. However, these data are not currently collated for all undertakings on a watershed basis due, in part, to relatively low pressures in most large watersheds.

The Yukon Water Board provides information on past and current water licences throughout Yukon via an online registry, available to the public at <https://apps.gov.yk.ca/waterline>.

The *Waters Act* also establishes a statutory compensation system, which, consistent with the principle of prior allocation, protects existing water users who may suffer adverse effects, loss or damage when a new use of water is licensed under the act. These users can include domestic, in-stream, and authorized users as well as owners and occupiers of property, holders of outfitting concessions and registered trap line holders.

Water use and protection are considered during the assessment and regulatory processes. Water licences contain operating conditions, discharge standards and requirements for monitoring, sampling and reporting. Mining industry proponents are required to prepare a mine-site water balance and provide details of their water management plan for operation and closure, including the storage, conveyance, diversion, treatment and monitoring of water. Continued review and update of water balance plans, based on site-specific data and operational changes, is also crucial to sound mining water management (Government of Yukon 2011a).

Water licences outline allowable water use, deposit of waste and mining activities, including the construction of dams and diversions. Sediment discharge standards are determined by the relevant watershed authorization under the Fish Habitat Management System for Yukon Placer Mining. Licensee requirements for sampling, monitoring and reporting of water quality objectives and aquatic health is carried out along with monitoring by government agencies (Government of Yukon 2011a).

9.4.2 Policy Direction

Water governance and management are central to ensuring sustainable water use. Water governance describes the context for a decision-making process, including how decisions are made and who makes them. Water management refers to the operational approaches adopted, including policies, models, principles and information used to make decisions (Government of Yukon 2011a).

A wide variety of governments and management agencies make decisions about water resources in Yukon.

9.4.2.1 Government of Yukon

A Draft Yukon Water Strategy (Government of Yukon 2013) was recently developed to clarify the Yukon government's approach to addressing complex water issues. It establishes a framework of goals and priority actions, which in turn are based on a vision and set of principles. Short- and long-term priority actions are proposed in the form of policies, plans and programs. A public review period was held in spring 2013, and a summary of comments received is available on the Environment Yukon website <http://www.env.gov.yk.ca/environment-you/draft-water-strategy.php>

Stated goals for the Draft Yukon Water Strategy are:

- *Water for People* – Ensure accessible, safe and sufficient water for drinking and other purposes, including industrial, recreational, heritage, cultural and spiritual uses and values. Promote sustainable and valuable use of water for communities and economies for key business sectors.
- *Water for Nature* – Preserve water quality and quantity for aquatic health and ecosystem services while respecting the intrinsic value of water.
- *Water Monitoring, Knowledge and Management* – Strengthen understanding, knowledge and overall management of water.

The Strategy calls for the following actions:

- Develop vision and principles for decision-making;
- Improve understanding of Yukon's water and groundwater resources;
- Facilitate collaboration among governments and organizations;
- Maintaining and improving access to safe and affordable drinking water;
- Improve communication of water resources information;
- Promote the sustainable and wise use of water; and
- Address climate change.

Within the Government of Yukon, there are six departments with responsibilities for water resources.

- **Environment** – Develops water-related strategic plans and policies and monitors, analyzes and reports on water quality and quantity; enforces the *Waters Act* and ensures compliance with water licences and for water-retaining structures; reviews project applications for water use and the deposit of waste; monitors permittee groundwater sampling requirements for solid waste disposal sites, park planning and operations, and freshwater fisheries management.
- **Energy, Mines and Resources** – Responsible for protecting water resources in relation to placer mining and large operating quartz mines; indirectly accountable for water resources through its mandate for managing minerals, abandoned mines, lands, oil and gas, energy, agriculture, forest resources and regional land use planning.

- **Community Services** – Builds and manages water, sewerage, road works, flood and erosion control, and solid waste disposal projects for unincorporated Yukon communities; provides advice and project assistance to municipalities and Yukon First Nations.
- **Health and Social Services** – Regulates drinking water through the *Drinking Water Regulation* under the *Public Health and Safety Act*; provides information and advice, as well as performing inspections and enforcement, in a variety of areas including drinking water quality, sewage disposal, food service, institutions and child care facilities.
- **Executive Council Office** – Houses the Yukon Water Board Secretariat, responsible for administering the water licensing process and supporting the Yukon Water Board.
- **Highways and Public Works** – Property Management Agency provides potable water and sewage disposal in Government of Yukon buildings.

9.4.2.2 Government of Canada

The *Federal Water Policy* (Government of Canada 1987) that was released by Environment Canada in 1987 continues to provide policy guidance for management of water resources by Canada. In a northern context, a significant component of the policy is found in its opposition to large-scale transfer and export of fresh water from northern rivers to more populous and water scarce regions in the south.

Several departments within the federal government have responsibilities for Yukon waters. Environment Canada focuses on hydrometric monitoring, pollution abatement, environmental contaminants, environmental emergency response and wildlife monitoring as well as participates in environmental assessments of project proposals. Aboriginal Affairs and Northern Development Canada provides safe water and effective wastewater systems for First Nations, including support and training of First Nation water operators. Fisheries and Oceans Canada reviews projects and proposals with the goal of protecting fish and fish habitat. Transport Canada is responsible for navigable waters as well as waters in contact with transportation corridors. It is also active in northern Yukon coastal waters through its Coast Guard operations.

9.4.2.3 Yukon First Nations

Yukon First Nations have rights in relation to water that are set out in Final Agreements. These include use and protection of water on Settlement Lands and use of water for trapping, non-commercial harvesting, and traditional heritage, cultural, and spiritual purposes. In addition, the Council of Yukon First Nations nominates one-third of the members of the Yukon Water Board. Many First Nations own and operate their own drinking water systems.

Yukon First Nations that have signed Final and Self-Government Agreements have certain water rights and management responsibilities, including the power to enact laws.

9.4.2.4 Municipal Governments

Incorporated Yukon communities such as the City of Dawson build and manage water and wastewater systems and solid waste management facilities.

9.4.2.5 Boards and Councils

The Yukon Environmental and Socio-economic Assessment Board, the Yukon Water Board, Regional Planning Commissions, and Renewable Resource Councils all play important roles with respect to Yukon waters. The Yukon Water Board, for example, issues water rights and regulates water use and waste deposit to water through its licensing process.

9.4.2.6 Other Stakeholders

Non-government organizations such as the Yukon River Inter-Tribal Watershed Council (YRITWC), the Yukon Conservation Society, and the BC/Yukon Water and Waste Association advocate and act to protect and conserve water. Tr'ondëk Hwëch'in and the YRITWC manage an active layer permafrost monitoring station as well as water monitoring programs in the region (Tr'ondëk Hwëch'in 2013). Industry (from large mining companies to local water-well drillers), community organizations and even ordinary citizens are responsible for protecting Yukon waters.

9.4.2.7 Inter-Jurisdictional Initiatives

Yukon participates in a number of regional and national water initiatives including the Mackenzie River Basin Board, Canadian Council of Ministers of the Environment, Council of the Federation Water Stewardship Council, and the Federal-Provincial-Territorial Committee on Drinking Water.

9.4.3 Current Best Management Practices

The five main mechanisms by which contamination and alterations to flow conditions can be detrimental to water quality, fish and other aquatic life are:

- Increased runoff;
- Sedimentation;
- Nutrient and contaminant influxes;
- Temperature alterations; and
- Flow alteration.

Yukon and First Nation governments and industry groups have developed Best Management Practices (BMPs) to mitigate many of these potential impacts. BMPs cover materials and methods for: erosion and sediment control, such as vegetation management and revegetation; contaminant control such as proper fueling practices; and fish specific guidelines for activities such as the use of fish screens and water pumping. They also detail best practices for working in and around water bodies, such as installing culverts, diverting streams, fording streams, setting up docks and barge landings, and minimizing site footprint (Government of Yukon 2011*b*).

BMPs have also been developed to address the impact of wilderness river travellers on the environment and on the experience of other river users (Wilderness Tourism Association of the Yukon 2013).

9.4.4 Monitoring Activity

A wide range of governments, departments and organizations are engaged in water monitoring and data collection in the Yukon. Due to the cross-boundary nature of the territory's watersheds, the groups include both Canadian and American government and non-government agencies, as well as First Nation organizations and universities from both countries.

9.4.4.1 Water Quality Objectives and Guidelines

There is no single measure that constitutes good water quality or that defines the health of a watershed. Water quality guidelines are scientifically determined and indicate the maximum allowable concentration of substances for a particular water use, such as livestock watering or swimming, and serve as the targets for environmental protection.

Water quality objectives specify the concentrations of substances permissible for all intended water uses at a specific location on a lake, river or estuary. The objectives are based on the water quality guidelines for the uses at that location as well as on public input and socio-economic considerations.

Monitoring programs help measure the changes in water quality over time, determine levels of water contaminants, establish a scientific basis for guidelines, identify emerging issues and threats, and track the results of remedial measures or regulatory decisions (Government of Canada 2012).

Governments use both guidelines and objectives to protect water quality and to describe how much of a substance should be permitted. For example, the Government of Yukon follows the *Canadian Water Quality Guidelines for the Protection of Aquatic Life* prepared by the Canadian Council of Ministers of the Environment.

Other indicators of water quality are less quantitative and reflect more of a holistic view of the watershed. For Aboriginal peoples and subsistence land users, aspects of a healthy watershed include healthy animals and healthy people who live there, clean water, a beautiful landscape and the natural food chain in its original abundance. This view is reflected in a Yukon River Inter-Tribal Watershed Council (2002) assessment:

Even though streams and rivers may fall within the stated standards and guidelines at a given time, when sampled, the watershed may not be healthy in the holistic sense of providing an environment for the flora and fauna of the watershed.

Indicators of an unhealthy watershed can be decreases in fish and wildlife populations, changes in animal distribution or increased incidence of tumours and cysts on fish and wildlife, which in turn affects the health of people who eat these foods.

9.4.4.2 Monitoring Agencies

Several departments within the Government of Yukon have responsibility for some aspects of water resources monitoring. These include Community Services, Energy Mines and Resources, Highways and Public Works, and Health and Social Services, and Environment.

The Department of Environment's Water Resources Branch holds the primary responsibility. The Hydrology Section's role is to carry out environmental impact assessments and reviews of water licence applications; monitor the compliance of water use licences; provide estimates of peak and low flows for the design and operation of hydraulic structures, such as highway stream crossings, flood protection works and water supply reservoirs; operate the Yukon flow forecasting and monitoring program, including preparing the Snow Survey Bulletin and Water Supply Forecast; provide estimates of the magnitude and timing of peak streamflow and water level for flood-prone communities, for the purpose of allowing sufficient lead time for the implementation of emergency measures; provide general services to the public; and monitor climate change impacts.

The Yukon Snow Survey Bulletin and Water Supply Forecast is prepared and issued by the Water Resources Branch three times annually after March 1, April 1, and May 1. The bulletin provides a summary of winter meteorological and streamflow conditions for Yukon, as well as current snow depth and snow water equivalent observations for 56 locations. This information is used to make projections of total volume runoff for the summer period and an estimate of peak flow for the main river basins and sub-basins.

The primary duty of the Water Inspections Section is to enforce compliance with the *Waters Act* and *Waters Regulations*. This includes identifying concerns with project descriptions submitted for environmental assessment, recommending water use licence operating conditions, and monitoring and promoting compliance with those licences. Water inspectors conduct inspections on both licensed and unlicensed undertakings. The Department of Energy, Mines and Resources monitors water licences for placer mining and quartz mining projects.

The Government of Canada retains some responsibilities for water monitoring and management as outlined in the legislation section above. Environment Canada, Fisheries and Oceans Canada, and

Natural Resources Canada are the key departments.

Cross-border organizations conduct research and monitoring activities specifically for the Yukon River Basin (e.g., Yukon River Inter-Tribal Watershed Council), and the United States Geological Survey also collects water information in Alaska. Several universities conduct water-related research in Yukon, and co-management bodies established under various land claim agreements also lead or participate in water research and monitoring. Private companies and industry collect water data to satisfy the requirements of water licensing and/or the environmental assessment process (e.g., collection of baseline data, ongoing monitoring and reporting). However, the data collected by these various organizations and agencies are not always publicly available.

9.4.4.3 Monitoring Networks

Monitoring networks and data collection programs gather information on Yukon's water resources. These networks fall into three broad categories:

- Aquatic Health – monitor environmental parameters related to contaminants and the impact of water quality on aquatic health.
- Hydrometeorological – monitor environmental parameters related to water quantity (e.g., meteorological factors, groundwater and permafrost).
- Water Quality – monitor environmental parameters related to water quality (e.g., those related to drinking water and tracking changes in long-term surface and groundwater chemistry).

A broad range of sample types and measurements are taken relating to aquatic organisms, hydrology, meteorology, microbiology, sediment chemistry, snowpack, and water chemistry. There are currently 27 Yukon water monitoring networks, shown in Table 9-2. A detailed description of program objectives and parameters measured is provided in (Government of Yukon 2011a).

These monitoring networks can adapt to changing needs and conditions as well as change management agencies. For example, the Yukon Hydrometric Network was initiated in 1974 by the federal Department of Indian Affairs and Northern Development with the objective of providing one or two years of flow information, primarily for culvert design and fisheries concerns. It was prompted by the lack of information available for small drainage basins (i.e., 500 km² and smaller), and the fact that hydraulic structures associated with small basins are susceptible to relatively large peak flow events. The original areas of interest were the North Canol, Nahanni Range and Dempster highways, but additional areas were added as more requests for data were received. Since then, the Department of Environment's Water Resources Branch has taken over management and operation of the network; some stations have been discontinued, but the network has expanded considerably because of requests for data to meet accelerating development pressures. There have been requests for hydroelectric development, fisheries management, mining development and forestry interests (Government of Yukon 2005).

As of June 2011, Water Resources Branch is responsible for three active and 12 inactive hydrometric stations, three active and one inactive snow survey courses, one active groundwater monitoring site, and one active water quality monitoring network station (operated in partnership with Environment Canada) within the Dawson planning region. However, the region is considered data sparse; increased water quality and quantity baseline data is required to adequately understand and assess the impacts of future development on water resources.

Table 9-2 Yukon water monitoring networks (Government of Yukon 2011a)

Network Type	Name	Lead Agencies	Period of Record
Hydrology Networks	Canada-Yukon Hydrometric Monitoring Network	Water Survey of Canada, Environment Canada, Environment Yukon	1940s to present
	Yukon Hydrometric Network	Environment Yukon	1974 to present
	Canadian Meteorological Network	Meteorological Service of Canada, Environment Canada	1920s to present
	Community Services Weather Network	YG Community Services Wildland Fire Management Program	1993 to present
	Yukon Meteorological Network	Environment Yukon	1993 to present
	Yukon Snow Survey Network	Environment Yukon	1975 to present
	Yukon River Ice Break-up at Dawson City Monitoring	Environment Yukon, Imperial Order of the Daughters of the Empire	1896 to present
	Yukon-wide Long-term Groundwater Monitoring Program	Environment Yukon	2008 to present
	Yukon Water Well Registry	Environment Yukon, Natural Resources Canada	1963 to present
Water Quality Networks	Pacific Yukon Water Quality Monitoring Program	Environment Canada, Environment Yukon, Parks Canada	1983 to present
	Yukon River Water Quality Monitoring Project	Yukon River Inter-Tribal Watershed Council	2004 to present
	Water Licence Water Quality Reporting and Audits	Environment Yukon	1970s to present
	Water Quality Baseline and Audit Repository	Environment Canada	1990s to present
	Placer Water Quality Objectives and Monitoring	YG Energy, Mines and Resources	1992 to present
	Water Quality Monitoring at Type II Abandoned Mines	YG Energy, Mines and Resources	Varies by site
	Metal Mining Effluent Regulations Reporting Requirements	Environment Canada	2006 to present
	Drinking Water Bacteriological Testing	YG Health and Social Services	1997 to present
	Property Management Drinking Water Database	YG Highways and Public Works	2004 to present

Network Type	Name	Lead Agencies	Period of Record
	Community Services Drinking Water Database	YG Community Services Community Development	1990s to present
	Groundwater and Surface Water Monitoring at Yukon Contaminated Sites	Environment Yukon	Varies by site
	Solid Waste Disposal Facilities Permittee Monitoring for Leachate Impacts	Environment Yukon	Early 2000s to present
Aquatic Health Networks	Biomonitoring Information System of the Yukon	Environment Canada	1973 to present
	Canadian Aquatic Biomonitoring Network (CABIN)	Environment Canada	Early 2000s to present
	Yukon Government Fisheries Database	Environment Yukon	1990s to present
	Ecological Monitoring of Freshwater Thermal Regimes	Ta'an Kwäch'an Council	2010 to present
	Monitoring of Freshwater Thermal, Chemical and Biological Regimes of Salmon Migration Habitat	Tr'ondëk Hwëch'in	2010 to present
	Michie Creek Monitoring Project	Kwanlin Dün First Nation, Yukon River Panel	2003 to present

9.5 Risks and Uncertainty

9.5.1 Water and Climate Change

Water is linked inextricably with climate. The warming trend recorded over the past decades shows up in changing precipitation patterns, widespread melting of snow and ice, increases in atmospheric water vapour through increasing evaporation, and changes in soil moisture and runoff.

In an effort to better understand where and when changes in hydrology are likely to occur, the Scenarios Network for Alaska and Arctic Planning (SNAP) and Yukon College collaborated to develop a tool for mapping future growing-season water availability in Yukon, based on a similar tool developed by SNAP and The Wilderness Society in Alaska. Results showed that much of the Yukon is likely to remain water-limited during summer months with some regional drying, particularly in the boreal regions. However, the greatest impacts to ecosystem hydrology may come from associated changes such as lengthened growing season and increased growing degree days, vegetation shifts, changing drainage from permafrost loss, and altered fire cycles (SNAP 2011).

If permafrost melts, the upper layers of soil become drier and well aerated and the active layer becomes deeper. Soil microbes oxidize more of the organic carbon sequestered in the soils. This increased respiration releases carbon, in the form of dissolved carbon, into the atmosphere; changes in dissolved organic carbon could affect stream communities at all trophic levels. The melting of the permafrost may increase recharge of aquifers, thus increasing base flow in streams. By increasing summer recharge, melting of permafrost will also decrease summer peak flows. Natural factors such

as wildfire can also affect permafrost; after a fire, the change in surface conditions results in soil warming and increased active depths. The soil may become well drained and may no longer have a perched water table. Thus, the hydrology changes and areas that once were wetlands become completely drained (Brabets et al. 2000).

General climate trends and projections affecting Yukon water resources are shown in Table 9-3. All of these changes present challenges to continuing water use and management.

Table 9-3 General climate trends and projections affecting Yukon water resources (Government of Yukon 2011a)

Factors	General trends
Temperature	Over the last several decades, winter and summer temperatures have increased in all Yukon regions and the forecast is for continued warming. A relatively uniform increase in annual temperature of 2.5 C to 3.5 C is projected for Dawson for the 30-year period to the 2050s.
Precipitation	Increased precipitation has been observed for some areas, especially increased winter precipitation in the northern regions and increased summer precipitation in southeast and central Yukon. Most projections suggest continued increases.
Snowpack	Northern Yukon has experienced significantly decreased winter and early spring snow depths, and earlier snowmelt and decreasing period of snow cover have been observed throughout the Arctic. Given the strong sensitivity of spring snowmelt timing to spring temperatures, a continued trend of earlier snowmelt and associated earlier peak flows can be expected.
Evaporation and Evapotranspiration	Climate change could have a critical impact on evapotranspiration, and therefore on water availability, with increasing temperatures resulting in increased evaporation.
Permafrost	Increasing air temperatures are leading to permafrost warming and degradation and this is expected to be greatest within the discontinuous and sporadic zones where the permafrost is warmer and more susceptible to thawing.
Glaciers	A 22-per cent reduction in glacial cover was calculated over the last 50 years in Yukon's St. Elias and Mackenzie mountain ranges and continued glacial decline could have a profound influence on the hydrology of Yukon's glacier-dominated basins.

Factors	General trends
River Ice	An advance of five days per century was calculated for break-up timing on the Yukon River at Dawson between 1896 and 1998. In the last two decades, the advance has been even more dramatic. A trend of increasing water level during break-up from the early 1970s to the present for Dawson has also been observed. Projections about the severity of ice jamming are not readily made given the complexity of factors, but the occurrence of a midwinter break-up event and associated ice jam on the Klondike River in 2002-3 indicates a possible shift in Yukon's river ice regime.
Streamflow	There are indications that Yukon streamflow characteristics are being affected by climate change, although they vary by hydrologic regime and season. These include increased winter low flows and an advanced spring freshet in mountainous streams, increased annual mean and peak flows in glacierized basins in southwestern Yukon, decreased peak flows and increased minimum winter streamflow within the continuous permafrost zone, and increased winter flow and a declining trend in average flows in summer in the Yukon River Basin. Increased river flow is generally projected for high-latitude rivers to the end of the 21st century.
Groundwater	Trends in streamflow investigated over periods of 20 to 50 years in the Yukon River Basin showed significant increases in estimated groundwater flow. The largest increases were detected in the Yukon River headwaters and in the Porcupine River watershed. Trends or projections of groundwater availability or recharge for community water supplies have not yet been well documented.
Erosion and Sediment Transport	Changing hydrological conditions could cause increased erosion and sediment transport. These conditions include permafrost degradation (both through increased peak flows and permafrost-related landslides), glacial retreat, and changing snowmelt and spring break-up conditions.
Metals and Contaminants	Permafrost thaw will likely lead to changes in groundwater flows and the quantity and quality of organic carbon in rivers, streams and lakes (with associated possible changes in metals and contaminants levels).
Solute and Nutrient Concentrations	Warming air temperatures leading to permafrost thaw and degradation can have significant impacts on hydrology, ecosystems and biogeochemical cycling. Changes in the timing and magnitude of glacial melt will also lead to changes in solute and nutrient concentrations.
Water Temperature	Lakes and rivers across the northern hemisphere are already exhibiting higher temperatures in response to warmer conditions, with surface water temperatures up as much as 2 C since the 1960s. Warmer water cannot carry as much oxygen as cooler water and this also means changes to the internal structure of lakes (e.g., more evaporative water loss, shallower thermoclines) that affect habitat, water volume and water chemistry.

Factors	General trends
Extreme Events	There appears to be an upward trend in the number of heavy snowfall events for autumn and winter over northern Canada, with no change in intense precipitation events. The Klondike River mid-winter break-up event, rapid lake drainage from thermokarst development in the Old Crow Flats, and Southern Lakes flooding (highlighting the effect that increased glacial melt and summer precipitation can have) are other extreme events of note in the last decade.

Changing streamflow timing, particularly the advance of the spring freshet and long-term decreases in flow in glacierized basins, could impose new constraints on water availability in certain watersheds and in certain seasons.

Many potential effects of climate change have major implications for hydro power production, including increased near-term peak flows in glacier-dominated basins followed by potential long-term decreases, increased magnitude of low flows from permafrost warming, earlier snowmelt, and potentially increased precipitation and evaporation.

Access to water, particularly from small creeks, by the oil and gas sector for the construction of ice roads in the Eagle Plains area could be impacted by changing flow regimes in the continuous permafrost zone.

Water can present both a threat and a safeguard to public safety. In the municipal sector, there is significant concern about protecting groundwater (drinking water sources) from contamination. Flooding and erosion are hazards to people, buildings, and roads and can cause extensive property and infrastructure damage. Alternatively, water is vital to the protection of homes and forests from fires.

Changing temperatures, precipitation and evaporation conditions will affect agriculture most strongly through the amount of irrigation water required to produce a crop. Increased water demand from a progression towards higher-value crops and changing streamflow regimes could become an issue for smaller creeks.

The health of fish and fish stocks is inextricably linked to a healthy aquatic ecosystem. Changing hydrological or water quality conditions caused by climate change could aggravate existing stressors, including the spread of fish diseases and invasive species, as well as stresses on fish habitat from such pressures as residential development, forestry, hydro projects, roads and mining.

Increased low flows and earlier spring snowmelt could benefit the placer mining industry, but shorter ice-road seasons would limit access to mining and exploration sites. For hard rock mining, management of on-site water could become more challenging given greater precipitation inputs, and require more frequent adjustments of site water balances, changes to water management plans, and potentially increased treatment. Hydrologic changes could also challenge efforts to divert clean water. Changing background water quality conditions as a result of climate change and the incorporation of climate change into closure planning are additional concerns.

The physical action of the ice within ice jams that form during break-up can also cause substantial damage, and when the jam finally breaks a tremendous amount of water is suddenly released downstream and more flooding can result. The City of Dawson suffered six major ice jam floods in the last century and an engineered dyke was constructed after the 1979 flood. A mid-winter break-up event and associated ice jam occurred on the Klondike River at Dawson during the winter of 2002-03, resulting in flooding of the community. This event was triggered by record high air temperatures

and rainfall and is the first recorded mid-winter break-up event in the Yukon (Government of Yukon 2011a).

Increased prevalence of forest fires, insect disturbances and changes to forest species could have dramatic effects on forests and water resources in forested watersheds.

Increased groundwater-surface water interactions as a result of melting permafrost, and increased groundwater contribution to streamflow could alter and possibly threaten the quality and quantity of municipal groundwater sources. Changing permafrost conditions could pose threats to the quality of groundwater supplies if buried sewage systems and landfills are impacted. Increased populations in communities could have an impact on water provision and sewage services, and most communities will need significant and costly upgrades to their water and sewer systems in the future due to aging infrastructure.

Changes to habitat, vegetation, snow conditions, weather patterns, and water volume and quality could impact fish and wildlife populations that residents of the region rely on for subsistence harvesting. For example, droughts or deficit streamflows in the Yukon River Basin primarily affect anadromous fish, such as salmon, which may not have sufficient streamflow to migrate upstream or whose eggs may not survive if they become exposed as stream levels decline (Brabets et al. 2000). Elevated levels of suspended sediments can adversely affect aquatic life by clogging gills, covering fish spawning sites or altering habitat of benthic organisms; land cover disturbance by activities such as mining can accelerate sedimentation processes, and metals and organic contaminants also commonly adsorb on suspended sediment (Brabets et al. 2000).

Water resources are one of the highest priority issues with respect to climate change impacts and adaptation in Canada. Waterways, wetlands and riparian zones in the planning region provide important ecological functions and can provide resilience to climate change. There is a need to enhance understanding and awareness of climate change in the region and to encourage development and implementation of adaptation strategies. Increased monitoring and expanded research is required. See **Section 1 – Chapter 5, subsection 5.8** for additional information on climate change in the region, including local adaptation planning.

9.5.2 Other Risks and Uncertainties

Land cover influences a number of hydrologic factors such as snow accumulation, soil moisture depletion, surface runoff, infiltration and erosion. These factors, in turn, can affect the water quality of a particular stream or river. For example, certain types of vegetation can prevent erosion, thus reducing the quantity of sediment that enters a stream. Also, the composition of certain types of vegetation will in turn affect the chemistry of the water quality. Land cover also has a direct influence on permafrost because of the thermal properties that determine the quantity of heat entering and leaving the underlying ground in which the permafrost exists. Vegetation exerts an indirect influence on permafrost by affecting climatic and other terrain features (Brabets et al. 2000). Increasing disturbance of land cover through anthropogenic activities can exacerbate or accelerate shifts occurring as a result of climate change.

Future industrial demand for water is expected to increase, which may impact both water quality and quantity. Water management decisions (e.g., issuance of water licences) need to take into account discrepancies between the needs of water users and the current and future supply.

Water quality concerns associated with agriculture arise mostly from non-point-source pollution resulting from various agricultural practices and from precipitation runoff. Yukon's semi-arid climate, limited summer precipitation, and riparian setbacks have, to date, prevented intensively used agricultural areas from impacting waterways (Government of Yukon 2011a).

Changes to water quality and aquatic ecosystems affect fish species, which have high value in the Dawson region for subsistence, commercial and sport fishing. Very little information exists on the distribution of freshwater fish and their important habitats in the planning region.

Groundwater is a vital resource to the majority of Yukon communities as a source of drinking water, but the groundwater regimes associated with community water supplies are relatively unstudied (Government of Yukon 2011a).

The Yukon River is a major contributor of water and solutes to the Bering Sea and Arctic Ocean ecosystems. Changes in the Yukon River, either flow or water quality, could also influence these ecosystems.

Despite the widespread presence of permafrost in Yukon, a major gap exists in the level of baseline data describing permafrost terrain. Detailed maps of permafrost character, distribution and ground temperature do not exist at a scale adequate for effectively assessing terrain stability hazards for infrastructure and communities; assessing the impacts of climate change and environmental disturbance on permafrost environments; or for facilitating responsible planning of infrastructure, transportation and development of hydrocarbon resources. The Yukon Geological Survey is involved in a number of projects to improve the available data (Yukon Permafrost Network 2013).

9.6 Chapter References

- Brabets, T.P., B. Wang and R.H. Meade. 2000. *Environmental and Hydrologic Overview of the Yukon River Basin, Alaska and Canada*. Water Resources Investigations Report 99-4204. United States Geological Survey, Anchorage.
- Campbell, K. and M. Horne. 2011. *Shale Gas in British Columbia: Risks to B.C.'s water resources*. Pembina Institute. Drayton Valley, Alberta, Canada. Available at: <http://pubs.pembina.org/reports/shale-and-water.pdf>.
- Canadian Council of Ministers of the Environment. 2010. *Water Valuation Guidance Document*. PN 1443 ISBN 978-1-896997-92-6 PDF. Available at: http://www.ccme.ca/assets/pdf/water_valuation_en_1.0.pdf.
- Government of Canada. 1987. *Federal Water Policy*. Environment Canada. Ottawa, Ontario, Canada. Available at: <http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=D11549FA-1>.
- Government of Canada. 2012. Environment Canada Website. Water, Water Quality, Freshwater Quality Monitoring. Available at: <http://www.ec.gc.ca/eaudouce-freshwater/Default.asp?lang=En&n=6F77A064-1> (accessed November 2012).
- Government of Yukon. 2005. *Yukon Water Resources Hydrometric Program Historical Summary 1975-2004*. Department of Environment, Water Resources Branch. Whitehorse, Yukon, Canada. Available at: <http://www.env.gov.yk.ca/air-water-waste/documents/hydrometricmanual2005.pdf>.
- Government of Yukon. 2006. *Summary of Yukon Water Wells*. Compiled from the Yukon Water Well Registry, May 11, 2006. Department of Environment, Water Resources Branch. Whitehorse, Yukon, Canada. Available at: <http://www.env.gov.yk.ca/air-water-waste/documents/YukonWaterWellsSummary.pdf>.
- Government of Yukon. 2011a. *Yukon Water: An Assessment of Climate Change Vulnerabilities* (and Summary Report). Department of Environment, Water Resources Branch. Whitehorse, Yukon, Canada. Available at: http://www.env.gov.yk.ca/publications-maps/documents/yukonwater_climatechange_report.pdf.

- Government of Yukon. 2011*b*. *Best Management Practices for Works Affecting Water in the Yukon*. Department of Environment, Water Resources Branch. Whitehorse, Yukon, Canada. Available at: http://www.env.gov.yk.ca/publications-maps/documents/bestpractes_water.pdf.
- Government of Yukon. 2012. Yukon Water Website. Understanding Yukon Water, Water Use. Available at: <http://yukonwater.ca/UnderstandingYukonWater/> (accessed November 2012).
- Government of Yukon. 2013. *Draft Yukon Water Strategy: For Public Review*. Department of Environment, Water Resources Branch. Whitehorse, Yukon, Canada. Available at: http://www.env.gov.yk.ca/publications-maps/documents/draft_water_strategy.pdf.
- Grods, J., S.R. Francis, J.C. Meikle and S. Lapointe. 2012. *Regional Ecosystems of West-Central Yukon. Part 1: Ecosystem Descriptions*. Prepared for Government of Yukon, Department of Environment by Makonis Consulting Ltd. and Associates, West Kelowna, British Columbia, Canada.
- Hennessey, R., S. Jones, S. Swales and F. Duerden. 2011. *Dawson Climate Change Adaptation Plan, Revised Edition*. Northern Climate ExChange, Yukon Research Centre, Yukon College, Whitehorse, Yukon, Canada.
- Klock, R., E. Hudson, D. Aihoshi, and J. Mullock. 2001. *The Weather of the Yukon, Northwest Territories and Western Nunavut*. Graphic Area Forecast 35, NAV CANADA, Government of Canada, Ottawa, Ontario, Canada.
- Scenarios Network for Alaska and Arctic Planning (SNAP). 2011. *Yukon Water Availability Analysis: An assessment of the potential impacts of climate change on the balance between precipitation and potential evapotranspiration in the Yukon, Canada*. Prepared for the Northern Climate ExChange, Yukon College, by SNAP, University of Alaska Fairbanks. Available at: http://www.snap.uaf.edu/attachments/Yukon_PET_Final_report_July_22_2011.pdf.
- Smith, C.A.S., J.C. Meikle and C.F. Roots. 2004. *Ecoregions of the Yukon Territory Biophysical Properties of Yukon Landscapes*. Agriculture and Agri-food Canada, Yukon Ecoregions Working Group, Summerland, British Columbia, Canada. PARC Technical Bulletin No. 04-01.
- TH – DIAND. 1998. The Tr'ondëk Hwëch'in Final Agreement. Department of Indian Affairs and Northern Development. Ottawa, Ontario, Canada.
- Tr'ondëk Hwëch'in. 2012. *Tr'ondëk Hwëch'in Resource Report*. Submitted to the Dawson Regional Planning Commission, May 2012.
- Tr'ondëk Hwëch'in. 2013. *Tr'ondëk Hwëch'in Comments on the August 2013 Draft Resource Assessment Report*. Submitted to the Dawson Regional Planning Commission, September 2013.
- Wilderness Tourism Association of the Yukon. 2013. *Best Environmental Practices on Yukon Rivers: A minimal impact guide for river travellers*. Whitehorse, Yukon, Canada. Available at: <http://wtay.com/resources/best-environmental-practices/>.
- Yukon Permafrost Network. 2013. Yukon Permafrost Network Website. Permafrost 101. Available at: <http://permafrost.gov.yk.ca/permafrost101> (accessed February 2013).
- Yukon River Inter-Tribal Watershed Council. 2002. *Yukon River Unified Watershed Assessment*. Anchorage, Alaska. Available at: <http://www.yritwc.org/Portals/0/PDFs/UnifiedWatershedAssessment.pdf>.
- Yukon Water Board. 2012. Yukon Water Board Website. Home page. Available at: www.yukonwaterboard.ca (accessed November 2012).

10 FORESTS

10.1 Highlights

- The forested areas of the region are part of a large circumpolar Boreal region
- Forest ecosystems are complex and dynamic
- Wildfire is an important driver of diversity in forest type, seral stage and age class, which in turn provides a diversity of habitats for birds and wildlife, cultural landscapes and harvest opportunity
- Timber is harvested locally for both fuelwood and sawlogs
- Annual allowable cut for the region will be determined by Forest Management Branch (currently set at 5,000 m³)
- Forests are important for function of ecological systems, cultural value, and harvesting of non-timber forest products such as mushrooms and berries
- Forested areas are important to tourism and recreation activities
- The most significant threat to forests is drought-induced stress, which contributes to the spread of insect pests and tree mortality

10.2 Description of Resource

Named for Boreas, the Greek god of the North Wind, the boreal ecosystem accounts for almost one-third of the earth's forested land and has been called the world's largest ecosystem. The boreal forest in the planning region is an extension of the boreal forest zone that arcs across the continent from Yukon to the Atlantic coast in Labrador (Figure 10-1). Of the 26,223 km² of the planning region that lies within the Boreal ecozone, approximately 75 per cent is covered by either coniferous (60 per cent) or mixed (15 per cent) forest (Smith et al. 2004). Most of the planning region north of the Ogilvie Mountains lies within the un-forested Taiga Cordillera ecozone.

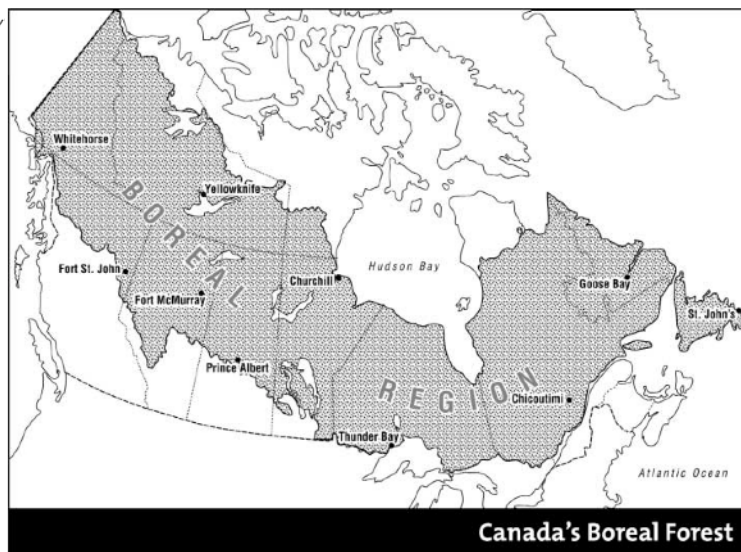


Figure 10-1 Canada's boreal forest region (Canadian Forestry Association 2005)

The boreal forest contains many plant communities because of the diverse habitats provided by mixed landforms and fire. Fires are frequent; most forest stands are less than 100 years old, although some islands may escape fire and be cloaked in old growth forest. A unique feature of the central Yukon boreal forest within the planning region is the mix of grasslands on south-facing slopes and boreal forest vegetation on north-facing slopes underlain by near-surface permafrost.

The treeline separating subalpine from alpine varies from near 1,000 m within the northern part of the Klondike Plateau ecoregion to over 1,500 m in the Yukon Plateau. Below treeline, vegetation reflects the discontinuous distribution of permafrost (Smith et al. 2004).

The dominant tree species in the forest are black spruce, white spruce, trembling aspen and birch on warmer aspects. Black spruce-sphagnum communities exist on wetter, poorly-drained depressions and at the toe of slopes. On gentle slopes, black spruce-sedge tussock communities predominate while black spruce-lichen communities are more common on better-drained, coarse-textured upland sites. The understory is dominated by shrub birch, willow, Labrador tea, alpine blueberry and heather overlying extensive feathermoss and lichen (Kennedy and Staniforth 1993 as cited in Smith et al. 2004). Black spruce stands are mixed with aspen and birch on sites where disturbance, such as fire, has occurred within about 100 years (Foote 1993 as cited in Smith et al. 2004).

Mixed forests of white spruce, paper birch, trembling aspen, balsam poplar, willow and water birch are found on warmer sites and south facing slopes. These young, mixed forest stands result from frequent fire; they are successional communities that should gradually become more coniferous over time. Kinnikinnick, grass and lichen form the understory on drier sites while moister sites contain shrubs such as willow, alder, lingonberry and soapberry. Lodgepole pine frequently invades burned areas and very dry sites, although it rarely occurs in the planning region as a result of being at the northern extent of its range.

Birch communities can be found on lower and mid-elevation slopes. Along major rivers, white spruce are found on stable terraces, while balsam poplar, willow and alder stands grow along floodplains.

Subalpine fir, white spruce and the occasional stunted lodgepole pine are found at higher elevations, along with mountain blueberry and crowberry, moss, lichen and Labrador tea (Oswald 1983 as cited in Smith et al. 2004).

Trees in riparian areas and on south-facing upland slopes may reach heights of over 30 m at maturity, with an average of 20-25 m for productive stands. In many areas forest growth is limited either by poor drainage, reduced nutrient availability or elevation.

Natural cycles of disturbance, regeneration and natural succession are fundamental to the boreal forest. Forest fires are the most significant natural disturbance impacting forest composition in the area (See **Section 1 – Chapter 5, subsection 5.7**). The fire history of the area is reflected in the mosaic of forests of different age classes across the landscape (Figure 10-2). The age class distribution shows the predominant age range between 30 and 120 years. The age classes covering the largest areas of the forested land base are between 30 and 50 years, with older age classes of forest covering successively smaller land areas. The relatively limited area of older forest (i.e., over 130 years) results from frequent stand-replacing wildfires that occur in the area, particularly in mature coniferous forest.

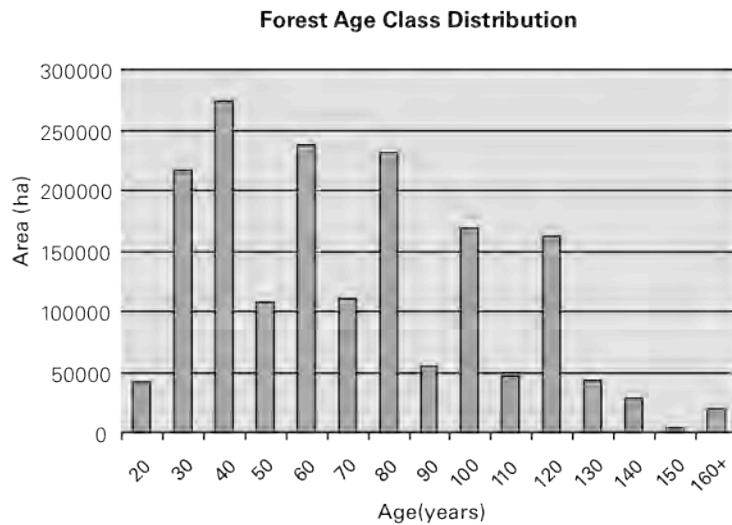


Figure 10-2 Forest age class structure (Dawson Forest Management Planning Team 2013)

10.3 Resource Values

10.3.1 Natural Value

10.3.1.1 Habitat

The mosaic of forest ecosystems provides a diversity of habitats that is constantly changing. The boreal forest provides habitat for many ecologically and economically important mammals, such as caribou, wolves, bear, moose, sheep, marten and lynx. More than 180 bird species have been recorded within the planning region, including 76 species that are confirmed to breed within the region.

In the Yukon portion of the boreal forest, over 1,110 species of flora are identified, including 127 species of grass (*Poaceae*), 118 species of *Asteraceae*, 115 species of sedge (*Cyperaceae*), 93 species of crucifer (*Brassicaceae*), 52 species of *Rosaceae*, 37 species of *Saxifragaceae* and 36 members of the snapdragon family (*Scrophulariaceae*) (Cody 1996).

The boreal forest also contains wetlands areas that support a high level of biodiversity and provide habitat for birds, mammals, amphibians, fish, invertebrates and plants. Wetlands are key indicators of environmental health and play an important role in regulating river flow and water filtration. Maintenance of quantity and quality of water is important for sustaining populations of Chinook and Coho salmon, anadromous Bering cisco, whitefish, arctic grayling, lake trout, northern pike and Dolly Varden.

The forest also allows for movement of wildlife between key habitat areas. Integrity of forest habitats, connectivity between key habitats, resilience to pests and ability to recover from disturbance are important indicators of ecological health.

10.3.1.2 Soil Retention and Erosion Control

Forest cover is a factor in the distribution of permafrost. Disturbance of forest cover and subsequent melting of permafrost may lead to slumping, erosion and ponding of surface water.

10.3.1.3 Carbon Cycling

During photosynthesis, trees produce oxygen and convert carbon dioxide, a "greenhouse gas," into woody tissue and leaves, thus locking carbon away for decades or centuries until the trees burn, decompose or are used in other processes. Some of the carbon from leaves and woody debris is stored in the forest soil. Tarnocai and Lacelle (1996) have concluded that Yukon's boreal forest stores seven billion tonnes of carbon in its soils, peat and forests, an amount equivalent to 33 years of Canada's annual carbon emissions (as cited by Canadian Boreal Initiative 2013).

10.3.1.4 Biological Controls

A diversity of forest species, age class and seral stages provides resilience against insect pests and pathogens. Forests of a single species type are more susceptible to pest invasion. In areas to the south of the planning region, small average volumes of timber and remote markets have attracted little industrial logging activity, and this, coupled with a low incidence of wildfires (compared to the rest of Yukon), has resulted in a landscape covered with relatively uniform, mature stands of spruce. An area near Haines Junction experienced significant spruce bark beetle infestations from the period 1994 to 2004, affecting over 350,000 hectares of spruce forest (Government of Yukon 2010).

Climate change may impact the rate of spread and extent of forest pests and invasive species. The range expansion of the mountain pine beetle is linked to many factors including warmer winter temperatures and high winter survival rates (Burgiel and Muir 2010). A warming climate is expected to allow the beetle to expand its range into higher elevations, eastward, and northward (Carroll et al. 2003, Régnière and Bentz 2007).

An increased frequency of wildfire would suggest more conservation focus be given to species that depend on older forest types, like caribou and marten (Reid et al. 2010).

10.3.2 Traditional Value

Tr'ondëk Hwëch'in citizen comments (Tr'ondëk Hwëch'in 2012):

I still gather plants and medicines all over.

Animals need the forest. If you take care of the forest then you're taking care of the animals.

Every tree has a job to do. Logging leads to erosion.

Protecting the land from clear cuts should come before money.

Large timber needs to be protected from mining and forestry.

Bear root, onion, caribou moss, mushrooms ... important food source.

10.3.2.1 Traditional Knowledge

Over thousands of years, Yukon Indian people have evolved a close and efficient relationship to the land, making use of a large variety of trees, shrubs, herbs, moss and fungi for food, fuel, medicine, fibre for clothing and building, and cultural materials for ceremonial use. Likewise, many species of wildlife found in the forest are used for food, clothing, medicine, decoration and other purposes.

The knowledge of where, when and how to harvest resources and how to preserve, prepare and use them is part of their traditional knowledge passed from generation to generation. Traditional knowledge of animal and plant resources, communicated through stories, legends, and place names, are essential to cultural values and social practices of the First Nation people of the region. Many Elders are concerned that development activity might impact their ability to continue harvesting these resources, and thus limit the passing of traditional knowledge along to youth.

Potential for conflict exists where timber harvest activities impact on heritage resources. Access roads or trails into remote areas may increase risks to previously exposed heritage sites from unauthorized

artifact collection. Road construction, grading and mechanical site treatment (e.g., scarification) of the surface creates the highest potential for impact to heritage resources such as buried archaeological sites or graves. Many impacts could be avoided where field crews are trained to recognize and avoid disturbance to historic resources and features (Thomas 2007).

10.3.3 Socio-Cultural Value

Forests generate local opportunities through both timber and non-timber forest values. Wage-based employment in forestry and logging, tourism, arts, food production, and traditional economic activities such as fuelwood harvest, fishing, hunting and trapping are important socio-cultural values that rely on healthy forest environments. The current annual demand in Dawson is approximately 3,500 m³ for sawlog and 1,500 m³ for fuelwood (Government of Yukon 2011a).

Boreal forests contain high recreational, educational and cultural value. Some activities relate directly to the forest resources, such as fuelwood gathering, plant harvesting, and mushroom and berry picking. Other activities occur in the forested landscape, including photography, nature viewing, hiking, bird watching, wildlife viewing, paddling, trail riding, cross country skiing, snowmobiling and dog-sledding. Activities occur in close proximity to access features, often on or adjacent to water bodies or wetlands, within coniferous forest and mixed forest landscape types. Recreation opportunity within the region is addressed in more detail in **Section 2 – Chapter 17 – Transportation and Access**.

Remote areas within the boreal forest that have experienced minimal historic human activity are valued as areas of high ecological integrity.

Some representation of boreal cordilleran ecoregions can be found within protected areas, mostly outside the planning region. Approximately three per cent of the Yukon Plateau–North ecoregion lies within existing park or protected area designations: Tombstone Park (90 km²), Devil’s Elbow and Big Island Habitat Protection Areas (HPA)(83 km²), Ddhaw Ghro HPA (1,609 km²) and Horseshoe Slough HPA (77 km²). About 0.5 per cent (143 km²) of the Yukon Plateau–Central ecoregion is contained within Lhutsaw Wetland HPA (32 km²), Nordenskiold HPA (78 km²) and Ta’tla Mun Special Management Area (33 km²). Klondike Plateau is not currently represented within a protected area.

Potential for conflict exists where timber harvest operations impact on aesthetic qualities of scenic landscapes.

10.3.4 Economic Value

10.3.4.1 Traditional Economic Activity

The forest provides for harvest and use of traditional foods, including caribou, moose, bear, sheep, grouse, rabbit/hare, freshwater fish and salmon. Plant-based foods are essential for fibre, vitamins C and A and nutrients like calcium in an otherwise meat-based diet. Many plant species including mushrooms, berries and shrubs are gathered for their nutritional or medicinal properties. Edible berries such as bearberry, black currant, blueberry, cloudberry, crowberry, gooseberry, juneberry (i.e., saskatoon berry) and strawberry are harvested in late summer or fall.

Raw materials such as wood, stone, bone, antler, fibre and dyes are also gathered for subsistence and cultural use. These products are used to produce a variety of cultural products including fish traps, snares, tools, weapons, boats, cooking water, baskets and shelters. The boreal forest also provides habitat for furbearers, including wolf, fox, lynx, marten and beaver, that provide an important source of cash income for First Nation trappers.

A portion of harvested resources is consumed directly by hunters and their families, and portions are traded, bartered, shared or otherwise given away. Over time, with the advent of commercial

suppliers, subsistence hunters have increased their use of cash and store-bought foods, and the portion of food coming from traditional harvest activity has decreased.

Estimating the dollar value of traditional harvest activity is difficult. Cultural values such as maintenance of traditional knowledge do not readily translate to economic value and there are limitations to our understanding about the distribution of social benefit from natural resource use (Brown and Burch 1992). Anielski and Wilson (2005) estimated the current value of the subsistence harvest of plants and animals by indigenous people within the Canadian boreal forest to range from \$261 million to \$575 million (as cited in Karst 2010).

In a Canadian Forest Service study of two First Nation communities in the Northwest Territories, Nahanni Butte and Fort Liard, the cash replacement value of materials harvested from the forest – wild meat (moose, fish, bear, caribou, rabbit, grouse), animal furs, firewood, and crafts – was estimated to be between \$950,000 and \$1.7 million per year (Beckley and Hirsch 1997). This did not include medicinal plants, wood products made for their own use, skin clothing, bush cabins or guiding activities from tourism and hunting, or for uses on which no monetary value can be placed, (e.g., as a source of spiritual and cultural inspiration and well-being). The study concluded that financial compensation for the harvested materials could not adequately replace many of the items and would not constitute an acceptable alternative, as the harvesting and related activities are integral to the peoples' way of life.

10.3.4.2 Timber

Forestry activity began around the late 19th century with the development of small-scale timber harvesting and milling for cabin logs, steamer fuelwood, mining, and construction of houses and boats. Dawson City founder, Joe Ladue, established the first sawmill in 1896. He had established a mill at the mining camp on Sixtymile River, and while miners staked claims, he staked a new townsite. Ladue floated the mill to the new townsite location at Dawson City and within six months, over 500 buildings had been erected. At least 12 sawmills operated in the region during that time, including the Canadian Yukon Lumber Co., Klondike Mining and Transportation Co. and the Canadian Klondike Mining Company. The largest and longest operating was the Yukon Sawmill Company, founded by Joseph L. Burke in connection with the Alaska Commercial Company. The Canadian Register of Historic Places (2006) describes the heritage value of the Yukon Sawmill Company as follows:

The Yukon Sawmill Company was one of the first sawmills to cut timber in the Klondike, registering its first timber lease in March 1898...The economic impact from these operations was far reaching, not only for residents, but also for the First Nations and non-First Nations contractors who cut the timber and rafted huge log booms down the Yukon River to the Dawson sawmills. The proximity to the Yukon River was integral to the Yukon Sawmill Company's operation; first to transport the logs from the timber berths to Dawson millponds and then to transport the logs under Front St. via a log chute.

Over the period from 2007 to 2011, forestry, logging and activities in support of them contributed approximately 0.05 per cent to the Yukon's real GDP, just under \$1 million per year (Government of Yukon 2013). The industry is small scale, and high year-to-year variability in timber supply and harvest activity is a factor in the growth of the forestry sector. Annual timber asset volumes represent approximately one per cent of Canada's accessible timber stock (Statistics Canada 2013). The annual allowable cut (AAC) in the Dawson region is currently defaulted to 5,000 m³/year of coniferous trees and 2,000 m³/year of deciduous trees. Implementation of the recently approved Dawson Forest Resources Management Plan (March 2013) will involve determination of the AAC by the Government of Yukon Forest Management Branch. Current annual harvest is estimated to be 3,000 to 4,000 m³. The largest commercial operator presently is Arctic Inland Building Products, which

began operations with a portable sawmill in 1975 and a permanent lumber outlet in Dawson in 1980. Products from the mill are distributed throughout the Yukon and Alaska.

Timber harvest requires road, trail or river access. Often, road access created by other land users creates opportunity for the efficient harvest of mature timber. Incidental salvage from other industrial operations is considered to be of marginal value and is done only when considered economical to do so.

Tree planting activity associated with regeneration of harvested areas occurred in 2005 with the planting of 50,000 seedlings in the North Klondike area.

Forestry is subject to taxes and stumpage rates designed to regulate timber harvest and, in some cases, compensate for various aspects of local governments and the industry. Stumpage rates in Yukon can include up to four fees including a Timber Fee, a Reforestation Fee, a Development Fee, and a Road Use Fee. Fees are calculated based on volume harvested and are adjusted annually. Currently, timber fees are \$1/ m³ and restoration fees are minimum \$5/ m³. Government of Yukon may set lower timber fees as an incentive for timber harvesting.

10.3.4.3 Commercial Fuelwood

Significant demand for wood also came from the steamboat industry. Steamers travelling between Whitehorse and Dawson would consume two cords of wood per hour, requiring boats to stop every four to five hours to refuel. In the *Dawson Forest Resources Management Plan*, Northern Design Consultants(1993) note that between 1898 and 1956 an estimated 300,000 cords of wood were harvested for operations of the sternwheelers. Today, an average of five to 10 permits are issued to commercial wood-cutters each year, harvesting between 600 and 700 m³ of firewood annually.

Major sources for fuelwood are dry wood from recent fires and white birch stands surrounding Dawson. Harvesting occurs in fall and winter and requires a permit.

The manufacture of biofuel from wood waste is an economic and environmental opportunity in the region. Cordwood, wood chips and wood pellets have the lowest cost per energy unit of the available heating fuels in Yukon. Burning wood is 30 to 50 per cent cheaper than using heating oil. Burning wood is deemed ‘carbon-neutral’ with respect to contributions to greenhouse gas emissions. Using modern, efficient, safe and clean wood burning appliances to reduce consumption of fossil fuels is part of Yukon’s Bioenergy Strategy. The Waste Water Treatment Facility in Dawson is presently utilizing woodchips from a local sawmill as an energy source.

10.3.4.4 Non-timber Forest Products

Harvest and processing of non-timber forest products, such as mushrooms and tree sap (birch syrup), contribute to the economic value of forests. Personal fuelwood harvest and berry-picking are also important as economic and recreational activities. Traditional economic activity also relies on non-timber forest products, for example traditional medicine, specialty foods and teas, essential oils, floral décor and cultural crafts.

10.3.4.5 Trapping

Numerous trapping concessions are held within the forested areas for harvest of furbearers such as wolf, lynx, beaver and marten. Harvesters report more active trapping in broadleaf/mixed wood riparian environments and throughout conifer and shrub areas (Tr’ondëk Hwëch’in 2012).

10.3.4.6 Tourism

Tourism opportunities within the boreal forest are somewhat constrained by short summers and long winters. Hiking, camping, fishing, wildlife viewing, photography and nature appreciation occur mostly in summer, while in winter, snowshoeing, snowmobiling, skiing and dog-sledding round out

the range of recreational activities. Tourism activity can be affected by forestry operations where impacts to visual or aesthetic quality impact on visitor experience, such as the routing of access for timber harvest or clear-cutting near areas of high visitor use.

10.4 Resource Management

The following sections note legislation and regulations that specifically address forest resource management. Other acts and regulations dealing with mining, land development, water use, or other industrial activities may also include measures to safeguard forest resources. Additional protocols and requirements may also apply if work is being conducted on Settlement Land.

10.4.1 Regulatory Framework

10.4.1.1 First Nations Final Agreements

Chapter 17 – Forest Resources, Section 17.3.1 of the Tr'ondëk Hwëch'in Final Agreement states:

- 17.3.1.1 Yukon Indian People shall have the right, during all seasons of the year, to harvest Forest Resources on Crown Land for purposes incidental to the exercise of their traditional pursuits of hunting, fishing, trapping and gathering;
- 17.3.1.2 each Yukon First Nation shall have the right, during all seasons of the year, to harvest Trees on Crown Land to a maximum of 500 cubic metres per calendar year for non-commercial community purposes;
- 17.3.1.3 Yukon Indian People shall have the right during all seasons of the year to harvest Forest Resources on Crown Land incidental to the practice of their traditional customs, culture and religion or for the traditional production of handicrafts and implements.

Section 17.3.4 states that the rights set out in 17.3.1, noted above, do not apply to Crown Land:

- 17.3.4.1 Where the exercise of a right conflicts with the carrying out of any activity authorized by Government;
- 17.3.4.2 That is subject to a surface lease or an agreement for sale, unless the Person, other than Government, holding such interest consents; or
- 17.3.4.3 Where access by the public is limited or prohibited.

Section 17.5 sets out a process for development of Forest Resource Management plans on Settlement and Non-Settlement Land.

Within the planning region, the Minister may establish the order for preparing Forest Resource Management plans after Consultation with First Nations and their Renewable Resource Councils within their respective Traditional Territory (“Consultation” used as defined in the TH Final Agreement). The TH Final Agreement establishes priority for forest inventory on Canada Land Inventory Class 4 and 5 soils in the North Klondike and Klondike River watersheds; within the Yukon River corridor; within the Chandinu and Thane Creek watersheds; and in the McQuesten River watershed.

Section 17.5.5 requires Forest Resource Management plans to take into account:

- 17.5.5.1 the principle of sustainable use of Forest Resources;
- 17.5.5.2 the principle of an integrated and balanced approach to the management and protection of interests in and uses of Forest Resources in a watershed;
- 17.5.5.3 the principle of integrated Forest Resources Management on Settlement Land and Non-Settlement Land;
- 17.5.5.4 the Forest Resources harvesting and management customs of Yukon Indian People;

- 17.5.5.5 Fish and Wildlife Harvesting rights and management plans as set out in Chapter 16 - Fish and Wildlife;
- 17.5.5.6 the knowledge and experience both of the Yukon Indian People and scientific communities in Forest Resources Management and use; and
- 17.5.5.7 the principle of implementing the plan on a watershed basis.

Section 17.6.1 requires a Forest Resource Management plan and a forest fire management plan to be consistent with any approved regional land use plan.

10.4.1.2 *Territorial Lands Act and Regulations*

The *Territorial Lands (Yukon) Act* (SY 2003, c 17), *Territorial Lands Regulation* (YOIC 2003/50) and *Land Use Regulation* (YOIC 2003/51) set out the regulatory framework for protection, control and use of the surface of land in Yukon, and establish a system of permits for the use of territorial land, conditions of those permits and fees for issuance of them.

The *Territorial Lands Act* provides for the unimpeded right for movement of timber along waterways and trails, around natural obstacles and the right to use or repair works constructed for the movement of timber.

The *Territorial Lands Regulations* set out the process for disposition of territorial lands. The Minister may reserve from the disposition of territorial land the right to cut timber. The regulations also prohibit the cutting of timber on leased territorial land without a permit.

The *Land Use Regulations* establish authority over the use of territorial land, including the requirement for permits for any clearing, grading or trail cutting exceeding 1.5 m in width; setting conditions on the crossing of water; and setting standards for restoration of stream channels. Exceptions to the regulations are provided for timber operations conducted pursuant to the *Timber Regulation* (s16 of the *Territorial Lands Act*).

10.4.1.3 *Forest Resources Act*

The *Forest Resources Act* (SY 2008, c 15) establishes the purpose and scope of forest resource management plans:

The purpose of this *Act* is to promote the sustainable use of forest resources for the benefit of current and future generations by ensuring that the environmental, economic, social and cultural interests of all users of the forest are considered with the need to promote the health of forests.

Forest resource management plans are to establish requirements for forest management, identify areas where harvesting may occur and establish guidelines for the harvesting of forest resources. The act requires the Minister to consult First Nations and consider the interests and intentions of other land users and stakeholders prior to establishing the planning areas for a forest resource management plan. Wildlife and their habitats are not considered as “forest resources” under the act.

Part 4 of the *Forest Resources Act* addresses the establishment and administration of roads constructed to assist in the harvest of forest resources.

10.4.1.4 *Forest Protection Act*

The *Forest Protection Act* (RSY 2002, c 94) and regulations empower the forest supervisor and forest officers to enforce provisions for the control of access, burning of inflammable material, use of fire, or operation of machinery, during the fire season. The fire season is defined in the act as beginning April 1 and ending September 30, but may be extended or shortened as necessary.

10.4.2 Policy Direction

10.4.2.1 Dawson Forest Resources Management Plan

On March 20, 2013, the Tr'ondëk Hwëch'in and Yukon governments approved a *Dawson Forest Resources Management Plan* (FRMP) (Dawson Forest Management Planning Team 2013). The Dawson FRMP applies to both Settlement and Non-Settlement land in the planning region. The principles, goals, objectives and directions of the FRMP provide the basic guidance for forest management and forest resources development in the region.

The Dawson FRMP is a strategic, overarching, landscape level (1,000,000 ha) plan intended to provide broad direction on where and why forest resource management activities should be undertaken. Plans are subsequently prepared at a successively smaller scale through Timber Harvest plans (5,000 ha to 300,000 ha) and site plans (1 ha to 500 ha).

The Dawson FRMP divides the forest management region into 17 watershed-based landscape units, adjusted to reflect forest productivity conditions (Figure 10-3). Key values are identified in each unit that must be considered when planning for timber harvest. These values are:

- Wildlife key areas;
- Parks and protected areas;
- Ungulate winter ranges;
- Heritage resources;
- Historic trails and routes;
- First Nation Settlement Lands;
- Wildfire history (1946 to 2005);
- Mining activity;
- Outfitting concessions;
- Forest cover;
- Community infrastructure; and
- Wilderness tourism key areas.

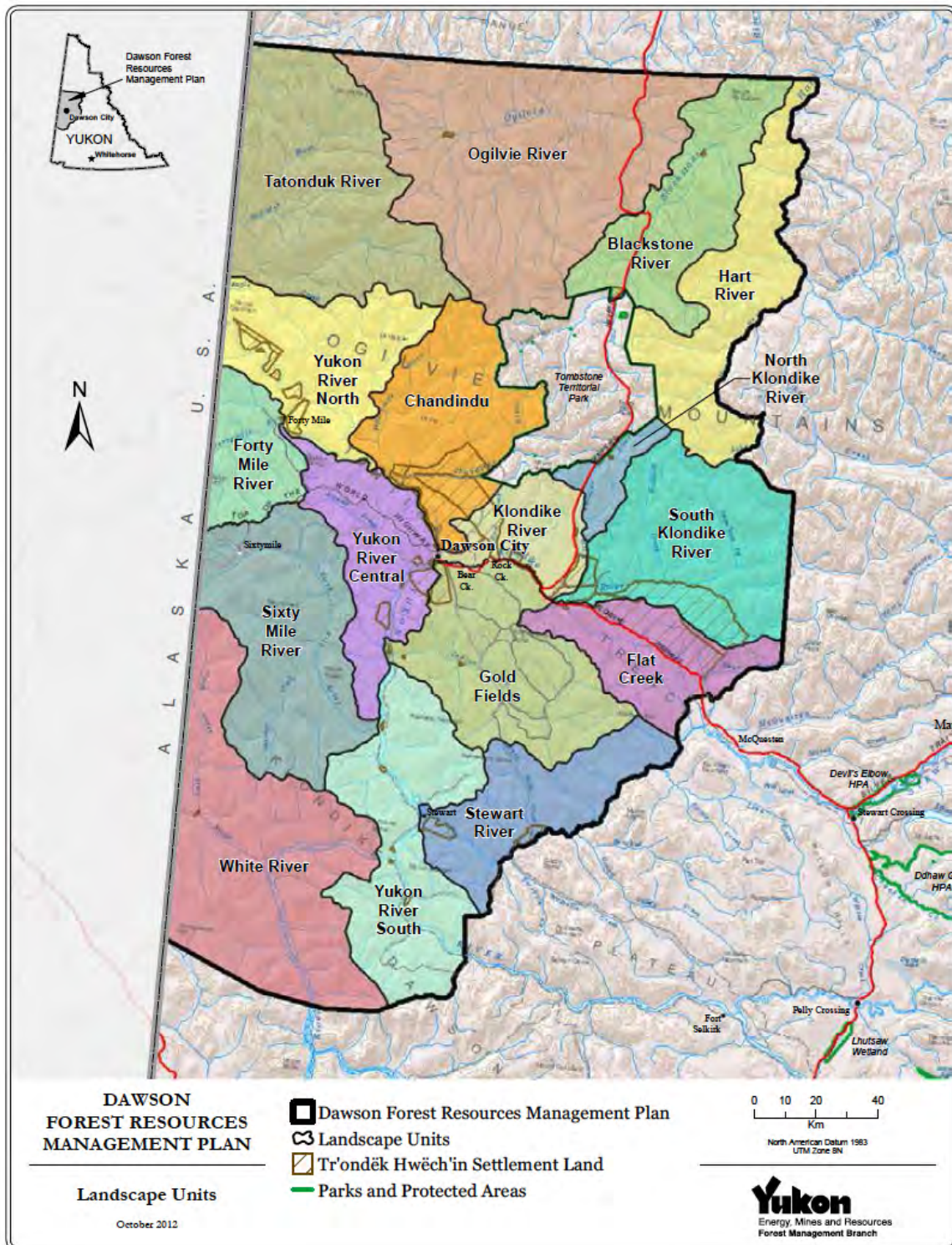


Figure 10-3 Dawson forest management units

A strategic designation system is applied to reflect management intent for each unit (Table 10-1). More detailed zoning may occur prior to harvest operations to identify specific objectives for conservation, general forest management or local forest planning areas (see Figure 10-4).

Table 10-1 Description of Forest Land Use Zones

Forest Land Use Zone	Description
Hinterland Forest Zone (HFZ)	<ul style="list-style-type: none"> • High wildlife, habitat and/or cultural value • Uncertainty around land use and economics • Small-scale non-commercial harvesting only
Forest Resource Management Zone (FRMZ)	<ul style="list-style-type: none"> • High forest economic value • Working forest where selected areas are prioritized for harvest planning or conservation • May provide for long-term tenure and woodlots • Management objectives for biodiversity and wildlife
Community Forest Development Zone (CDFZ)	<ul style="list-style-type: none"> • Municipal and developed areas • Local community use

Specific objectives are established for sustainable forest management in the Dawson planning area:

1. Conserve biological diversity
 - a. Conserve ecosystem diversity
 - b. Conserve species diversity
 - c. Conserve genetic diversity
2. Maintain forest ecosystem health and productivity
 - a. Maintain and enhance ecosystem condition and productivity
 - b. Maintain natural processes (e.g., fire, succession)
 - c. Maintain ecosystem resilience
3. Conserve and maintain soil and water systems
4. Maintain and enhance multiple socio-economic benefit from timber and non-timber forest resources
5. Strengthen traditional uses of forest resources by Tr'ondëk Hwëch'in citizens
6. Respect rights of all forest users

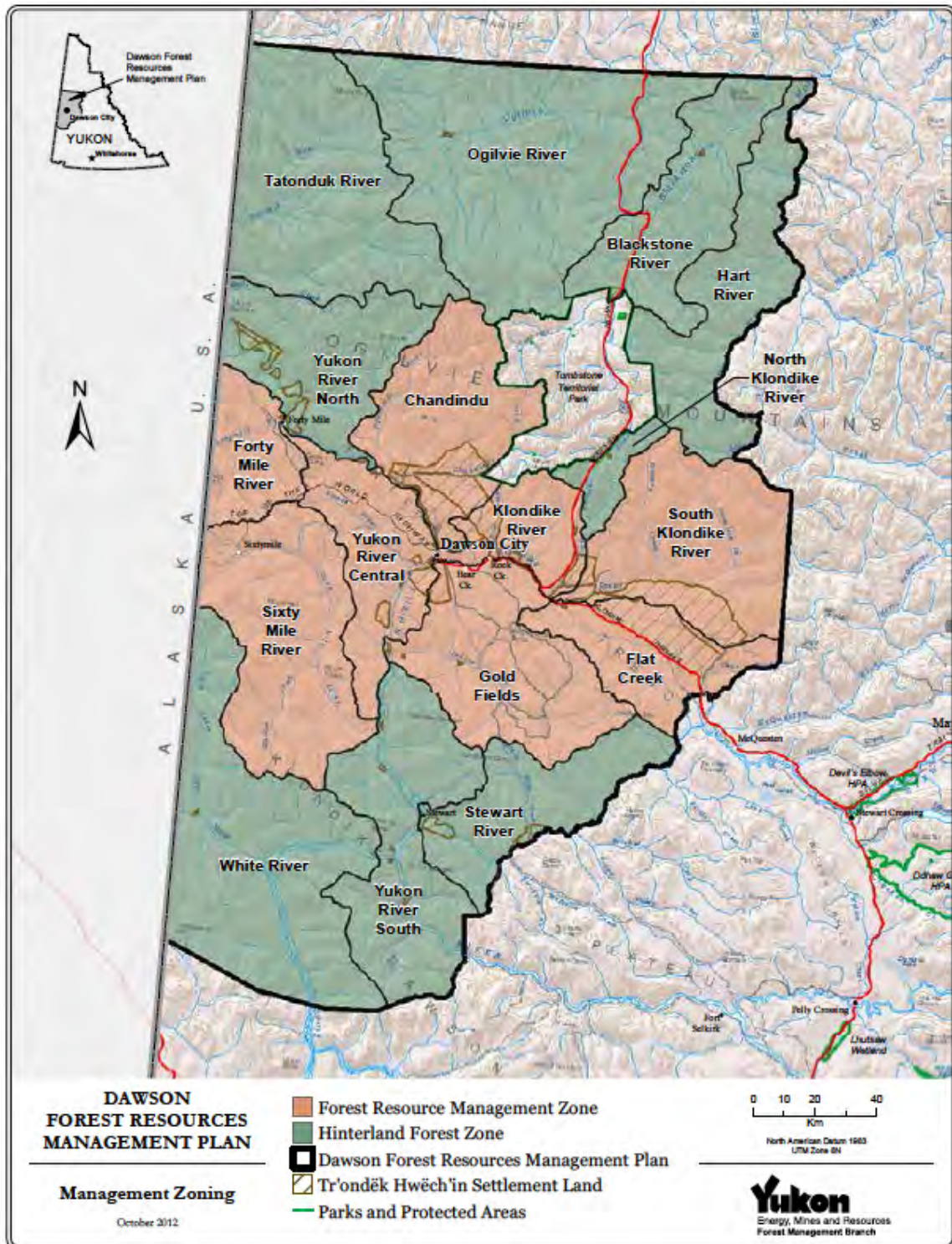


Figure 10-4 Forest Management Zoning for Dawson FRMP landscape units

Prior to commencement of harvest operations, a Timber Harvest Plan (THP) is prepared. THPs are landscape-level operational plans that guide the access and harvest of wood, and identify environmental and social values and provide direction on addressing these values. A THP ranges in area from 5,000 to 300,000 hectares and may extend over landscape units or watershed boundaries. THPs have been developed for nine areas within the Dawson FRMP (Table 10-2).

Table 10-2 Timber Harvest Plans in Dawson FRMP

Timber Harvest Area	Landscape Unit	Area available for Harvest (ha)	Volume available for Harvest (m ³) ¹⁴
Bonanza Creek	Gold Fields	241	13,212
Bruin Creek (II)	Forty Mile	1,200	10,500
Bruin Creek	Forty Mile	65	4,200
Clear Creek	Flat Creek	103	5,000
Dempster Highway	South Klondike	98	7,350
Dome Road	Klondike	48	4,800
Flat Creek	Flat Creek	343	16,250
North Fork	South Klondike	220	18,230
Five Mile	Klondike	320	12,000

The Dawson FRMP, as per Section 17.6.1 of the Tr'ondëk Hwëch'in Final Agreement, may require amendment in order to be consistent with the approved Dawson regional land use plan.

The FRMP prescribes an adaptive management framework. According to *An Introductory Guide to Adaptive Management for Project Leaders and Participants* (Government of British Columbia 1999), “adaptive management” is a formal approach to learn from the responses of existing forest management actions, determine how to best improve current approaches, and therefore improve overall management practices.

The steps in the adaptive management process are shown below:

- Step 1. Assessing the Problem** – includes defining the management concern, identifying measurable objectives (indicators), forecasting responses to management actions.
- Step 2. Designing the Management Plan** – includes both the management plan and a monitoring program to address gaps identified in Step 1.
- Step 3. Implement the Management Plan** – implementing the plan.
- Step 4. Monitor** – using indicators identified in Step 1 to test forecasts.
- Step 5. Evaluate** – comparing responses measured in Step 4 with forecasts identified in Step 1.
- Step 6. Adjust** – adjusting management actions, ecosystem objects, etc. to accommodate results evaluated in Step 5.

¹⁴ Allowance made for riparian management, wildlife management and operational constraints.

It is imperative that the Dawson regional land use plan and the FRMP be integrated and coordinated to ensure that land uses for forestry management and other resources are accounted for. The integration of any specific rules or conditions for land use, or any guidelines together with forest management and timber harvest planning, will be required to ensure that the desired future forest landscape conditions maintain multiple values.

10.4.2.2 Forest Health Assessment

In 2009, Government of Yukon's Forest Management Branch adopted a risk-based approach to forest health monitoring (prior to 2009, Yukon relied on the Canadian Forest Service to conduct the field surveys). The Dawson and Whitehorse districts were the first districts to be assessed, with aerial surveys conducted over 18 days in the summer of 2009. Grid surveys were conducted along a 16-km wide highway corridor for areas within 20 km of communities and within the Dawson and Whitehorse region more generally. Approximately four million hectares of forested area were surveyed. At that time, pest activity in the Dawson district was observed to be limited primarily to major river courses and their tributaries. Total area identified in the 2009 survey for each factor in forest health within the Dawson Forest Health Monitoring District is shown in Table 10-3.

Table 10-3 Dawson Forest Health Monitoring Assessment 2009 (Government of Yukon 2009)

Forest Health Agent	Total Area (ha)
Aspen leaf miner	180,118
Drought - spruce	613
Flood	259
Poplar decline	602
Slide	23
Spruce beetle	32
Willow blotch miner	1,429
Windthrow	13

10.4.2.3 Wildland Fire Management Policy

Government of Yukon's Wildland Fire Management Unit has established priorities for response to occurrences of wildland fire (Table 10-4). Five wildland fire management zones have been identified and applied across the Yukon landscape.

Table 10-4 Wildland Fire Management Zones (Government of Yukon 2003)

Zone	Management Action
Critical Fire Management	<ul style="list-style-type: none"> • Greatest human values • Protection of human life and values at risk • Fire exclusion zone • Rapid and aggressive fire attack
Full Fire Management	<ul style="list-style-type: none"> • Recreation, aesthetic and community values • Protection of people, property or resources • Initial attack and ongoing fire suppression
Strategic Fire Management	<ul style="list-style-type: none"> • Moderate human values relative to high ecological and wilderness values • Initial attack, then response to consider factors such as weather, drought and fire load

Zone	Management Action
Transitional Fire Management	<ul style="list-style-type: none"> • Lower density of human values and low to moderate resource value • Fires assessed prior to action being taken • Cost justifiable action where protection of values consistent with long-term cost effective benefit
Wilderness Fire Management	<ul style="list-style-type: none"> • High ecological and wilderness values relative to low human values • Wildland fire expected to fulfill ecological function • Response limited to confirmation and surveillance

An example of this for the Dawson area is provided in Figure 10-5.

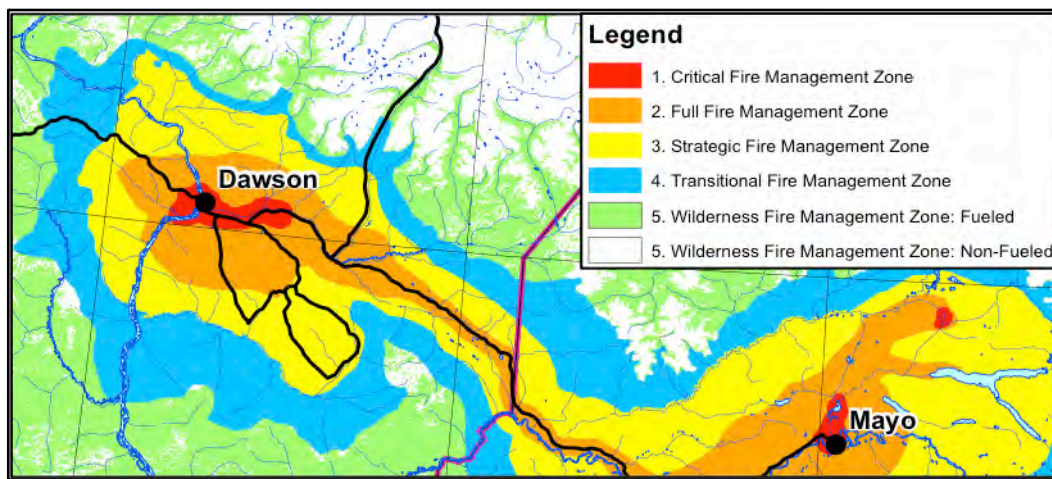


Figure 10-5 Zonation of fire response in the Dawson region (Government of Yukon 2003)

10.4.2.4 Other Stakeholders

Yukon Wood Products Association is a non-profit society formed in 2007 to represent forest industry businesses that manage, harvest, manufacture or sell wood products.

Conservation organizations, industry stakeholders and First Nation leaders have initiated broad initiatives for conservation of the boreal forest ecosystem within Canada. In 1999, the Sub-Committee on Boreal Forest of the Standing Senate Committee on Agriculture and Forestry observed that maintaining ecological complexity and ecosystem resilience of the forest are the most important factors in decreasing the impact of climate change (Senate Subcommittee on the Boreal Forest 1999). Coalitions such as the Canadian Boreal Initiative have goals related to maintaining forest health and respect for the rights of First Nations while in pursuit of sustainable development and long-term economic benefit. These initiatives promote sustainable use of forest resources and reduced impact from land use within the boreal region.

The Canadian Boreal Initiative works at the national level to advance a Boreal Forest Conservation Framework. The goals of the framework include:

- Maintaining the health of the Boreal Forest;
- Protecting sustainable commercial interests and ensuring long-term economic benefits for Northern communities;
- Respecting the lands, rights and ways of life of First Nations;

- Getting the most environmental, social and economic benefit from the least raw material, cost and impact on the workforce; and
- Combining scientific knowledge, traditional knowledge and local perspectives to protect natural and cultural values.

Objectives for implementation of the Boreal Forest Conservation Framework include protection for at least 50 per cent of Canada's Boreal Forest in a network of large protected areas (Canadian Boreal Initiative 2012).

10.4.3 Current Best Management Practices

The Dawson FRMP identifies several strategic directions that should be considered best management practices in relation to forest health. Other guidelines for activity in and around water, for minimizing impact on heritage resources, and for minimizing disturbance to wildlife are also relevant to timber harvesting and forest management activities.

Key strategies for mitigating undesirable consequences of forestry operations include:

- Maintaining a variety of cut block sizes and corridor retention provides habitat for interior forest, early seral and edge species.
- Where it is economical and efficient to do so, salvage of timber should occur prior to mining operations.
- Reflect natural disturbance regimes in forest management.
- Utilize existing access to reduce land use conflict caused by road access.
- Locate access away from permafrost areas.
- Aggregate timber harvesting activity in time and space.
- Avoid winter harvest of critical winter moose habitat, cover and forage.
- Manage operations to minimize seasonal conflict with breeding and nesting birds.
- Develop cut blocks that simulate natural forest openings and blend into the visual landscape.
- Manage access using gates, natural barriers and access restrictions.

10.4.4 Monitoring Activity

Adaptive forest management provides flexibility to modify management actions based on ecosystem response. Our ability to predict ecosystem response is limited by the low level of harvest activity. The Dawson FRMP recommends a suite of indicators that could be monitored for improving understanding of ecosystem response. Indicators considered in the near-term should have established methodologies and/or readily available data. Suitable indicators may include the following:

- Forest area, by type, age class and landscape unit (LU)
- Area of forest, by type and age class, in protected areas
- Harvested or burned area within riparian and/or lowland forest
- Area and patch size of old forest
- Regeneration methods applied in harvested areas
- Total growing stock of merchantable tree species
- Amount of harvested area successfully regenerated
- Area of each LU affected by harvesting, relative to natural disturbances such as fire and insect pests
- Number, patch size and cause of forest fire
- Density of all-season roads
- Size and distribution of cut patches

- Area of productive land base
- Proportion of riparian areas included in timber harvest areas
- Proportion of watershed with stand replacing disturbance in last 20 years
- Proportion of local population employed in forestry-based activity
- Number of locally owned forestry operations relative to area of productive forest land base
- Forest area by timber tenure
- Annual harvest relative to allowable cut
- Hunter/angler effort surveys
- Proportion of valued viewsapes affected by natural disturbances
- Number of tourism operators
- Total tourism revenue
- Area of forest accessible to the community
- Forest carbon balance (for climate change mitigation and adaptation as well as economic considerations)

10.5 Risks and Uncertainty

The boreal forest relies on natural disturbance processes for continuous renewal. Insects, fire, landslides and windthrow contribute to the range in forest cover type, seral stage and age class. This in turn provides a diversity of habitats that support a broad range of valued wildlife, bird and fish species.

Facilitating access into new wood harvesting areas creates opportunity for recreation in the forms of hunting, boating, fishing and driving off-road vehicles. It also increases the potential for human disturbance of wildlife and man-made fires.

Forest composition and tree health may be impacted by drought or insect induced stress, or through competition from invasive pest species.

10.5.1 Insect Pests and Pathogens

The Government Yukon's Forest Management Branch have identified nine forest pests or pathogens that pose the greatest risk (i.e., extensive mortality or defoliation) to Yukon forests and can be effectively monitored as part of a risk-based forest health monitoring program (Government of Yukon 2011b):

- Spruce bark beetle (*Dendroctonus rufipennis*) – most damaging forest pest of mature spruce
- Northern spruce engraver (*Ips perturbatus*) – secondary invader of stressed spruce trees
- Western balsam bark beetle (*Dryocoetes confusus*) – attacks mature subalpine fir
- Budworms (*Choristoneura* spp.) – defoliation of spruce, subalpine fir and larch forest
- Larch Sawfly (*Pristiphora erichsonii*) – defoliation and mortality to larch trees
- Large aspen tortrix (*Choristoneurs conflictana*) – defoliation, dieback and mortality of trembling aspen
- Aspen serpentine leafminer (*Phyllocnistis populiella*) – defoliates aspen and balsam poplar
- Pine needle cast (*Lophodermella concolor*) – common cause of premature needle loss to lodgepole pine
- Mountain pine beetle (*Dendroctonus ponderosae*) – attack lodgepole and ponderosa pine. Not currently present in Yukon, but endemic to North America, and most important forest health concern in B.C. forests. Cold winters control population dynamics, but a warming climate may allow extension of beetles into higher elevations, eastward and northward.

10.5.2 Drought

The greatest risk to Yukon forest health comes from tree dieback due to drought. Aspen typically occupies the driest sites on the landscape, and is first to exhibit dieback from drought-induced stress. In 2009, die-off south of Dawson and in the lower Stewart, lower White and Yukon drainages affected about 2,500 ha of spruce forest, leading to an increase in secondary spruce bark beetle activity. An increase in the occurrence of drought conditions may occur with a warming climate.

10.5.3 Invasive Species

Currently, Yukon does not have specific legislation regarding invasive species management; however, re-vegetation requirements do exist for sites disturbed during natural resource extraction under the *Yukon Quartz Mining Act* (2003), the *Placer Mining Act* (2003) and under the *Land Use Regulations of the Territorial Lands (Yukon) Act* (2003). These regulations require vegetated areas disturbed by operational activities to be returned to a state that either allows re-vegetation by native plants or the site should be left in a state that closely resembles the pre-disturbance conditions.

The Yukon Invasive Species Council (YISC) was formed with the goal of preventing and managing the introduction and spread of invasive species in Yukon (Yukon Invasive Species Council 2013). YISC is involved with public education and awareness, coordinating volunteer management efforts (e.g., community weed pulls), and invasive species research as well as prevention, early detection and rapid response activities.

10.5.4 Anthropogenic Disturbance

The creation of linear features and surface disturbance associated with forestry operations contribute to fragmentation of the forest ecosystem. Most of the environmental consequences of timber harvest can be anticipated and mitigated to minimize adverse impacts. Harvest patterns that mimic natural disturbances are used to minimize the cumulative effects of clearings and cut blocks. Strategies to reduce the number of stream crossings and maintain riparian buffers are critical to aquatic ecosystem function. Maintaining visual aesthetics in proximity to tourism facilities and scenic landscapes is also a consideration during timber harvest planning.

10.5.5 Climate Change

Among the potential effects of climate change are melting permafrost, an increase in the frequency and severity of fire, spreading of insect pests, altered patterns of surface drainage, seasonal access constraints, and changes in forest regeneration and succession.

Adaptive management approaches that respond to climate change are consistent with sustainable forest management objectives for conserving biological diversity, maintaining productivity and health of forest ecosystems, carbon and nutrient cycling, water management, and enhancing long term socio-economic benefit. Continuous monitoring is necessary, though, to evaluate the effectiveness of management practices, and where necessary modify and improve management responses to achieve these management objectives (Ogden 2008).

10.6 Chapter References

- Beckley, T.M. and B.H. Hirsch. 1997. *Subsistence and non-industrial forest use in the lower Liard Valley*. Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, Edmonton, Alberta, Canada. Information Report NOR-X-352. Available at: <http://cfs.nrcan.gc.ca/publications/?id=11586>.
- Brown, T.C. and E.S. Burch, Jr. 1992. *Estimating the Economic value of Subsistence Harvest of Wildlife in Alaska*. Pages 203-254 in G.L. Peterson, C.S. Swanson, D.W. McCollum and M.H. Thomas

- (editors). *Valuing Wildlife Resources in Alaska*. 1992 edition. Westview Press Inc., Boulder, Colorado, USA. Available at: http://www.fs.fed.us/rm/value/docs/estimating_economic_value_subistence_harvest_wildlife_alaska.pdf.
- Burgiel, S.W. and A.A. Muir. 2010. *Invasive species, climate change and ecosystem based adaptation: Addressing multiple drivers of global change*. Global Invasive Species Programme (GISP), Washington, DC, USA, and Nairobi, Kenya.
- Canadian Boreal Initiative. 2012. *Canadian Boreal Forest Conservation Framework* Available at <http://www.borealcanada.ca/documents/FrameworkEnglish-June2012.pdf>. (accessed Aug 9, 2013)
- Canadian Forestry Association. 2005. *The Boreal Forest – A Global Legacy: Teaching Kit*.
- Canadian Register of Historic Places. 2006. Yukon Sawmill Company Office Statement of Significance, Canadian Register of Historic Places <http://www.historicplaces.ca/en/rep-reg/place-lieu.aspx?id=4832>.
- Carroll, A.L., S.W. Taylor, J. Régnière and L. Safranyik. 2003. *Effects of climate change on range expansion by the mountain pine beetle in British Columbia*. Pages 223-232 in Shore, T.L., J.E. Brooks, and J.E. Stone (editors). *Mountain pine beetle symposium: challenges and solutions*. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Information Report BC-X-399.
- Cody, W.J. 1996. *Flora of the Yukon Territory*. NRC Research Press, Ottawa, Canada.
- Dawson Forest Management Planning Team. 2013. *Dawson Forest Resources Management Plan*. Prepared for Government of Yukon, Department of Energy, Mines and Resources, Forest Management Branch. Whitehorse, Yukon, Canada. Available at: http://www.emr.gov.yk.ca/forestry/dawson_frmp.html.
- Government of British Columbia. 1999. *An Introductory Guide to Adaptive Management for Project Leaders and Participants*. B.C. Forest Service, Forest Practices Branch. Victoria, British Columbia, Canada. Available at: <http://www.for.gov.bc.ca/HFP/amhome/Training/am-intro-guide.htm>.
- Government of Yukon. 2003. *Yukon Fire Management Policy Wildland Fire Management Zones: 2003*. Department of Community Services, Protective Services Branch, Wildland Fire Management Unit. Available at: ftp://ftp.geomatics.yukon.ca/fire/PDF/ZonationPublic_2003_Dsize_300dpi.pdf.
- Government of Yukon. 2009. *2009 Forest Health Report*. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada. Available at: http://www.emr.gov.yk.ca/forestry/forest_health_reports.html.
- Government of Yukon. 2010. *2010 Forest Health Report*. Department of Energy, Mines and Resources, Forest Management Branch. Whitehorse, Yukon, Canada. Available at: www.emr.gov.yk.ca/forestry/pdf/forest_health_report_2010.pdf.
- Government of Yukon. 2011a. *Clear Creek Timber Harvest Plan within the Dawson Annual Allowable Cut Area*. Department of Energy, Mines and Resources, Forest Management Branch. Whitehorse, Yukon, Canada. Available at: http://www.emr.gov.yk.ca/forestry/pdf/approved_clear_creek_thp_20110614.pdf.
- Government of Yukon. 2011b. *2011 Forest Health Report*. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada. Available at: http://www.emr.gov.yk.ca/forestry/forest_health_reports.html.

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- Government of Yukon. 2013. *Gross Domestic Product by Industry 2011*. Executive Council Office, Bureau of Statistics. Information sheet no. 65.18 – January 2013. Whitehorse, Yukon, Canada. Available at: http://www.eco.gov.yk.ca/stats/pdf/gdp_2011correctedforweb.pdf (accessed August 9, 2013)
- Karst, A. 2010. *Conservation Value of the North American Boreal Forest from an Ethnobotanical Perspective*. Canadian Boreal Initiative, David Suzuki Foundation and Boreal Songbird Initiative; Ottawa, Ontario; Vancouver, British Columbia; Seattle, Washington.
- Ogden, A. 2008. *Climate Change Adaptation And Sustainable Forest Management In The Boreal Forest*. Ph.D. Thesis, University of British Columbia. Vancouver, British Columbia, Canada.
- Regniere, J., and B. Bentz. 2007. *Modeling cold tolerance in the mountain pine beetle, Dendroctonus ponderosae*. Journal of Insect Physiology 53: 559-572.
- Reid, D., B. Pelchat and J. Weaver. 2010. *Strategic Conservation Assessment for the Northern Boreal Mountains of Yukon and British Columbia*. Wildlife Conservation Society Canada Conservation Report No. 5. Toronto, Ontario, Canada.
- Senate Subcommittee on the Boreal Forest. 1999. *Competing Realities: The Boreal Forest at Risk*. Report of the Sub-Committee on Boreal Forest of the Standing Senate Committee on Agriculture and Forestry. The Senate, Ottawa, Ontario, Canada.
- Smith, C.A.S., J.C. Meikle and C.F. Roots. 2004. *Ecoregions of the Yukon Territory Biophysical Properties of Yukon Landscapes*. Agriculture and Agri-food Canada, Yukon Ecoregions Working Group, Summerland, British Columbia, Canada. PARC Technical Bulletin No. 04-01.
- Statistics Canada. *Table 153-0030 – Timber assets (volume), annual (cubic metres)*, CANSIM (database). Available at: <http://www5.statcan.gc.ca/cansim/home-accueil?lang=eng> (accessed August 9, 2013).
- Thomas, C. 2007. *Historic Resources Potential Overview Study: Tr'ondëk Hwëch'in Traditional Territory Forest Management Planning Area*. Report prepared by Government of Yukon, Department of Tourism and Culture for Government of Yukon, Department of Energy, Mines and Resources. Whitehorse, Yukon Canada.
- Tr'ondëk Hwëch'in. 2012. *Tr'ondëk Hwëch'in Resource Report*. Submitted to the Dawson Regional Planning Commission, May 2012.
- Yukon Invasive Species Council (YISC). 2011. Yukon Invasive Species Council Website. About Us. Available at: http://www.yukoninvasives.com/about_council.html (accessed August 9, 2013).

11 FISH and WILDLIFE HABITAT

11.1 Highlights

11.1.1 Focal Species

- Caribou, moose, sheep, grizzly bear, lynx, beaver and muskrat and rare mammals are considered focal species at the landscape level
- There are 46 mammal species in the planning region; mammalian biodiversity is higher in the southern portions of planning region
- Caribou are an important subsistence species, but cumulative impacts are largely unknown
 - Major roads in the planning region bisect herd ranges
 - Recommendations in the draft habitat management measures for the Forty Mile caribou herd call for protection of winter range
- Current estimates for caribou herds are:
 - Porcupine: 169,000
 - Forty Mile: 56,509
 - Hart River: 2,200
 - Clear Creek: 900
- Moose populations appear stable
- Areas southeast of Dawson City that support high moose densities also receive high hunting pressure and contain a relatively large human footprint
- Late winter habitat is considered critical seasonal moose habitat, especially during deep snow winters
- For sheep:
 - Mountains and alpine areas in and northwest of Tombstones provide year-round habitat
 - Winter range, lambing areas and migration corridors are key
- It is estimated that there are 533 grizzly bears in the planning region (11.8 per 1,000 km²); densities are highest in Central and North Yukon Plateau
- Lynx – furbearer important to trapping; high abundance in Klondike Valley, which is identified as a lynx/snowshoe hare refugium (no agriculture or residential development)
- Beaver – driver of biodiversity in aquatic and riparian environments
- Rare mammals - seven species of management concern exist in the planning region (collared pika, woodchuck, Ogilvie Mountains collared lemming, grizzly bear, wolverine, mule deer and caribou)

11.1.2 Birds

- 182 species known from surveys and incidental sightings
- 76 breed in region; 38 overwinter
- Six species have been assessed under the *Species at Risk Act* including Peregrine Falcon, short-eared owl, rusty blackbird
- 17 species of special management concern (two of which are identified under the *Yukon Wildlife Act* and 15 identified by other organizations)
- Key areas for raptors are along the Yukon River and in alpine areas within the Dempster Highway corridor and Ogilvie Mountains

- Key areas for waterfowl include wetlands (regionally scarce) and the flyway along the Tintina Trench

11.1.3 Invertebrates

- 55 species of butterflies recorded in the planning region (i.e., over half the species found in Yukon); 28 moths (i.e., 10 per cent of species found in Yukon), including four globally rare moths (e.g., tiger moth)
- Rare species in unglaciated portions of the planning region

11.1.4 Fish

- Little information aside from surveys in the Yukon River; most information comes from lakes; no information on overwintering or traditional harvest sites
- 22 species are present in the planning region, including three species of salmon; there is the potential that a Beringian relict species is present in the Miner River (trout perch)
- Freshwater fish habitat has been modeled (Yukon Placer Secretariat) but does not provide information on distribution

11.1.5 Habitat Conservation

- Mineral licks, lakes and wetlands, riparian zones, grassland slopes, unglaciated mountains, springs, old growth forest and rare plants all represent key conservation values
- Conservation Landscapes (intact ecological benchmark areas):
 - Tatonduk River – high conservation value and connection to Yukon Charley Preserve in Alaska
 - Ní'íinli Njik (Fishing Branch) – Miner River has high value for chinook salmon
 - Intact sub-watersheds in the southern region – North Ladue, Indian River, Sixty Mile River and Matson Creek
- River corridors – Yukon, Stewart, White, Klondike, North Klondike, Sixty Mile, North Ladue, Forty Mile, Tatonduk, Fifteen Mile, Chandindu, Whitestone and Hamilton Creek

11.2 Description of Resource

Relative to other parts of Canada, the region is remote and largely undeveloped. The region supports a variety of wildlife species including moose, caribou, sheep, furbearers, freshwater fish and salmon. Wildlife and habitat information for focal species, fish and birds in the planning region was taken from a summary prepared by the Fish and Wildlife Branch of the Government of Yukon's Department of Environment (Government of Yukon 2011). An extensive list of research and local knowledge sources about wildlife and habitat within the region is provided in that report.

11.2.1 Ecosystems and Habitats

The mosaic of forest ecosystems provides a diversity of habitats that is constantly changing. Wildfire is the dominant driver of diversity in forest habitat in the southern boreal portion of the planning region. The boreal forest provides habitat for many ecologically and economically important mammals, such as caribou, wolves, bear, moose, sheep, marten and lynx.

Fewer species are present than in more southern regions, reflecting the harsher climatic conditions and low productivity of arctic and northern boreal vegetation (Smith et al. 2004). Species diversity is generally higher in the southern portions of the region, however distinct and unique Beringian landscapes in the far north contain relict species not found anywhere else in the world.

In the Yukon portion of the boreal forest, over 1,110 species of flora are identified, including 127 species of grass (*Poaceae*), 118 species of *Asteraceae*, 115 species of sedge (*Cyperaceae*), 93 species of crucifer (*Brassicaceae*), 52 species of *Rosaceae*, 37 species of *Saxifragaceae* and 36 members of the snapdragon family (*Scrophulariaceae*) (Cody 1996).

Information about wildlife habitat is generally derived from scientific data collected during systematic wildlife and habitat surveys. Information collected from local wildlife and habitat experts is often used to augment the scientific data, to provide information where no science data exist, and to provide a broader perspective on wildlife habitat and selection. Local knowledge of wildlife habitat and perceived suitability across the planning region was collected for a suite of focal species (Clarke 2012).

Local knowledge information was used to develop habitat suitability maps to indicate the relative probability of selection of particular habitats by each species. Habitat classes were defined from various data sources using Geographic Information Systems (GIS) – ecological classification schema, land cover data from satellite imagery, fire history and surface disturbances, aerial photos, digital elevation models and topographic data for waterbodies and watercourses. Habitat classes represent habitats relevant to focal species, based on perspectives of local knowledge sources, and landscape features that could be mapped using the available information. Forest habitats are differentiated by degree of canopy closure (i.e., dense, open and sparse); non-forested habitats include non-vegetated areas, wetlands, waterbodies, meadows and shrublands. A four-level ranking system may be used to indicate the potential of a habitat to support a particular species where 0 = none; 1 = low; 2 = moderate; and 3 = high.

Due to the limited extent of land cover data, habitat suitability was mapped for only a portion of the planning region, as shown in Figure 11-1.

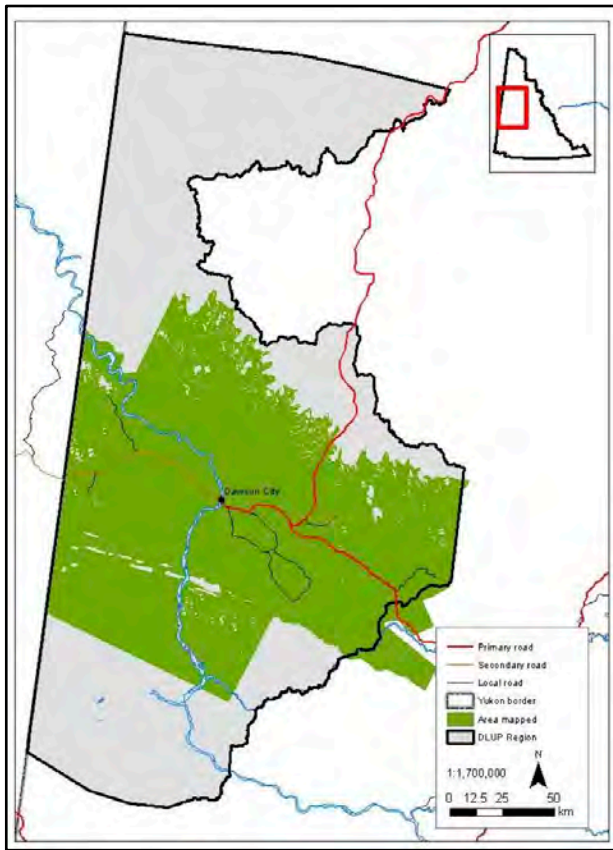


Figure 11-1 Extent of rank-based habitat suitability mapping in the Dawson planning region (Clarke 2012)

Habitat use varies according to seasonal timing, and the timing of seasonal changes varies between the northern and southern portions of the planning region. Seasons defined for focal species in the planning region is shown in the following Table 11-1.

Table 11-1 Seasons used in focal species habitat models

Season	South of Ogilvie Mountains	North of Ogilvie Mountains
Early Winter	Mid-October – early February	Early October – mid-January
Late Winter	Early February – late April	Mid-January – mid-May
Spring	Late April – late May	Mid-May – mid-June
Summer	Late May – early September	Mid-June – mid-August
Fall	Early September – mid-October	Mid-August – early October
Grizzly pre-denning	Early September – mid-October	Mid-August – early October
Grizzly post-denning	Late March – late April	Mid-April – early May

Based on their personal knowledge of wildlife habitat use, local wildlife and habitat knowledge experts ranked each habitat class for each of these seven species/season combinations:

- Moose – late winter
- Woodland caribou – late winter
- Marten – winter
- Lynx – year round
- Grizzly – spring
- Grizzly – summer
- Grizzly – pre and post-denning

Expert rankings of moose habitat use were validated by conducting aerial surveys and observing the occurrence of moose relative to the predicted quality of the habitat. Habitat use for focal species such as muskrat, beaver and peregrine falcon that tend to have specialized landscape requirements were assessed using a more qualitative approach.

Results for habitat suitability rankings are shown in **Section 3 – Resource Summary Maps**.

Late winter habitat is most critical for most species, including moose, caribou and sheep; although it may not be used every year, in high snow years these areas become key to survival. Spring calving and lambing areas for focal mammal species are also considered key habitat areas. For non-migratory woodland caribou, including the Hart and Clear Creek herds, key habitat includes winter range, migration corridors and fall rutting areas.

Wetlands habitats are well known as ecological hotspots; however, both lakes and wetlands are rare in the region relative to other areas of Yukon. Many of the wetlands in the region are fens; these support numerous plant and insect species not found in other habitats and provide breeding habitat for shorebirds and songbirds.

The interaction of land and water along the edge of rivers and creeks support a variety of complex and productive ecosystems in the riparian zone. Within these riparian zones, mature white spruce and balsam poplar forests, well-developed shrub habitats, sloughs, oxbows and wetlands host rare plant communities (e.g., spiked saxifrage), year-round ice-free areas, fish spawning and over-wintering habitat, and ecosystem services associated with hydrological function of rivers and streams.

Rare and ecologically important ecosystems are old growth areas (i.e., forest greater than 140 years old), south-facing grassland slopes along major river valleys, unglaciated alpine areas above 1,300 m and mineral licks. These ecosystems are limited in the planning region, but provide unique habitat for rare mammal, birds and invertebrate species.

11.2.2 Focal Mammal Species

Focal wildlife species are those animals that occur widely throughout the planning region and have habitat requirements that encompass those of many other species in the ecosystem. Focal species are identified as those of particular conservation, subsistence or cultural value within the planning region (Clarke 2012). Within the planning region, habitat for caribou, moose, sheep, grizzly bear, beaver, marten and lynx may be used as a “coarse filter” to determine landscape scale habitat requirements. Habitat requirements for focal species are described in the following sections.

11.2.2.1 Caribou

Both barren ground and woodland caribou occur in the planning region. The ranges of the barren ground Porcupine and Forty Mile herds, and the northern mountain Hart River and Clear Creek herds cover nearly the entire planning region, except in the southeast. It is thought the Forty Mile herd once ranged from Dawson City to Whitehorse during winter periods. The Porcupine caribou

herd is the largest herd in Yukon; the Forty Mile herd is smaller but slowly increasing. A management plan required under the federal Species At Risk legislation sets out habitat objectives for northern mountain caribou in Yukon. Population status for caribou herds in the planning region is shown in Table 11-2.

Table 11-2 Population status of caribou herds within the planning region (Government of Yukon 2011)

Herd	Population Trend	Population Estimate	Last Survey	Survey Method
Porcupine	Unknown	169,000	2010	Photo-count
Forty Mile	Increasing	56,509	2010	Photo-count
Hart River	Unknown	2,200	2006	Modified, intensive rut count
Clear Creak	Stable	900	2001	Stratified random quadrat sampling

Wildfires directly affect winter range for the Forty Mile caribou herd (FMCH) through the removal of lichen forage. The effect of wildfires on caribou populations is not well understood, but represents a high risk where caribou are forced to travel farther or expend more energy to reach a lichen food source. The cost of fire suppression is high, and habitat occurring in wilderness and transition zones where fire suppression response is limited accounts for 59 per cent of “high suitability” habitat available to the FMCH (Government of Yukon and Tr’ondëk Hwëch’in 2013).

The Top of the World and Dempster highways are the two major roads that bisect caribou herd ranges and represent major disturbances to habitat.

11.2.2.2 Moose

The area southeast of Dawson City supports a stable moose population at relatively high densities. These areas also experience high moose hunting pressure and contain a relatively large human footprint.

Moose are widely dispersed on the landscape, and few key areas for moose have been identified through surveys.

Moose are known to use different habitats based on sex and stage of life history. Habitat selection patterns of adult moose differ from cows with one or more calves, the latter being primarily associated with habitats that provide protection from predators (Dussault et al. 2005 as cited in Morrison and Wong 2012).

Predictive models of habitat suitability for moose in the planning region have been developed using selected topographic, habitat and disturbance variables (Morrison and Wong 2012). Fire history, human disturbance, slope aspect, elevation and vegetation type were mapped and compared against observed late winter observations from fixed wing aerial surveys.

Both adult moose and cows with calves were observed to avoid wetland, shrub, conifer and mixed wood vegetation types within their immediate surroundings. It might be anticipated that one or more of these would be selected for by moose in late winter due to requirements for shelter (conifer), forage (shrub) or a combination (mixed-wood). The reasons for avoidance are not known, but age of forest stands may be a factor (Poole and Stuart-Smith 2006, Lundmark and Ball 2008, both as cited in Morrison and Wong 2012).

Northern moose populations show patterns of seasonal habitat use that reflect a trade-off among shelter, forage, ease of travel and predation risk. The relative importance of these factors may vary throughout the year, or from year to year.

Home range surveys for moose show seasonal elevation migration patterns. In early winter, moose inhabit subalpine areas, but move to river valleys for the remainder of the season, primarily to avoid deep snow (Johnston et al. 1984 as cited in Morrison and Wong 2012). During late winter (i.e., January to April), moose have more difficulty travelling and foraging in deep snow and move to late winter habitat with more shallow snow depths and abundant browse. Selection of mid-elevation areas may be a trade-off between greater snow depths in valley bottoms and lower forage abundance and unsuitable climate at higher elevations. Late winter habitat is generally found near rivers, in shrub and aspen stands adjacent to mature white spruce trees, which intercept the snow as it falls and keeps it off the ground.

In most years, average annual snowfall is not sufficient to cause moose to move to their late winter range. However, in years of high snowfall accumulation, approximately one in every 10 years, availability of late winter range is critical to survival.

Both adult moose and cows with calves appear to favour areas burned 11 to 25 years ago and seem to avoid areas close to areas burned within the past 10 years. This use pattern likely reflects the successional stage of vegetation following a fire, such that preferred browse is most abundant 10 to 25 years following fire. Future fire patterns will significantly affect distribution of moose in the region (Maier et al. 2005 as cited in Morrison and Wong 2012).

Human disturbance features did not affect habitat selection of cows with calves, and adult moose appeared to prefer areas closer to wider linear features, perhaps for ease of movement through the landscape. Adult moose are known to use cleared roads, railroad tracks and similar features during periods of deep snow (Morrison and Wong 2012). Conflict along linear features often occurs as moose-vehicle collisions, or through predation pressure by wolves; however, habitat suitability models indicated no avoidance of linear features.

11.2.2.3 Sheep

Alpine tundra and mountain ranges in and to the northwest of the Tombstone Ranges are important year-round habitat for sheep, although large portions of the region known to harbor sheep have never been surveyed. Sheep return regularly to the same winter ranges, lambing areas and migration corridors, and consequently these habitats are considered as key habitat.

Sheep late winter habitat may be characterized as having high elevation, close proximity to rugged and highly convex topography, southerly aspects and access to escape terrain (i.e., greater than 27 degree slope). Generally, late winter habitat is found on steep, south facing slopes where strong winds and sunshine prevent snow accumulation. Late winter is a critical period, as snow becomes hard packed. Late winter feeding areas are a small portion of the sheep's annual range, and access to late winter habitat is presumed to be a limiting factor for Dall sheep (Barichello et al. 1987 as cited in Barker 2012). In May and June, ewes give birth on steep cliff faces to reduce vulnerability to predation. Movement corridors are well-worn routes between summer and winter range, mineral licks and other key habitats. Alpine regions near Mount Klotz and the Tombstone Ranges are identified as key winter range.

11.2.2.4 Grizzly Bear

Grizzly bears have been assessed as a species of “Special Concern” by the Council On the Status of Endangered Species in Canada (COSEWIC). Grizzly bears require diverse habitats dispersed over large areas and they are susceptible to disturbance by humans. Few studies have been conducted on grizzly bears in the planning region. There is a good understanding of seasonal food requirements for

grizzly bears (e.g., soapberry and sweetvetch), but little is known about population or denning ecology.

High quality food production and security influence bear habitat preference. Adult females may avoid areas of high quality food production if they are predominated by adult males. Habitat suitability maps based on seasonal food preferences may allow for better prediction of the distribution of grizzly bears. Denning sites are presumed to be limited by the occurrence of permafrost (Pearson 1976 as cited in Government of Yukon 2011).

Other factors affecting grizzly bear distribution include human-caused mortality, social ecology, and denning. The primary causes of mortality are hunting, bear vehicle collisions and lethal removal of problem bears from areas with high human density.

Based on expert opinion, habitat suitability and harvest rates, the estimated regional grizzly bear population is 533 bears (11.8 bears per 1,000 km²), according to Government of Yukon Department of Environment (Government of Yukon 2011). The Central and North Yukon Plateau have higher grizzly bear density (14.8 bears per 1,000 km²) than the Mackenzie Mountains (13.8 bears per 1,000 km²), Klondike Plateau and North Ogilvie (11 bears/1,000 km²) and Eagle Plains (nine bears per 1,000 km²) ecoregions (Figure 11-2).

Occurrences of human-bear conflict are not well documented. Models of seasonal habitat suitability for grizzly bears are currently being developed for portions of the planning region.

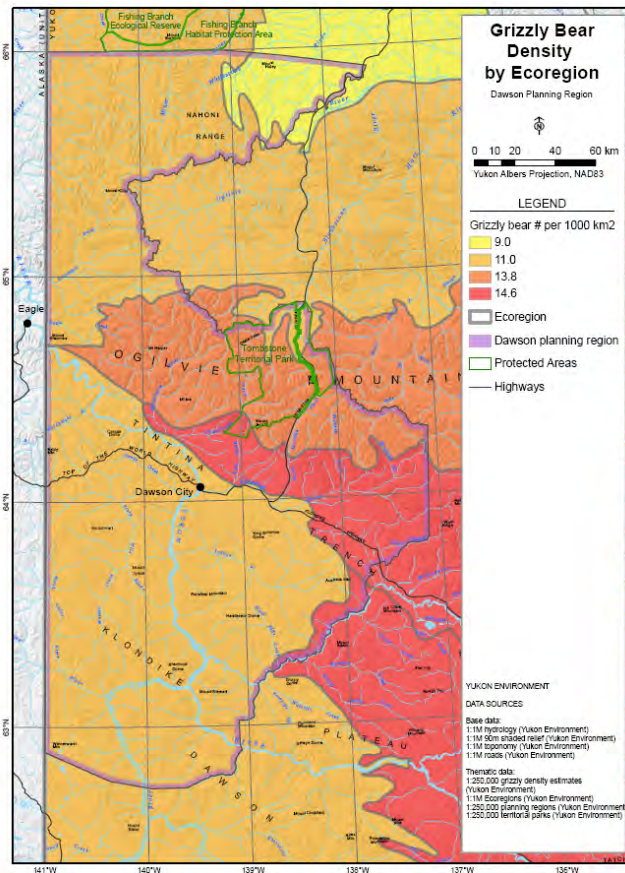


Figure 11-2 Grizzly bear density by ecoregion (Government of Yukon 2011)

11.2.2.5 Lynx

Lynx populations correlate with abundance of snowshoe hare. Ideal habitat for snowshoe hare consists of early, mid and late successional forests of mixed softwood and hardwood species. These are the areas experiencing frequent but relatively small wildfires.

The Klondike Valley has been identified as having high concentrations of both lynx and hare. During periods of low relative abundance, this area acts as a refugium for hares and lynx. However, this area is in a priority fire protection zone close to human settlement and thus will not likely continue to benefit from periodic wildfire.

Areas exhibiting similar disturbance occur as a result of placer mining, but these areas do not become good hare habitat for several decades post-mining. Logging may be an alternative for sustaining lynx/hare cycles, if harvest practices can mimic the natural disturbance patterns of small fires.

Outside the Klondike Valley area, little is known about the distribution of either species.

11.2.2.6 Beaver and Muskrat

Beavers are fairly common in the planning region, albeit at low relative densities. The few population surveys that have been conducted in the region indicate preference for streams and rivers with extensive wetlands, low stream gradients and relatively little seasonal fluctuation in water levels. Beavers appear to avoid areas of conifer cover, recent forest fire or fluctuating water levels. The ability to store sufficient food for the extended winter season is considered a limitation to the northern distribution of beavers.

Through workshops, local wildlife experts identified the following as important characteristics of good pond-dwelling beaver water bodies:

- They do not freeze to the bottom
- They have a source of inflow and outflow
- They occur in a sequence, rather than as isolated water bodies
- They are surrounded by poplar and willow to provide food and lodge-building materials

While beavers may occupy streams and rivers, within the planning region the use of water bodies appears more common. Beavers often use existing tailings ponds, particularly those surrounded by shrub habitat, or live in culverts. Any wetland of suitable depth with an open water component is potentially suitable; however, the deeper the water, the better a habitat is for overwintering.

Colony density is a measure of the quality of beaver habitat. In better habitats, less stream length is required to support a beaver colony. Beaver density in the planning region is lower than in southern Yukon and is known to decrease exponentially with latitude (Jarema et al. 2009 as cited in Government of Yukon 2011a). Within the planning region, three kilometres per beaver colony or less is considered as better quality habitat. Streams identified as good habitat were Rosebute Creek, Clinton Creek, Eldorado Creek, sections of the Klondike River, Dominion Creek, Indian River, Bonanza Creek, Chandindu River and Davidson Creek.

Government of Yukon, Department of Environment maintains an extensive GIS database providing information on wildlife locations and key habitats – the Wildlife Key Areas Inventory. Two key areas for beavers were identified in 1989-1990 in the inventory: “North Ladue River” and “Klondike River and Tailing Ponds.” Key areas for beaver are expected to shift as forage is depleted. In a 2007 survey, North Ladue River was found to have relatively low beaver colony density. Beaver lodges may be abandoned and later reoccupied depending on vegetation abundance and regeneration.

Muskrat have similar requirements for aquatic habitat, but with greater preference for herbaceous vegetation. Muskrat are less likely to use existing tailings ponds as habitat as they are generally lacking in sufficient food. The mud bottom of new tailings ponds are likely more suitable as muskrat habitat.

A map showing known areas of suitable habitat for beaver and muskrat are shown in **Section 3 – Resource Summary Maps**.

11.2.2.7 Rare Mammals

Species of conservation concern that are identified by the federal *Species at Risk Act* or the Yukon *Wildlife Act* require protection of critical habitats. Mammal species at risk are generally habitat specialists and therefore represent high value or unique habitats. Cougars are specially protected under the *Wildlife Act*.

The distribution of rare species is poorly understood. The Ogilvie collared lemming is the only mammal endemic to the Yukon, is the Yukon's rarest mammal, and is only found within the Tombstone area. The pygmy shrew is a rare mammal found only on the Blackstone and Fortymile rivers. The woodchuck is a rare sub-species found in the Indian River area, in the Forty Mile townsite and in the Klondike Valley.

Wolverines were assessed as a species of "Special Concern" by COSEWIC, and as "Sensitive" in the Yukon. Their dens are rarely found and are considered as critical habitat. It is believed that deep snow (i.e., greater than one metre) with snow tunnels is an important habitat feature. Dens are not found in densely forested areas; it is suspected that wolverines den in alpine habitats. Along the Dempster Highway, wolverines are associated with taiga and in similar habitat as caribou (Pretzlaw 2006 as cited in Government of Yukon 2011a).

11.2.2.8 Other Mammals

Other mammals present in the planning region include shrew, squirrel, mice, voles, lemmings, porcupines, coyote, black bear, marten, fox, otter, and bats. A complete list of mammal species known to occur within the planning region are presented in Table 11-3. These lists may be incomplete, as many areas within the planning region have never been surveyed.

Table 11-3 List of mammals by ecoregion (Government of Yukon 2011a)

Species	Ecoregion (x=present)					
	North Ogilvie Mountains	Eagle Plains	Mackenzie Mountains	Klondike Plateau	Yukon Plateau - Central	Yukon Plateau - North
Shrews						
Dusky Shrew	x	x	x	x	x	x
Masked Shrew						
American Water Shrew				x	x	x
Pygmy Shrew	x	x	x	x	x	x
Tundra Shrew	x	x	x	x		
Bats						
Little Brown Myotis				x	x	x
Hares and Pikas						
Collared Pika°	x	x	x	x	x	x
Snowshoe Hare	x	x	x	x	x	x
Rodents						
Red Squirrel	x	x	x	x	x	x
Least Chipmunk			x	x	x	x
Woodchuck*				x	x	x
Hoary Marmot	x		x	x	x	x
Arctic Ground Squirrel	x	x	x	x	x	x
Northern Flying Squirrel				x	x	x
American Beaver	x	x	x	x	x	x
Bushy-tailed Woodrat				x	x	x
Deer Mouse			x	x	x	x
Northern Red-backed Vole	x	x	x	x	x	x
Ogilvie Mountain Collared Lemming*	x		x			
Meadow Vole	x	x	x	x	x	x
Tundra Vole	x	x	x	x	x	x
Long-tailed Vole	x	x	x	x	x	x
Taiga Vole						
Singing Vole	x		x	x		x
Common Muskrat	x	x	x	x	x	x
Brown Lemming						
Northern Bog Lemming	x	x	x	x	x	x
Meadow Jumping Mouse				x	x	x
North American Porcupine	x	x	x	x	x	x

Species	Ecoregion (x=present)					
	North Ogilvie Mountains	Eagle Plains	Mackenzie Mountains	Klondike Plateau	Yukon Plateau - Central	Yukon Plateau - North
Carnivores						
Coyote				x	x	x
Grey Wolf	x	x	x	x	x	x
Red Fox	x	x	x	x	x	x
American Black Bear	x	x	x	x	x	x
Grizzly Bear ^{° +}	x	x	x	x	x	x
Northern River Otter	x	x	x	x	x	x
American Marten	x	x	x	x	x	x
Ermine	x	x	x	x	x	x
Least Weasel	x	x	x	x	x	x
American Mink	x	x	x	x	x	x
Wolverine ^{° +}	x	x	x	x	x	x
Mountain Lion				x	x	x
Canada Lynx	x	x	x	x	x	x
Ungulates						
Mule Deer [°]				x	x	x
Moose	x	x	x	x	x	x
Caribou ^{° +}	x	x	x	x	x	x
Dall's Sheep	x		x	x	x	x
Total species	32	28	34	42	40	41
Total species ranked as sensitive or may be a risk for the Yukon	5	4	5	6	6	6
Total species listed as special concern for Canada (COSEWIC)	3	3	3	3	3	3

[°] Ranked as sensitive for the Yukon

* Ranked as may be at risk for the Yukon

+ Listed as special concern (COSEWIC)

11.2.3 Birds

The Tintina Trench is a major migration route within the planning region, and the diversity of habitats within the region sustains a wide range of birds. Observations over the past hundred years have recorded 182 species, 76 of which are confirmed to breed and 38 of which spend their winters in the planning region. Tombstone Territorial Park is one of the best places in North America to observe subarctic breeders such as Gyrfalcon, Long-tailed Jaeger, Northern Wheatear and Smith's Longspur (Yukon Bird Club 2010). Birds of conservation concern include: Horned Grebe, Peregrine Falcon, Blue Grouse, American Golden Plover, Semipalmated Plover, Wandering Tattler, Upland Sandpiper, Surf-bird, Arctic Tern, Short-eared Owl and Rusty Blackbird (Government of Yukon 2011*a*).

A list of bird species within the planning region was summarized in Government of Yukon (2011) with information from the Yukon Birds Database (1960-1998) and is shown in Table 11-4.

Table 11-4 List of birds in the planning region (Government of Yukon 2011a)

Species	Breeding Status (x=confirmed)	Season (x=present)			
		Spring	Summer	Fall	Winter
Loons and Grebes					
Red-throated Loon	x	x	x	x	
Pacific Loon		x	x	x	
Common Loon	x	x	x	x	
Yellow-billed Loon			x	x	
Horned Grebe ^{+ 1}	x	x	x	x	
Red-necked Grebe	x	x	x	x	
Cormorants and Vultures					
Double-crested Cormorant					
Turkey Vulture		x			
Swans and Geese					
Tundra Swan		x	x	x	
Trumpeter Swan			x	x	
Greater White-fronted Goose		x		x	
Snow Goose		x		x	
Brant		x	x		
Canada Goose		x	x	x	
Waterfowl					
Gadwall		x	x		
Eurasian Wigeon		x	x		
American Wigeon	x	x	x	x	
Mallard	x	x	x	x	
Blue-winged Teal		x	x	x	
Northern Shoveler		x	x	x	
Northern Pintail	x	x	x	x	
Green-winged Teal		x	x	x	
Canvasback	x	x	x	x	
Redhead		x			
Ring-necked Duck	x	x	x	x	
Greater Scaup	x	x	x		
Lesser Scaup		x	x	x	
King Eider		x			
Harlequin Duck	x	x	x	x	
Surf Scoter		x	x	x	
White-winged Scoter		x	x	x	
Black Scoter		x	x		
Oldsquaw	x	x	x	x	

Species	Breeding Status (x=confirmed)	Season (x=present)			
		Spring	Summer	Fall	Winter
Waterfowl cont'd...					
Bufflehead	x	x	x	x	
Common Goldeneye		x	x	x	
Barrow's Goldeneye	x	x	x	x	
Hooded Merganser				x	
Red-breasted Merganser		x	x	x	
Common Merganser		x	x	x	
Ruddy Duck		x	x		
Raptors					
Osprey	x		x		
Bald Eagle	x	x	x	x	
Northern Harrier		x	x	x	
Sharp-shinned Hawk		x	x	x	
Northern Goshawk		x	x	x	x
Swainson's Hawk ²		x		x	
Red-tailed Hawk	x	x	x	x	
Rough-legged Hawk		x		x	
Golden Eagle	x	x	x	x	x
American Kestrel	x	x	x	x	
Merlin	x	x	x	x	
Peregrine Falcon ^{+ **}	x	x	x	x	
Gyrfalcon	x	x	x	x	x
Ptarmigan and Grouse					
Ruffed Grouse	x	x	x	x	x
Spruce Grouse	x	x	x	x	x
Blue Grouse ²	x	x	x		
Willow Ptarmigan	x	x	x	x	x
Rock Ptarmigan	x	x	x	x	x
White-tailed Ptarmigan	x	x	x	x	
Sharp-tailed Grouse	x	x	x	x	x
Cranes and Rails					
Sora			x		
American Coot		x	x		
Sandhill Crane		x	x	x	
Shorebirds					
Black-bellied Plover		x			
American Golden-Plover ^{o 3}	x	x	x	x	
Semipalmated Plover ^o	x	x	x	x	
Killdeer		x	x		
Lesser Yellowlegs		x	x	x	

Species	Breeding Status (x=confirmed)	Season (x=present)			
		Spring	Summer	Fall	Winter
Shorebirds cont'd...					
Solitary Sandpiper ³		x	x	x	
Wandering Tattler ^o	x	x	x	x	
Spotted Sandpiper	x	x	x	x	
Upland Sandpiper ³	x	x	x	x	
Whimbrel ³		x	x		
Hudsonian Godwit		x	x	x	
Ruddy Turnstone ^{o 3}			x		
Surfbird ³	x	x	x	x	
Sanderling ^{o 3}		x			
Semipalmated Sandpiper		x	x	x	
Least Sandpiper	x	x	x	x	
Baird's Sandpiper	x	x	x	x	
Pectoral Sandpiper		x	x	x	
Dunlin ³		x	x		
Buff-breasted Sandpiper		x	x		
Long-billed Dowitcher		x			
Wilson's Snipe		x	x	x	
Red-necked Phalarope		x	x	x	
Seabirds					
Parasitic Jaeger		x			
Long-tailed Jaeger	x	x	x	x	
Bonaparte's Gull	x	x	x	x	
Mew Gull	x	x	x	x	
Herring Gull	x	x	x	x	
Glaucous-winged Gull			x		
Glaucous Gull		x			
Red-legged Kittiwake				x	
Arctic Tern ¹	x	x	x	x	
Mourning Dove			x	x	x
Owls					
Great Horned Owl	x	x	x	x	x
Snowy Owl		x			x
Northern Hawk-Owl	x	x	x	x	x
Great Gray Owl			x	x	x
Short-eared Owl ⁺⁺⁺²	x	x	x	x	x
Boreal Owl	x	x	x	x	x
Nightjars, Hummingbirds, Kingfishers, Woodpeckers					
Common Nighthawk [*]			x	x	
Rufous Hummingbird ²			x		
Belted Kingfisher		x	x	x	
Yellow-bellied Sapsucker	x	x	x	x	
Downy Woodpecker				x	
Hairy Woodpecker		x	x	x	x
Three-toed Woodpecker		x	x	x	x
Black-backed Woodpecker		x			
Northern Flicker	x	x	x	x	

Species	Breeding Status (x=confirmed)	Season (x=present)			
		Spring	Summer	Fall	Winter
Songbirds					
Olive-sided Flycatcher * 2		x	x	x	
Western Wood-Pewee		x	x	x	
Yellow-bellied Flycatcher			x		
Alder Flycatcher	x	x	x		
Least Flycatcher			x	x	
Hammond's Flycatcher	x	x	x	x	
Say's Phoebe	x	x	x	x	
Eastern Kingbird			x	x	
Northern Shrike		x	x	x	
Gray Jay	x	x	x	x	x
Black-billed Magpie		x	x	x	
Common Raven	x	x	x	x	x
Horned Lark	x	x	x	x	
Purple Martin			x		
Tree Swallow	x	x	x	x	
Violet-green Swallow	x	x	x	x	
Bank Swallow	x	x	x	x	
Cliff Swallow	x	x	x	x	
Barn Swallow	x	x	x		
Black-capped Chickadee		x	x	x	x
Boreal Chickadee		x	x	x	
Red-breasted Nuthatch		x	x		
American Dipper	x	x	x	x	x
Golden-crowned Kinglet			x	x	
Ruby-crowned Kinglet		x	x	x	
Northern Wheatear	x	x	x	x	
Mountain Bluebird		x	x	x	
Townsend's Solitaire		x	x	x	
Gray-cheeked Thrush	x	x	x	x	
Swainson's Thrush	x	x	x	x	
Hermit Thrush		x	x		
American Robin	x	x	x	x	
Varied Thrush		x	x	x	
European Starling	x	x	x	x	
American Pipit		x	x	x	
Bohemian Waxwing	x	x	x	x	x
Tennessee Warbler		x	x	x	
Orange-crowned Warbler		x	x	x	
Yellow Warbler	x	x	x	x	
Yellow-rumped Warbler	x	x	x	x	
Townsend's Warbler	x	x	x	x	
Blackpoll Warbler		x	x	x	
Northern Waterthrush		x	x	x	
Common Yellowthroat			x	x	
Wilson's Warbler	x	x	x	x	
American Tree Sparrow	x	x	x	x	
Chipping Sparrow	x	x	x	x	
Clay-colored Sparrow		x			

Species	Breeding Status (x=confirmed)	Season (x=present)			
		Spring	Summer	Fall	Winter
Songbirds cont'd...					
Savannah Sparrow	x	x	x	x	
Fox Sparrow		x	x	x	
Lincoln's Sparrow		x	x	x	
White-crowned Sparrow	x	x	x	x	
Golden-crowned Sparrow		x	x	x	
Dark-eyed Junco	x	x	x	x	x
Lapland Longspur	x	x	x	x	
Smith's Longspur ²		x	x	x	
Snow Bunting		x	x	x	x
Red-winged Blackbird		x	x		
Eastern Meadowlark	x		x	x	
Rusty Blackbird ⁺⁺ ° ²	x	x	x	x	
Brewer's Blackbird		x			
Brown-headed Cowbird		x			
Gray-crowned Rosy Finch		x	x	x	x
Pine Grosbeak		x	x	x	x
Purple Finch			x		
Red Crossbill		x			
White-winged Crossbill		x	x	x	x
Common Redpoll		x	x	x	
Hoary Redpoll		x	x	x	
Pine Siskin		x	x	x	
House Sparrow		x			

⁺ Listed Special Concern by COSEWIC

* Listed Threatened by COSEWIC

⁺⁺ Listed Special Concern by SARA

^{**} Listed Threatened by SARA

[°] General Status "Sensitive" by CESSC

¹ Moderate Concern by Wings Over Water

² Partners in Flight "Watch List"

³ High Concern by USSCP

11.2.3.1 Raptors

With the exception of Gyrfalcons, raptors are predatory birds that migrate to the area to breed. Gyrfalcons are year-round residents found where their primary food source of ptarmigan is abundant. Raptors are of conservation concern throughout North America. Raptor key areas have been identified along the Yukon River corridor to the south, and in alpine areas along the Dempster Highway corridor and the Nahoni Range to the north. Summer nesting areas are key because of specialized nesting requirements. Disturbances within two kilometres of nesting sites can damage breeding success (Government of Yukon 2009).

Local knowledge of Peregrine Falcons suggests the importance of steep cliff faces adjacent to water, where prey such as waterfowl is present. There is no relationship between nesting sites and aspect, or with surrounding vegetation. Unlike Bald Eagles and Osprey, which commonly nest in large trees near the shore of lakes or rivers, falcons and Golden Eagles prefer cliffs, with nests typically occurring at least 25 m off the ground. Breeding pairs will often return to the same nest site year after year. Exact locations of nesting sites are kept confidential to protect birds from illegal activities.

11.2.3.2 Waterfowl

The few lakes and wetlands in the planning region are considered key habitat as areas where waterfowl congregate during spring and fall staging, and for summer nesting and moulting. The Tintina Trench is a major flyway for migratory waterfowl. The Flat Creek wetlands are a hotspot for several species, including waterfowl.

11.2.3.3 Invertebrates

Large portions of the planning region were unglaciated during the Pleistocene and support insect species not found anywhere else in the world. 55 butterfly species were recorded in a survey along the Top of the World Highway and near Mount Klotz (Crispin and Guppy 2007 as cited in Government of Yukon 2011*a*). This represents over half of all butterfly species found in the Yukon. 28 species of moths (i.e., 10 per cent of species found in the Yukon), including four globally rare species (e.g., tiger moth) are found in the planning region.

11.2.3.4 Fish

The planning region extends across three major drainage basins. The southern portion of the region drains northwest via the Yukon River; the northern portion drains north via the Porcupine River, then to the Yukon River; and the Blackstone River in the Tombstone Ranges drains eastward to the Peel and Mackenzie drainage.

Information regarding fish and fish habitat is very limited; most fish inventory work is conducted on lakes, few of which occur in the planning region. Northern portions of the planning region, where limited placer mining has taken place, have never been sampled, including the Nahoni Range and Blackstone River. Almost no information is available on overwintering areas for fish or traditional fish harvest sites. The few sites established for ongoing fish studies are reference sites managed by the Yukon Placer Secretariat that monitor water quality, benthic invertebrates and fish (Government of Yukon 2011*a*).

22 species of fish are recorded in the planning region, including three species of salmon: chinook, chum and coho. The Yukon, Stewart and Whitestone rivers have the highest recorded diversity of fish species.

In spite of high levels of suspended sediment near Dawson City, the Yukon River remains an important migratory habitat for salmon. During studies into the stranding of juvenile fish from the wake of a high-speed catamaran, the Yukon Queen II, creek mouths were identified as particularly sensitive to wake wash and had high numbers of stranded salmon and freshwater fish (EDI Environmental Dynamics Inc. 2006, 2007*a,b* as cited in Government of Yukon 2011*a*).

In a survey of Clear Creek from 1977 to 1981, it was determined that salmon did not spawn in the area, and that the creek generally had low fish productivity and little capacity for overwintering fish or incubation of eggs (Steigenberger and Elson 1982 as cited in Government of Yukon 2011*a*).

Bering cisco, a species of “Special Concern” to COSEWIC, has been recorded at Dawson City. It is speculated that relict Beringian species may also occur in the planning region. Trout perch may be present in the Miner River. The Alaska Blackfish may be present in the Yukon River. Dolly varden, a species of char being assessed by COSEWIC, are found in the Tombstone area.

11.3 Resource Values

11.3.1 Natural Value

Relative to other parts of Canada, the planning region is remote and largely undeveloped. Many areas remain in a highly natural state with low levels of anthropogenic (human-caused) disturbance. The

Boreal and Taiga Cordilleran ecozones of Yukon have some of the last extensive boreal, subalpine and alpine habitats in North America (Smith et al. 2004). Fauna occurring in the planning region have remained relatively consistent for over a thousand years. The boreal region is unique in North America for having a strong Pacific salmon run.

Wildlife species are important to habitat composition and function. Beavers, for example, modify surface drainage, regulate water flow and provide habitat for other species. Birds and insects are vital to the dispersal of genetic material such as seeds and pollen. Salmon cycle nutrients from the oceans to the forest.

Species such as snowshoe hares are considered “keystone” species as the survival of so many other species is affected by their abundance. Populations of many species, including marten, lynx and raptors fluctuate naturally and dynamically with the abundance of snowshoe hare, which every 10 years reach up to 300 times those at cyclic lows. During peaks in the cycle, hares may compete with moose for browse. When hares are scarce, other prey become the target of predators.

Wildlife may also have negative influence on natural value. Invasive plant or animal species may compete or even displace native species in the absence of other natural or cultural controls.

Potential conflict with natural values of wildlife may also occur where land use activities result in the loss of habitat, change in demographic composition (e.g., disproportionate hunting of females), overexploitation (e.g., over-trapping) or fragmentation and loss of connectivity in habitat.

11.3.2 Traditional Value

Tr'ondëk Hwëch'in citizen comments (Tr'ondëk Hwëch'in 2012):

Animals are our survival. All wildlife needs to be protected.

Too many people scare away the animals. Helicopters disturb cows with calves.

Animals get hurt in trenches and pits.

Intensive mining might affect my salmon fishing.

The salmon is deteriorating. If we pollute the water it hurts the fish. We need to monitor things like mining more closely.

We need to protect spawning areas.

Moose are not on the islands the way they used to be.

Roads can be good for moose because new willow grows.

The traditional economy depends on sustainable harvesting of fish, wildlife and plants. Harvesting of resources has been an important traditional economic activity for thousands of years. An annual “round” was typical in the traditional economy – people following natural cycles of animal migration and seasonal abundance of fish and plants. People were also opportunistic; they would go to where the resources were or would follow caribou or travel for game. Places of harvest and travel routes might change from year to year.

Small, mobile family groups would often gather along the Yukon River during late spring and early summer for salmon fishing; boat building; mending of traps, nets and drying racks; and tanning hides. Later in summer, plants and berries would be harvested. Fall was the time to head into the uplands for hunting sheep, caribou and moose in preparation for winter. At strategic locations in headwaters of the Fortymile, Ogilvie and Blackstone rivers, fences were constructed to intercept migrating caribou. As food became scarcer, groups would disperse into small, semi-permanent family fish camps, surviving off of small game, berries and salmon. In early spring, people would harvest freshwater fish (e.g., grayling), small game, waterfowl, beaver and muskrat. In late spring, people would move back to the Yukon River to prepare for fishing, and the round would be repeated. Late

summer runs of spawning salmon and the migration of caribou herds through the region in fall are regarded as part of the relationship between the human, natural and spiritual worlds.

Ungulates, principally moose, and salmon are an important component of the traditional diet and essential to the good health of the Tr'ondëk Hwëch'in. Caribou are a highly valued source of food, traditional tools and clothing.

Environmental knowledge held the traditional economy together: an in-depth understanding of complex relationships with the natural world that helped ensure survival. Family groups continuously shared information, passing knowledge from old to young throughout their lifetime. People worked together, providing a context for teaching and practice of skills.

Traditional stewardship practices contribute to the health of wildlife habitat, ensuring a sustainable harvest over long periods of time. Selective harvesting was the principle management tool, along with habitat alteration to improve browse, reduce pests, ensure areas for fish spawning or remove obstacles to migration routes. Shifting patterns of harvest activity were used to conserve and rebuild natural resource capital. Elders place the highest priority on the ability to act as active stewards of the land.

Stewardship includes using knowledge about land and wildlife resources as an economy. Guiding and outfitting are traditional activities, but stewardship includes Elders sharing their knowledge and providing guidance in information-based projects. Traditional knowledge provides observations about cyclical patterns in natural populations (e.g., migration, movement, population growth and decline) and changing environmental conditions. During time spent on the land, traditional resource users are front-line observers of environmental conditions and constantly monitor for change or unusual conditions.

Tr'ondëk Hwëch'in citizens hold approximately 40 per cent of trapping concession within the planning region, and the Final Agreement provides for up to 70 per cent ownership through acquisition of available concessions. Guiding, outfitting and trapping contribute important cash for fuel and other supplies, as well as providing families with an opportunity to maintain cultural traditions and spend time on the land.

Cultural and spiritual values are important considerations. The inherent connection to the land and wildlife for First Nations inevitably results in areas of cultural or spiritual value overlapping with areas of ecological value.

In an “economic value framework” wildlife values are expressed in terms of consumptive use, non-use and indirect benefit (Adamowicz et al. 1991). Consumptive use values have a direct impact on wildlife populations, such as hunting or trapping. Non-use values do not directly affect wildlife populations and include activities such as wildlife viewing, bird watching and study. Indirect benefit comes from the publication of articles, photographs and similar media that express enjoyment and interest in wildlife. In describing the traditional economy, wildlife values might include (InterGroup Consultants 2008):

- Direct use values – value of meat harvested; value of hides, antlers and furs as inputs to arts, crafts and cultural products
- Non-consumptive use values – value of recreational enjoyment from traditional harvest activity, value of kinship and bonding, value of education in traditional way of life, value of option to defer harvest to future, and the value of leaving resources for future generations

11.3.3 Socio-Cultural Value

Wildlife and their habitats are highly regarded for intrinsic and spiritual values in addition to the benefits associated with consumptive use of wildlife resources or economic activity associated with

wildlife harvest. Attempts to quantify the intangible qualities of wildlife in a natural environment using “willingness-to-pay” models usually show a greater indirect economic benefit from protection than from direct job creation or consumption, once the full range of ecosystem services are accounted for.

Wildlife and natural scenery are important draws for tourism and recreational activities that benefit the regional economy. Along with historic sites and heritage attractions, protected areas and territorial parks are major tourism assets in the Yukon.

Recreation values represent an overlap between ecological/biophysical values and human-use values for the planning region. A number of key recreation values are aligned with areas of importance as identified by conservation criteria (Government of Yukon 2012). Criteria important to recreation values that share common ground with ecological values include:

- **Wilderness:** Areas that exist in a highly natural state with self-regulating populations of wildlife are of high wilderness value and, in a northern context, are considered to hold the highest recreation values.
- **Watershed integrity:** Rivers are a primary recreation value in northern regions, and the long-term integrity of watersheds is essential to the protection of those values.
- **Healthy fish and wildlife populations:** An important component of recreation considers non-consumptive activities – such as bird watching, wildlife viewing, visual arts and photography – that benefit from healthy fish and wildlife populations.
- **Special features:** Site-specific and broader landscape features of high value include biophysical features, such as canyons, mountain ridges, hot springs and rare or scenic landscape formations. The combination of these features in a wilderness setting present especially attractive destinations for backcountry recreation.
- **River corridors:** Large and small rivers in a largely undisturbed wilderness setting present attractive water-based recreation opportunities, such as angling, motorized boat tours and canoeing (e.g., entire length of Yukon River in the planning region as well as Forty Mile, Stewart and Klondike rivers).
- **Connectivity:** Landscape-level connectivity of natural or ecologically intact areas is a key consideration for recreation values as they pertain to ecologically sensitive modes of travel such as by foot or canoe.

Value conflicts may occur where feeding or harassment of wildlife causes behavioral change; where invasive species or disease are introduced into the environment; from interference with the movement of animals due to roads or other obstructions; from increased predation; and from pollution or destruction of habitat.

11.3.4 Economic Value

The economic value of wildlife and of conservation areas is a consideration when deciding whether areas should be withdrawn from the land base accessible for resource extractive activities.

Commercial uses of wildlife include guided hunting and outfitting, trapping, and wild game meat processing. These activities usually involve few participants and have limited impact on the regional economy relative to the value of ecosystem services and the non-consumptive benefits of wildlife and wild spaces.

Healthy wildlife and good quality habitat generate economic benefit by attracting visitors from outside the planning region for hunting, wildlife nature viewing, or appreciation of nature, who in turn spend money on local goods and services. The scale of such impacts is regional in nature, as the closure of an area to tourism or recreational opportunity may simply result in a shift of expenditure from one region to another. While expenditures are not an appropriate measure of value for wildlife

per se, such approaches allow the regional economic value of wildlife and habitat to be inferred and incorporated into an economic analysis.

Many people in the Dawson area (over 50 per cent of the Dawson City residents surveyed in 2011) prefer wild meat such as moose, caribou and fish, obtained either from personal hunting and fishing or shared within families or through informal barter systems (Conservation Klondike Society 2011).

When combined with Government of Yukon harvest statistics, the value of local wild meat harvest can be estimated at \$285,000 or 19.4 per cent of the total value of Klondike meat consumption, based on pound-for-pound store replacement value (Conservation Klondike Society 2011).

11.4 Resource Management

The following sections note legislation and regulations that specifically address fish and wildlife habitat. Other acts and regulations dealing with fish, wildlife, harvest, habitat alteration, water use or other activities may also include measures to safeguard fish and wildlife habitat. Additional protocols and requirements may also apply if work is being conducted on Settlement Land.

11.4.1 Regulatory Framework

11.4.1.1 First Nations Final Agreements

In Chapter 11 – Land Use Planning of the First Nation Final Agreements it is stated:

11.4.5 In developing a regional land use plan, a Regional Land Use Planning Commission:

11.4.5.8 shall take into account that the management of land, water and resources, including Fish, Wildlife and their habitats, is to be integrated

Chapter 16 – Fish and Wildlife, Section 16, of the First Nation Final Agreements state:

16.3.2 The management and Harvesting of Fish, Wildlife and their habitats shall be governed by the principle of Conservation.

Chapter 10 – Special Management Areas of the First Nation Final Agreements state:

10.6.0 Relationship to the Land Use Planning and Development Assessment Processes

10.6.1 Special Management Areas established after the effective date of Settlement

Legislation shall be:

10.6.1.1 consistent with land use plans approved in accordance with Chapter 11 - Land Use Planning; and

10.6.1.2 subject to the provisions of Chapter 12 - Development Assessment.

This would apply to Tombstone Territorial Park and any alteration to Ni'inlii njik (Fishing Branch).

11.4.1.1 *Canada Wildlife Act*

The act allows for the creation, management and protection of wildlife areas for wildlife research activities, or for conservation or interpretation of wildlife. It protects and manages resources to preserve habitats critical to migratory birds and other species.

11.4.1.2 *Migratory Birds Convention Act (Canada)*

The purposes of this act are to regulate the hunting of migratory birds and ensure conservation of migratory bird populations through the establishment of sanctuaries. The act prohibits any person

from depositing into water or on area frequented by migratory birds any substance that is harmful to the birds.

11.4.1.3 *Species at Risk Act (Canada)*

This act is aimed at preventing at-risk wildlife species from disappearing, to facilitate the recovery of wildlife species and manage species of special concern. The act permits Canada to protect habitat of endangered or threatened wildlife species.

11.4.1.4 *Yukon Wildlife Act*

The act administers hunting of terrestrial wildlife for non-subsistence purposes and hunting by those who are not beneficiaries of a Yukon First Nation Final Agreement. The act requires a person to have a permit to hunt or trap game animals, game birds and fur-bearing animals. Wildlife hunting and trapping of protected wildlife or in wildlife sanctuaries is prohibited.

Part 2 of this act establishes and regulates outfitting, guiding and trapping. It allows licensed Yukon outfitters the exclusive right to guide non-resident and non-Canadian hunters within established concession areas in Yukon.

The *Wildlife Regulation* (O.I.C. 2012/84), Section 8 describes areas where hunting is prohibited, including:

8(3) No person shall hunt big game animals within 500 metres of the centre line of the Dempster Highway from kilometer 68 to the Yukon-Northwest Territories boundary.

The act and associated regulations do not apply to Tr'ondëk Hwëch'in citizens or other Yukon First Nation citizens who have obtained written consent from TH to hunt within their traditional territory.

11.4.1.5 *Tr'ondëk Hwëch'in Fish and Wildlife Act (2009)*

This Act protects the right of Tr'ondëk Hwëch'in (TH) citizens to harvest fish and wildlife for subsistence in the traditional territory, provides authority to regulate harvesting on settlement land and ensure it is conducted in a respectful way, and establishes management practices that conserve fish and wildlife species for future generations.

The Act applies to TH citizens harvesting fish or wildlife for subsistence within the traditional territory, and to citizens of other Yukon First Nations with Final Agreements who have obtained written consent from TH. It does not apply to citizens of Vuntut Gwitchin First Nation, Selkirk First Nation, Na-Cho Nyak Dun First Nation, and Tetlit Gwich'in who are harvesting in the portion of their traditional territory that overlaps with TH.

The Act permits TH to establish quotas, closures by geographic area or season, restrictions on methods or equipment, or other limitations on harvesting; make regulations for eligibility and/or reporting requirements; set penalties for offences; and designate person(s) as stewards with the authority to enforce provisions of the Act. The Director may also issue licences to Yukon residents (non-commercial) or outfitters and their guides, granting access to settlement land for the purposes of harvesting fish or wildlife, if such harvesting is permitted by the laws of general application.

11.4.1.6 *Fisheries Act (1985)*

This federal Act is meant to prohibit the harmful alteration, disruption, or destruction of fish and fish habitat and to prevent pollution by prohibiting the deposit of harmful substances into Canadian waters. Section 35 of the Act prohibits any work that results in harmful alteration, disruption or destruction of fish habitat. An authorization may be issued for projects in which this will happen, typically with an aquatic effects monitoring program and a fish habitat compensation plan.

Jurisdictional responsibilities for enforcement of the Act in the Yukon are complicated. The Government of Yukon has responsibility for management of freshwater fish and fisheries including establishing policies and regulations. In all other cases (including fish habitat), the federal government retains administration and enforcement responsibility through Fisheries and Oceans Canada. Fisheries and Oceans Canada enforces the clauses related to deposition of harmful substances (including sediment), but Environment Canada enforces the pollution prevention clauses (Government of Yukon 2011*b*, p.8).

11.4.1.7 Yukon *Environment Act*

The act ensures management of the environment, preservation of biological diversity and promotes sustainable development.

11.4.1.8 *Parks and Land Certainty Act* (Yukon)

Parks are established under this act to provide protection and management of areas that are of territorial significance. Parks may be established as an ecological reserve, natural environment park, wilderness preserve, recreation park or other type of park as prescribed by regulation. Within a park, all development, use and activity require authorization. Within ecological and wilderness preserves, no industrial development is permitted.

11.4.2 Policy Direction

11.4.2.1 Tombstone Territorial Park

Tombstone Territorial Park is designated as a natural environment park. A management plan was approved in 2009. Implementation of the management plan is intended to achieve the objectives for the Tombstone Territorial Park as set out in Schedule A to Chapter 10 – Special Management Areas of the Tr'ondek Hwechin Final Agreement:

1.1.0 The objectives of this schedule are:

1.1.1 to protect for all time a natural area of territorial significance which includes representative portions of the Mackenzie Mountains ecoregion, including the Ogilvie Mountains and Blackstone Uplands areas, and contains important physical and biological features as well as sites of archaeological, historical and cultural value, by the establishment of a territorial park under the Parks Act, R.S.Y. 1986, c. 126, to be known as the Tombstone Territorial Park (the “Park”);

1.1.2 to recognize and protect the traditional and current use of the area by Tr'ondëk Hwëch'in in the development and management of the Park;

1.1.3 to recognize and honour Tr'ondëk Hwëch'in history and culture in the area through the establishment and operation of the Park;

1.1.4 to encourage public awareness, appreciation and enjoyment of the natural, historical and cultural resources of the Park in a manner that will ensure it is protected for the benefit of future generations;

1.1.5 to provide a process to develop a management plan for the Park;

1.1.6 to provide economic opportunities to the Tr'ondëk Hwëch'in in the development, operation and management of the Park in the manner set out in this schedule.

A three-year review of the management plan was recently completed in 2012. The Park Management Committee reviewed 91 specific action commitments and determined that while no changes to the management plan would be appropriate due to the short three years of implementation, a subsequent

review again in five years would provide adequate information for a comprehensive evaluation of the plan (Tombstone Territorial Park Management Committee 2013).

11.4.2.2 Ní'iinli njik (Fishing Branch)

Management plans were first established in 2004 and updated in 2010 for the Ecological Reserve, Wilderness Preserve and Habitat Protection Area. The plans work together to protect the cultural, historic and scientific significance of the biodiversity in the area, particularly salmon and grizzly bears; to provide habitat protection; and provide a buffer against human activity that might affect the wilderness values of the area.

11.4.2.3 Forty Mile Caribou Herd Management Plan

In 2007, Government of Yukon Department of Environment and Tr'ondëk Hwëch'in convened a working group to develop a broad framework of recommended strategies to guide the habitat management for the Forty Mile caribou herd in the Yukon. The working group reviewed extensive information about the history, management and current status of the Forty Mile caribou herd and in 2009 submitted habitat protection recommendations to Yukon and Tr'ondëk Hwëch'in governments in support of growing the herd.

It is anticipated that a habitat management plan will soon be approved and implemented. It is expected to address wildland fire management within critical caribou habitat, impacts of mineral exploration on caribou and their habitat, and guidance for YESAB review processes in order to mitigate any industrial activity that might affect habitat of the Forty Mile caribou herd. In particular, the importance of their range within the region as habitat for winter use should be emphasized, such that disturbance during that period may be constrained.

11.4.2.4 Other Stakeholders

Land claim and trans-boundary agreements established several public bodies to inform decision making on fish, wildlife, habitat and forest in a manner respecting traditional values and traditional economic activity.

Porcupine Caribou Management Board (PCMB) is a co-management board established under a 1985 agreement between Government of Canada, Government of Yukon, Government of the Northwest Territories, Inuvialuit Game Council, Gwich'in Tribal Council and the Council of Yukon First Nations. Objectives of the agreement aim to co-operatively manage, as a herd, the Porcupine caribou and its habitat within Canada so as to ensure the conservation of the herd with a view to providing for the ongoing subsistence needs of native users.

Chapter 16 of the Umbrella Final Agreement (UFA) established a Yukon Fish and Wildlife Management Board (YFWMB) as the principal instrument for fish and wildlife management in Yukon. The Yukon Salmon Sub-Committee was established in the UFA as a sub-committee of the YFWMB and is the primary instrument for salmon management in the Yukon. The Dawson District Renewable Resources Council was established in Chapter 16 of the Tr'ondëk Hwëch'in Final Agreement (THFA) to provide local community input on resource management decisions affecting fish and wildlife (under Chapter 16 of the THFA) and forests (under Chapter 17 of the THFA) within Tr'ondëk Hwëch'in Traditional Territory, and to provide an advisory role to YFWMB on matters of concern to community members.

11.4.2.5 Big Game Outfitting Land Application Policy

This policy facilitates applications for license or leasehold tenure for pre-existing sites with longstanding use by outfitting concession holders. The policy is only intended to allow application for sites that are directly related to the operation of outfitting concessions as authorized pursuant to

the Wildlife Act. Sites that are approved for leases or licenses pursuant to this policy are limited to big game outfitting purposes.

Land tenures are only authorized in an amount reasonably necessary to satisfy the purpose for which the land is needed, up to 3.99 hectares in area, but generally 1 hectare or less. Parcels must be setback a minimum of 30 metres from the shores of lakes and rivers, and a minimum of 10 metres from creeks.

A process coordinated by the Land Management Branch, Government of Yukon to assess an area for its suitability for development considers social, economic and environmental information in areas that are experiencing heightened interest: where multiple applications are received; where multiple sensitivities are identified through a land application review; where planning is occurring or anticipated; or where consultation with other governments, such as First Nations is advisable.

To facilitate multiple activities on the landscape, approved tenures may be restricted by season or duration to avoid land use conflict between outfitters, the public, commercial wilderness recreation activity and other resource users.

11.5 Risks and Uncertainty

11.5.1 Climate Change

A key finding of the Arctic Climate Impact Assessment (ACIA) was that animal species' diversity, ranges and distribution will change as a result of climate change. Habitats are predicted to shift northwards in latitude and upwards in elevation. It is expected that there will be more forest and less tundra in the Arctic, and a general decline in wetlands (ACIA 2004).

The potential exists for a cascading impact from climate change, especially in arctic systems where there are fewer species performing similar roles (as prey species, for example). Moss and lichen are particularly vulnerable to climate change. As a primary winter food source for reindeer/caribou and other species, a decline in moss/lichen leading to a decline in reindeer and caribou populations would also affect species that hunt them (including wolves, wolverines, and humans) as well as species that scavenge on them (such as arctic foxes and various birds). The well-being of individuals and local communities dependent on caribou will also be affected (ACIA 2004).

The effect of climate change can vary between species, or be both positive and negative population factors. Long-term changes in snowfall and the timing of spring may alter the distribution and abundance of moose, caribou and deer. More snow makes movement difficult, and reproductive success is tied to snow patterns and the availability of food in calving season. Less snow may provide better habitat conditions for moose, but facilitate ease of movement for predators. A delay in spring thaw may impact bird migration, while a warmer climate may improve survival of chicks through longer nesting season and increase in food availability (Government of Yukon 2006).

In the face of environmental stresses associated with climate change, wildlife populations must either adapt to change, relocate to more suitable habitat, or face extirpation and extinction. Species most at risk are those at the edge of their range; those with specific and limiting habitat requirements; those that cannot move easily between areas; or those that adapt less readily to changing environmental conditions. Human activity places additional stress on wildlife populations, which in turn compromises subsistence hunting and fishing.

Ensuring ecological integrity is maintained across a broad range of environmental gradients provides the greatest opportunity for wildlife to adapt to climate change.

11.5.2 Cumulative Effects

In the Deh Cho Cumulative Effects Study (Ray 2000), Salmo et al. (2004) identified roads as having the greatest cumulative effect because they represent corridors where vehicle traffic is likely to occur, revegetation of the right-of-way is prevented, and hunting and vehicular mortality is concentrated. Animals may avoid otherwise suitable habitat areas that lie close to roads. Other linear and surface disturbances such as trails, cut lines, and mined areas can disturb and stress wildlife populations, fragment habitat areas, reduce habitat quality and disrupt traditional harvesting practices. While it may be that activity levels, not roads themselves, are the more likely cause of impact on wildlife populations, all corridors facilitate a greater range and efficiency of predator movement (e.g., wolves and humans). Marten and lynx are particularly susceptible to habitat fragmentation ((Hargis et al. 1999, Koehler and Aubry 1994) as cited in Ray 2000).

11.5.3 Trans-Boundary Management (caribou, salmon)

Migratory species like caribou and salmon transcend jurisdictional boundaries, and these populations are subject to differing management objectives at the national level.

The Yukon's management emphasis for the Fortymile Caribou herd is to re-establish its former range; Alaska maintains a secondary goal of increasing harvest. In Canada, all licensed hunting of the herd is closed, and Tr'ondëk Hwëch'in voluntarily abstain from hunting while efforts are underway to grow the herd (Environment Yukon and Tr'ondëk Hwëch'in 2013). Meanwhile, Alaska continues to harvest at least 150 bulls per season, and propose an increase to harvest levels of four per cent once the herd reaches 70,000 animals (Harvest Management Coalition 2012). Reported quotas for fall 2013 are: 225 for Zones 1 and 4, 185 for Zone 2, and 340 for Zone 3 for a total of 750 (Tr'ondëk Hwëch'in 2013).

In the Yukon, the goal of the Yukon Salmon Sub-Committee is to preserve salmon stocks in the Yukon in order to maintain this vital part of the Yukon ecosystem, economy and lifestyle. The policy of the Alaska Department of Fish and Game is to manage the salmon runs to the extent possible for maximum sustained yield and to allow for spawning escapement to natal waters in Canada. Management of the Yukon River salmon fishery is complex because of the current inability to determine stock specific abundance and run timing, overlapping multi-species runs, the increasing efficiency of fishing gear, allocation issues, and the immense size of the Yukon River drainage (Yukon River Panel 2013).

11.6 Chapter References

- Adamowicz, W.L., J. Asafu-Adjaye, P.C. Boxall and W.E. Phillips. 1991. *Components of the Economic Value of Wildlife: An Alberta Case Study*. Canadian Field-Naturalist 105(3):423-429.
- Arctic Climate Impact Assessment (ACIA). 2004. *Impacts of a Warming Arctic: Arctic Climate Impact Assessment*. ACIA Overview report. Cambridge University Press. London, U.K.
- Barker, O.E. 2012. *Late winter habitat selection by sheep in the Dawson Region*. Government of Yukon, Department of Environment. Yukon Fish and Wildlife Branch Report TR-12-24. Whitehorse, Yukon, Canada.
- Clarke, H. 2012. *Local Knowledge-Based Habitat Suitability Mapping in the Dawson Land Use Planning Region*. Government of Yukon, Department of Environment. Whitehorse, Yukon, Canada.
- Cody, W.J. 1996. *Flora of the Yukon Territory*. NRC Research Press, Ottawa, Canada.
- Cooke, H.A. and D. Reid. 2012. *Ecological Benchmarks Networks in the Boreal Cordillera: Priority Areas for Conserving Ecological Values*. Presented at Dawson Planning Conference, January 2012.

- Dawson, Yukon, Canada. Available at:
http://planyukon.ca/index.php/documents/ylupcdocs/doc_download/739-ecological-benchmark-networks-in-the-boreal-cordillera-priority-areas-for-conserving-ecological-val.html
- Environment Yukon and Tr'ondëk Hwëch'in First Nation. 2013. *Habitat Management Measures for the Fortymile Caribou Herd 2013-2018*. Whitehorse, Yukon, Canada.
- Government of Yukon and Tr'ondëk Hwëch'in. 2013. *Habitat Management Measures for the Forty Mile Caribou Herd 2013-2018*.
- Government of Yukon. 2006. *Climate Change Strategy*. Department of Environment. Whitehorse, Yukon, Canada.
- Government of Yukon. 2009. *Yukon Wildlife Key Area Inventory User's Manual*. Department of Environment, Fish and Wildlife Branch, Habitat Programs Section. Available at:
http://www.env.gov.yk.ca/publications-maps/wka_gis_data.php.
- Government of Yukon. 2011a. *Summary of Fish, Wildlife and Habitat Data for the Dawson Regional Land Use Planning Process* (draft). Department of Environment. Whitehorse, Yukon, Canada.
- Government of Yukon. 2011b. *Overview of Legislation and Policies Pertaining to Regional Land Use Plans in the Yukon*. Department of Energy, Mines and Resources, January 2011.
- Government of Yukon. 2012. *Dawson Regional Land-use Plan Preliminary Conservation Values Assessment*. Department of Environment. Whitehorse, Yukon, Canada.
- Harvest Management Coalition. 2012. *Fortymile caribou herd harvest plan 2012– 2018*. Alaska Department of Fish and Game, Fairbanks, Alaska.
- InterGroup Consultants. 2008. *Economic Valuation and Socio-Cultural Perspectives of the Estimated Harvest of the Beverly and Qamanirjuaq Caribou Herds*. Prepared for Beverly and Qamanirjuaq Caribou Management Board. Stonewall, Manitoba, Canada.
- Morrison, S. and M. Wong. 2012. *Later winter habitat selection by moose in the Dawson land use planning region*. Prepared by Dryas Research Ltd. and Mark Wong Consulting for Government of Yukon, Department of Environment. Yukon Fish and Wildlife Branch Report TRC-12-01. Whitehorse, Yukon, Canada.
- Ray, J.C. 2000. *Mesocarnivores of Northeastern North America: Status and Conservation Issues*. WCS Working Papers No. 15, June 2000. Available at: <http://www.wcs.org/science/>.
- Reid, D. 2012. *Conservation Assessment Priorities: Ideas for the Dawson Regional Planning Commission*. Written submission to Dawson Regional Planning Commission. Wildlife Conservation Society.
- Smith, C.A.S., J.C. Meikle and C.F. Roots. 2004. *Ecoregions of the Yukon Territory Biophysical Properties of Yukon Landscapes*. Agriculture and Agri-food Canada, Yukon Ecoregions Working Group, Summerland, British Columbia, Canada. PARC Technical Bulletin No. 04-01.
- Tombstone Territorial Park Management Committee. 2013. *The First Three Years. A Progress Report on the Implementation of the Tombstone Territorial Park Management Plan*. Available at:
<http://tombstonepark.ca/ttp/themes/tombstone/docs/the-first-three-years-draft-for-public-review-Jan2013.pdf> (accessed August 9, 2013)
- Tr'ondëk Hwëch'in. 2012. *Tr'ondëk Hwëch'in Resource Report*. Submitted to the Dawson Regional Planning Commission, May 2012.
- Tr'ondëk Hwëch'in. 2013. *Tr'ondëk Hwëch'in Comments on the August 2013 Draft Resource Assessment Report*. Submitted to the Dawson Regional Planning Commission, September 2013.

Weaver, J.L. 2006. *Big Animals and Small Parks: Implications of Wildlife Distribution and Movements for Expansion of Nabanni National Park Reserve*. Wildlife Conservation Society Canada Conservation Report No. 1. Toronto, Ontario, Canada. Available at: <http://www.wcscanada.org/QuickLinks/Publications/tabid/4462/Default.aspx>.

Yukon Bird Club. 2010. *Checklist of the Birds of Tombstone Territorial Park, Yukon*. Whitehorse, Yukon, Canada. Available at: <http://www.yukonweb.com/community/ycb/ybcpub.html>.

Yukon River Panel Website. 2013. <http://yukonriverpanel.com>, accessed August 30, 2013.

12 CONSERVATION PRIORITIES ASSESSMENT

12.1 Conservation Value

Broad criteria for assessing conservation priorities may be based on principles of conservation biology, which are supported by a substantial scientific literature and practice to guide identification of special areas for conservation-based management approaches. The First Nation Final Agreements provide a definition for the term conservation:

“Conservation” means the management of Fish and Wildlife populations and habitats and the regulation of users to ensure the quality, diversity and Long Term Optimum Productivity of Fish and Wildlife populations, with the primary goal of ensuring a sustainable harvest and its proper utilization.

Although conservation assessments are primarily focused on wildlife habitat and ecological values, conservation values are also held for heritage, water and forest resources. Furthermore, sustainable development implies the conservative use of all resources, including minerals and hydrocarbons. In surveys conducted during the 1980s, Canadians identified several desirable conservation objectives including sustainable living, biodiversity conservation, greening the economy and eco-tourism (Gray et al. 1993).

The following were identified as important considerations at a landscape level in evaluating priority areas for conservation in the land use plan (Government of Yukon 2012):

- Identification of focal species
- Watershed-based management units
- Identification of sensitive fish over-wintering and spawning habitat
- Maintenance of the integrity and biodiversity of ecological hotspots
- Protection for rare and sensitive elements (e.g., mineral licks, raptor nests)
- Vulnerability of range-edge species
- Maintenance of ecologically intact areas (e.g., highly natural areas with minimal anthropogenic disturbance)
- Scale conservation areas to reflect natural disturbance regimes (e.g., fire)
- Connect areas of high conservation value at the landscape level
- Represent all ecosystem types and process

Wildlife resources that warrant conservation priority should include (Tr'ondëk Hwëch'in 2012):

- All caribou herds, including the Fortymile, Clear Creek, Hart River and Porcupine caribou herds, prior to any development within key habitat areas;
- All mineral licks;
- Moose, sheep, fish, and their habitats.

As well, Tr'ondëk Hwëch'in have repeatedly expressed the importance of protecting the boreal forest, which supports a wide range of values including wildlife habitat, ecological health, carbon sequestration, and a sustainable renewable resource economy.

Conservation of ecological integrity is highly valued for the maintenance of ecosystem function and providing resilience to climate change. Ecological integrity is defined under the *Canada National Parks Act* to be “a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological

communities, rates of change and supporting processes” (Statutes of Canada 2000 as cited in Weaver 2006). Ecological integrity includes conservation of: genetic diversity; a natural range of ecological processes such as fire and flood; broad representation of different ecological types and associations; adequate habitat for viable plant and animal populations in natural patterns of distribution, abundance and connectivity; special elements, such as mineral licks or springs; and the potential for evolutionary adaptation in response to environmental change.

Resilience refers to the ability of species for absorbing disturbance and still persisting (Holling 1973 as cited in Weaver 2006). Wildlife develop patterns of behavior in response to a range of natural variability in habitat conditions over time and space. Wildlife resilience exists at the individual level (e.g., a change in foraging behavior), at a population level (e.g., change in age/sex composition) or at the meta-population level (e.g., migration or dispersal). Each species has a different capacity for resilience.

Adopting conservation approaches for entire drainage basins is the most effective means of managing conservation, recreation and other values. Watershed boundaries as the basis for landscape management units are practical to implement and easy to recognize on the ground.

Ecological requirements of ungulates and carnivores make them a logical choice as focal species for a regional land use plan. Moose, sheep, caribou and peregrine falcon are identified as focal species in the Dawson planning region. Maintenance of habitat for focal species provides a “coarse filter” representation of ecosystem processes and elements of biodiversity at a landscape scale.

Fine filter components of a conservation analysis are those that attempt to capture specific elements of biodiversity or require specific attention beyond identification as high priority landscapes (Reid 2012). Ecological hotspots, including riparian areas, wetlands, grassland slopes and rarer ecosystem types, are areas with high concentrations of high value habitats. Riparian zones along rivers and creeks are complex and productive habitats with high conservation value. Wetlands along the Tintina Trench are known for high diversity and abundance of waterfowl and numerous species of plants and insects not found in other habitats. Small and scattered lakes too small to be mapped are part of an important lake/marsh complex that provides breeding habitat for shorebirds and songbirds. Steep south-facing grassland slopes that are a part of the Beringian steppe are rich with endemic species.

Mineral licks are highly valuable to wildlife. Many animals use mineral licks to obtain essential minerals such as sodium, magnesium and trace elements. Sheep and goats use dry earth exposures, and moose and caribou use wet licks and mineral springs. Animals are vulnerable to disturbance and harvesting near mineral licks. The exact location of mineral licks, known from observation during wildlife surveys and from local knowledge or outfitter questionnaires, is kept confidential.

Other rare and sensitive habitats that may be used to fine-tune landscape scale conservation efforts include raptor nesting sites, colonial nesting sites (e.g., often on islands), wildlife travel routes, salmon spawning stream reaches, rare plant sites and range edge species. Rare species known or suspected to occur in the planning region are shown in Table 12-1. Other ecologically important features are described in Table 12-2 and shown on the map at **Section 3 – Resource Summary Maps – Unique and Special Landscape Features**.

The spiked saxifrage (*Micranthes spicata* D. Don) is a rare species in Canada, with an apparently narrow habitat tolerance and a limited geographic range. It is found only in Alaska and a small portion of the Yukon, first collected in 1898 “along mountain streams, near Indian River” by John Berry Tarleton (Cannings 2010). In Canada it is known from six sites in the Klondike Plateau ecoregion, with four extant populations within the planning region. Cannings (2010) documented 57 spiked saxifrage plants along a short reach of Donahue Creek. In a subsequent five-day survey along the Yukon River, the original collection sites were documented as well as a larger population of 500 plants found at a new location. Extrapolation of the small population, based on its preference for wet, shady stream

banks with angular rocks or rock cliffs and sensitivity to disturbance by placer mining, indicates the species may become threatened over a short time.

Table 12-1 Rare species known to occur in the Dawson planning region (Yukon Conservation Data Center 2012) (For definitions of Subnational conservation ranks go to www.natureserve.org)

SCIENTIFIC NAME	COMMON NAME	NATURESERVE RANK (Yukon)	COSEWIC STATUS
ANIMALS, FISH and INVERTEBRATES			
<i>Ochotona collaris</i>	Collared Pika	S3	
<i>Asio flammeus</i>	Short-eared Owl	S3B	
<i>Coregonus laurettae</i>	Bering Cisco	S3	
<i>Euphagus carolinus</i>	Rusty Blackbird	S3B	
<i>Marmota monax</i>	Woodchuck	S2S3	
<i>Salvelinus malma</i>	Dolly Varden	S3S4	
<i>Dicrostonyx nunatakensis</i>	Ogilvie Mountains Collared Lemming	S2	
<i>Holoarctia sordida</i>	Rockslide Tiger Moth	S1S3	
PLANTS			
<i>Lestes dryas</i>	Emerald Spreadwing	-	-
<i>Parnassius phoebus</i>	Phoebus Parnassian	-	-
<i>Iris setosa</i>	Beach-head Iris	S1	
<i>Claytonia ogilviensis</i>	Ogilvie Mountains Spring Beauty	S2S3	
<i>Polystichum lonchitis</i>	Northern Holly-fern	S1	
<i>Viola biflora ssp. biflora</i>	Twin-flowered Violet	S2	
<i>Micranthes spicata</i>	Spiked Saxifrage	S1S2	April 2013
<i>Podistera yukonensis</i>	Yukon Podistera	S2	November 2013
<i>Stellaria dicranoides</i>	Matted Starwort	S1	
<i>Botrychium alaskense</i>	Alaska Moonwort	S2S3	

Areas with dolostone or limestone dominated bedrock that were unglaciated	These areas tend to support rare plants and insects
Unglaciated areas greater than 1,300 m in elevation	These areas are considered an important seed source for post-glacial re-instatement of subarctic boreal conifers across western North America (Savidge 2012)
Point locations of tracked plants	Known locations of specific plants of conservation concern (see Yukon Conservation Data Centre (YCDC 2012) regarding limitations and note that the absence of data does not necessarily indicate an absence of plants – the area may not have been assessed)
Locations (polygons) of rare plant and animal species	These are known areas of land or water in which a rare plant or animal species is or was present (see YCDC (2012) for data limitations and note that the absence of data does not necessarily indicate an absence of plants – the area may not have been assessed). Also see <i>2010 Field Survey for Spiked Saxifrage</i> (Cannings 2010) for information on that data collection
Location (buffered) of known wildlife mineral licks (surveyed and anecdotal)	Mineral licks are an important and limiting wildlife resource. Areas surrounding mineral licks often have a higher abundance of certain wildlife species (see <i>WKA Manual 2009</i> (Government of Yukon 2009) and note that the absence of data does not necessarily indicate an absence of mineral licks – the area may not have been assessed)
All wetlands	Compared to elsewhere in the territory, wetlands are in low abundance across the planning region. Wetlands support a high level of biodiversity and provide habitat for birds, mammals, amphibians, fish, invertebrates, and plants. They are key indicators of ecosystem health and play an important role in regulating river flow and water filtration
Intact forest that is greater than 140 years old	In relation to other forest age classes, old-growth forest is limited across the planning region. Old-growth forest provides important habitat for several mammal, bird and invertebrate species through its unique structural and compositional qualities (e.g., decaying trees and abundant coarse woody debris)
Point areas deemed ecologically important as a result of local knowledge workshops in 2011 and 2012	Important, rare or unique landscape features and wildlife resources are not always captured during systematic surveys. Local knowledge provides further information on specific features deemed to be important for healthy ecosystems and wildlife populations
Polygon areas deemed ecologically important as a result of local knowledge workshops in 2011 and 2012	Important, rare or unique landscape features and wildlife resources are not always captured during systematic surveys. Local knowledge provides further information on specific areas deemed to be important for healthy ecosystems and wildlife populations

12.2 Conservation Landscapes

Areas of broad conservation interest include intact areas, representative of natural environmental variation, that are sufficiently large enough to represent benchmarks of natural ecosystem dynamics, ecologically functional wildlife populations, and terrestrial and hydrologic connectivity (Cooke and Reid 2012). No single area would adequately represent the whole planning region, and so the establishment of geographically distinct ecological benchmarks is essential for landscape-level conservation and adaptive management. During subsequent phases of work on the land use plan, an analysis of conservation values within each of the broad geographic areas described below will be used to identify candidate areas for prioritizing conservation (Government of Yukon 2012).

12.2.1 Northern Area – Beringian Connections

The Northern area is the portion of the planning region north of Dawson City and includes the Ogilvie Mountains north to the Nahoni Range. This area is rich in limestone and has a unique ecology represented by a suite of rare Beringian endemic species, both plants and insects, that is not present to the south. Opportunities for conservation focus in this region include:

- *Tatonduk River – high conservation values and trans-boundary connection to Yukon-Charley Rivers National Preserve in Alaska:*

The Tatonduk River watershed is of high conservation value as it features a diversity of Beringian endemics and is currently in a natural state and ecologically intact. The area features unglaciated limestone/dolomite mountains and is known to have permanent freshwater springs. The planning process offers the opportunity to develop connectivity with existing protected areas in Alaska. Conservation-based management of the Tatonduk would link to the Yukon-Charley Rivers National Preserve in Alaska.

- *Ni'inlii Njik (Fishing Branch) Habitat Protection Area (HPA) southern boundary:*

Currently, the southern boundary of the Fishing Branch HPA is delineated by the northern boundary of the Tr'ondëk Hwëch'in Traditional Territory. The planning and watershed boundaries present an opportunity to delineate a planning unit that connects and is consistent with the HPA, which protects the Miner River watershed. This area also includes a collection of overlapping conservation, including many ecological hotspots and rare/sensitive habitats.

12.2.2 Southern Area – Intact Sub-Watersheds

The Southern area is the portion of the planning region south of Dawson City. It includes the Klondike Plateau and the northern edge of the Dawson Range. This area lacks the extensive limestone that characterizes the north, and therefore has a distinctly different ecology. This area also supports a unique assemblage of endemic species, particularly plants, that is not represented to the north. Conservation of intact sub-watersheds in the Southern area would serve both to represent and protect unique endemic species, as well as ecological benchmarks (Cooke and Reid 2012). There are numerous sub-watersheds in the southern portion of the region that reflect conservation values criteria including the North Ladue River, Indian River, Sixty Mile River and Matson Creek.

12.2.3 River Corridors

The ecology of the planning region, particularly in the central and southern portions, is largely defined by the dominant river systems, which are the Yukon and Stewart rivers. The Yukon River features habitats and species that are not represented elsewhere in the planning region. Focal species habitats along the Yukon River include peregrine falcon, sheep and salmon. The Stewart River also supports exceptional fish and wildlife populations. Other key river corridors in the planning region should be assessed for conservation values. These include the White, Klondike, North Klondike,

Sixty Mile, North Ladue, Forty Mile, Tatonduk, Fifteen Mile, Chandindu, Whitestone, Hamilton Creek and other tributaries identified through local knowledge workshops.

12.3 Chapter References

- Cannings, S. 2010. 2010 *Field Survey for Spiked Saxifrage (Saxifraga spicata D. Don)* Preliminary Report. Unpublished. Environment Canada, Canadian Wildlife Service.
- Cooke, H.A. and D. Reid. 2012. *Ecological Benchmarks Networks in the Boreal Cordillera: Priority Areas for Conserving Ecological Values*. Presented at Dawson Planning Conference, January 2012. Dawson, Yukon, Canada. Available at: http://planyukon.ca/index.php/documents/ylupcdocs/doc_download/739-ecological-benchmark-networks-in-the-boreal-cordillera-priority-areas-for-conserving-ecological-val.html
- Government of Yukon, 2012. *Dawson Regional Land Use Plan Preliminary Conservation Values Assessment*. Department of Environment. Whitehorse, Yukon Canada.
- Government of Yukon. 2009. *Yukon Wildlife Key Area Inventory User's Manual*. Department of Environment, Fish and Wildlife Branch, Habitat Programs Section. Available at: http://www.env.gov.yk.ca/publications-maps/wka_gis_data.php.
- Gray, P. A., Boxall, P., Reid, R., Filion, F. L., DuWors, E., Jacquemot, A., Bouchard, P. and Bath, A. 1993. *The Importance of Wildlife to Canadians: Results from Three National Surveys*, in I. D. Thompson (ed.), 'Forests and Wildlife...Towards the 21st Century', Halifax, Nova Scotia, pp. 151-157 http://cfs.nrcan.gc.ca/bookstore_pdfs/19075.pdf
- Reid, D. 2012. *Conservation Assessment Priorities: Ideas for the Dawson Regional Planning Commission*. Written submission to Dawson Regional Planning Commission. Wildlife Conservation Society.
- Savidge, R.A. 2012. *Yukon Taiga – Past, Present and Future*. In Dr. N. Ishwaran, editor. *The Biosphere*. ISBN: 978-953-51-0292-2. InTech. Accessed on-line June 5, 2013 from: <http://www.intechopen.com/books/the-biosphere/yukon-taiga-past-present-and-future>
- Tr'ondëk Hwëch'in. 2012. *Tr'ondëk Hwëch'in Resource Report*. Submitted to the Dawson Regional Planning Commission, May 2012.
- Weaver, J.L. 2006. *Big Animals and Small Parks: Implications of Wildlife Distribution and Movements for Expansion of Nabanni National Park Reserve*. Wildlife Conservation Society Canada Conservation Report No. 1. Toronto, Ontario, Canada. Available at: <http://www.wcscanada.org/QuickLinks/Publications/tabid/4462/Default.aspx>.
- Yukon Conservation Data Centre. 2012. *Vascular Plant Track List and Rare Species Database*. Yukon Department of Environment. Whitehorse, Yukon, Canada.

13 MINERALS

13.1 Highlights

- For over a century, Yukon economic development has been closely linked to its mineral deposits
- Mineral claims in good standing cover about 10,861 km² or 24 per cent of the region (as of June 2011)
- Placer claims cover about 1,100 km² (1,900 km of stream length) or about two per cent of the region
- Hard rock (quartz) mining and placer mining are distinct and different land use activities; each has its own unique pattern of exploration, development, production and reclamation
- Annual placer gold production is estimated to be \$50 million; no producing hard rock mines
- Mineral exploration expenditures may vary considerably from year to year, historically ranging from less than \$7 million to over \$300 million
- Estimates of gross in place value (GIPV) for all minerals exceeds \$120 billion
- Mineral claim staking can impact ecological and cultural values
- Mineral exploration is an extensive activity with potential for adverse cumulative effects on ecological and cultural resource values
- Mine development occurs on a very small footprint, but with significant and enduring impacts

13.2 Description of Resource

13.2.1 Historic Land Use

Prior to the arrival of European explorers to the Yukon, First Nations people were recovering copper nuggets from the White River area in southwestern Yukon to use in tool implements. Around 1850, explorers from the Hudson Bay Company reported fine gold on the banks of the Pelly River.

In 1874, coarse gold was discovered on a tributary of the Liard River. In 1885, significant quantities of gold were found on bars of the Stewart River. Gold was first discovered in the Fortymile area on both sides of the border in 1886. By 1893, the Sixtymile district had active mining on both Miller and Glacier Creeks.

On August 17, 1896, the chance discovery of a gold nugget on Rabbit Creek (later renamed Bonanza) set off the Klondike Gold Rush. By 1900, over a million ounces were being mined in a season, at that time completely by hand. Large-scale mining, with dredges and heavy equipment, began in later years.

Early discoveries of placer gold led to a rapid influx of prospectors in the Klondike Gold Rush during the latter part of the 1890s. By the early 1900s, the most easily accessible placer deposits had been extensively sluiced and dredged. Royalty records, which represent the minimum amount of gold production, show that over 16.6 million crude ounces (518 tonnes) of placer gold have been produced in the Yukon since the discoveries at Fortymile.

For over a century, Yukon economic development has been closely tied to its deposits of lead/zinc, gold, silver, tungsten, molybdenum, nickel and iron. Past and present mining is a significant element of the Yukon cultural landscape; most notably those activities associated with placer operations along the creeks and valley bottoms in the “Goldfields”.

Designated national historic sites acknowledge the important role the historic events associated with the gold rush had in shaping today's relationship between Yukon Indian people and newcomers. Extensive background material on historic mining details the evolution of this cultural landscape (for example, see bibliography in Hogan 1995).

13.2.2 Hard Rock (Quartz)

Hard rock minerals are base or precious metals including gold, silver, copper, zinc and other elements found in veins or lodes. Minerals are found in a variety of host rock types, each with varying potential for grade and tonnage of valuable metals.

13.2.2.1 Mineral Potential

The unique and complex geology of the Dawson planning region contains well-documented areas of high mineral potential. As of June 2011, the Yukon government MINFILE database indicates 365 mineral occurrences in the Dawson region, out of 2,643 occurrences recorded Yukon-wide. Gold is the primary target but copper, silver, zinc and lead occurrences have also received advanced exploration activity. Six deposits known to occur in the planning region are shown in Table 13-1.

Table 13-1 Discovered deposits and tonnes of contained commodities, Dawson Assessment Area (Kilby 2013)

Deposit	TRACT	GOLD	SILVER	COPPER	BARITE	TUNGSTEN
White Gold	S53	49.18924				
MARN	B124	1.941374	3.882748	2267.96		226.796
Brewery CR	B117	9.0124				
Zeba	B118		54.80273			
Omega	B118		20.217		26400	
Lone Star	S34	2.17728				

A mineral potential assessment was prepared for the Dawson planning region that reconsidered previous and overlapping assessments to estimate relative mineral potential more uniformly across the region (Kilby 2013). Mineral potential assessments provide a forward looking evaluation of mineral potential based on a variety of data such as bedrock geology, stream sediment geochemistry, and mineral occurrences. Expert judgment and deposit models are used to estimate the number of undiscovered deposits that could exist in areas with common geological characteristics. Figure 13-1 shows 67 mineral tracts that were evaluated for 22 different mineral commodities associated with 36 deposit types in the planning region.

Estimates of volume and current commodity prices are used to calculate the gross-in-place value (GIPV) of all resources. A standardized assessment of value is thereby created that is consistent across the region of interest. GIPV helps in ranking the relative mineral potential of different areas of the planning region (e.g., to identify areas that have lower relative mineral potential). A number of ranking methods and commodity pricing scenarios were used to test the stability of the ranking. Kilby (2013) suggests using an unbiased ranking that gives more weight to areas with high probability discovered and undiscovered resources and protects them from being overshadowed by large masses of low probability estimates (p. 44). The ranking proved to be relatively insensitive to commodity

price changes, and the ranking methods provided slightly different but fully expected variations in the ranking order (Kilby 2013).

Figure 13-2 shows a grouping of mineral tracts into equal area classes, each class representing 20 per cent of the area of the region, ranked from highest to lowest for GIPV for all commodities. This grouping shows a concentration of high mineral potential (top 2 classes) in the Tintina Gold Belt and Klondike areas.

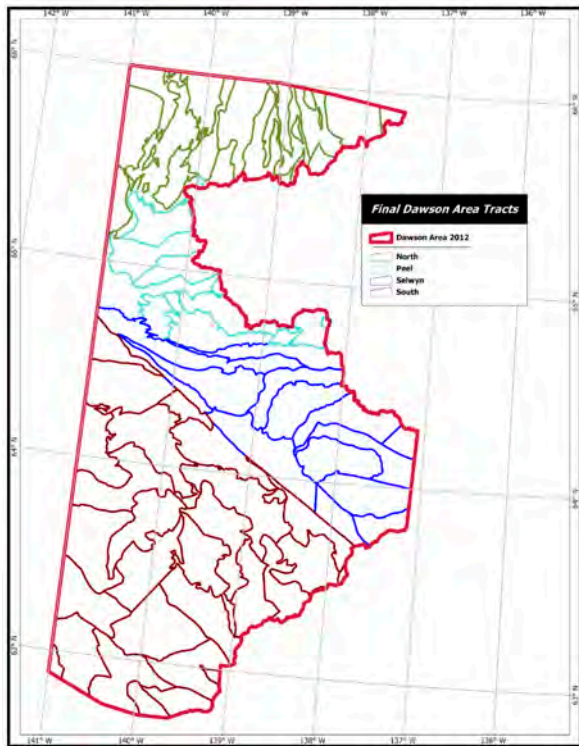


Figure 13-1 Dawson Mineral Assessment Tracts (Kilby 2013, p. 13)

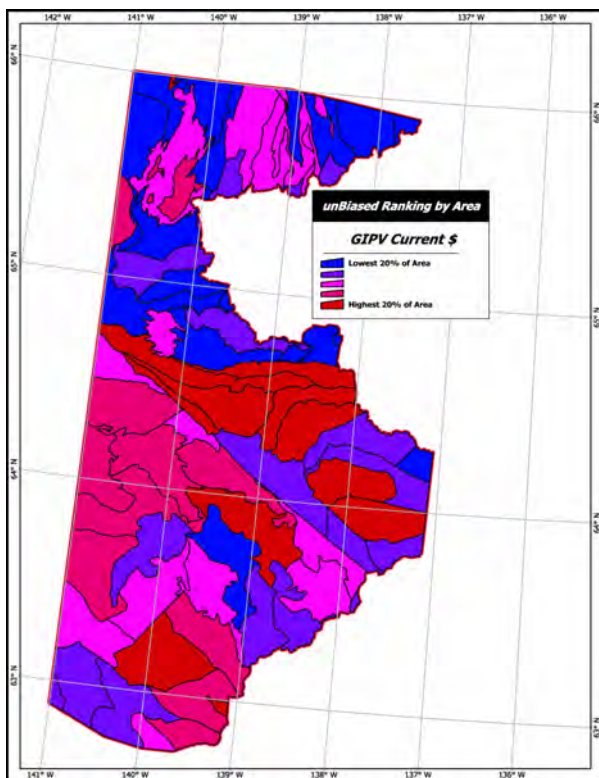


Figure 13-2 Five equal area classes of GIPV, all commodities (Kilby 2013)

Gold is by far the most significant metal in terms of economic importance, accounting for most of the known mineral occurrences documented within the planning region. Tracts with highest relative potential for gold are primarily associated with the Tintina Gold Province and the Tombstone Gold Belt. These areas have been mined for over 125 years. Areas in the northern part of the planning region have relatively low potential for gold deposits, although other minerals are known to occur there (see **Section 3 – Resource Summary Maps – Relative Distribution of Gold, All Deposit Types**).

Actual economic value of deposits at any market price is affected by many factors, including ease of development, rates of recovery, value of commodities and accessibility to markets. See **Appendix I – Mineral Potential Assessment** for a discussion of the methodology used to determine GIPV for the Dawson planning region.

It should be noted that the level of confidence that can be placed in the mineral deposit model for each tract varies according to the amount of information available for the tract and deposit types being estimated (Kilby 2013). Lower confidence should be placed on estimates of potential where limited exploration has occurred, such as in the northern part of the planning region.

13.2.2.2 Quartz Claim Staking

The process of exploration and development of hard rock minerals begins with prospecting. The free-entry system allows anyone 18 years of age or older to enter onto land available for mining purposes to prospect, locate and mine for gold and other precious minerals or stones. Under an orderly system for allocation of mineral rights, staking and recording of a mineral claim provides the holder with an exclusive right to publicly owned mineral substances from the surface of their claim to an unlimited extension downward vertically. Staking may only occur on “open ground,” that is, land

that is not already subject to mineral claims or withdrawn from staking because other land uses exist which cannot be displaced (e.g., yard of a house, park or Special Management Area, cemetery or burial ground, Category A Settlement Land, agricultural land or other land withdrawn by Government of Yukon through an Order in Council). Claims tags must be obtained from the Mining Recorder's Office and securely affixed to posts marking the claim. In order to stake a claim in the Yukon, it is mandatory to visit the site in the field and record the date and time of post placement. Claims must be recorded with the Mining Recorder within 30 days of staking, regardless of the distance from the claim to the Mining Recorder's office. It is unlawful to disturb claim posts. Where there is a dispute about boundaries, a claim holder may apply to have a Canada Lands Surveyor prepare a survey of mining claims.

A quartz mineral claim may be no more than 457 m by 457 m (1,500 feet by 1,500 feet), although fractional claims may be allowed where ground is bounded by existing claims. Claims must be kept in good standing by performing a minimum amount of representation (assessment) work on the claim each year (\$100 per year). Claims may also be kept in good standing by payment in lieu for up to five years of work. Failure to submit documentation of assessment work ("Application for Certification of Work") will result in the lapse of mineral claims.

Once the Yukon's Chief Geologist certifies that a vein or lode has been discovered within the bounds of a claim, the holder may request a more secure form of mineral tenure by way of a lease to the subsurface of the claims. Quartz leases are issued for 21 years and can be renewed for a further 21 years, provided terms and conditions of the lease are met. Quartz leases are not subject to annual work requirements.

During the staking season of 2011, the number of claims staked reached record levels. Many claims were recorded in areas not previously considered to have potential. It is anticipated that some claims will lapse without being revisited for assessment work.

13.2.2.3 Exploration and Development

Mine permitting and development typically follows mineral exploration and the completion of environmental baseline studies that establish an understanding of the mineral potential and existing environmental conditions (Government of Yukon 2010).

Hard rock mineral exploration is a significant economic activity within the planning region. Continued high gold prices through 2011 spurred Yukon exploration expenditure to over \$300 million, well above the previous year expenditure of \$160 million, shown in Figure 13-3 (Yukon Geological Survey 2013).

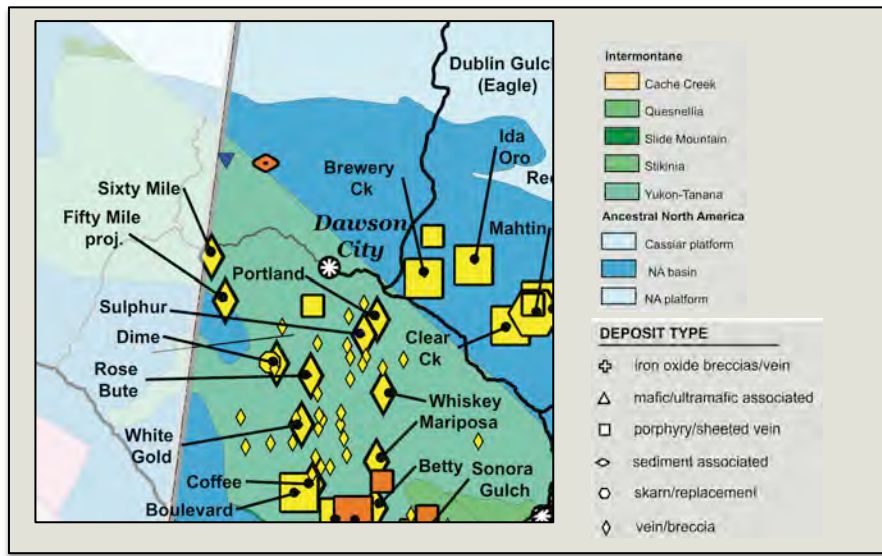


Figure 13-3 Dawson area exploration projects, 2011, showing advanced projects greater than \$1million in expenditure as larger symbols (adapted from YGS 2013)

Estimated expenditure within the Dawson region for 2010-2011 was in excess of \$45 million. Roughly one-third of currently active or pending quartz claims (21,954 out of 66,937 as of November 14, 2012) have been staked since start-up of the Dawson Regional Planning Commission, as shown in Figure 13-4. In June of 2011, mineral claims in good standing covered about 10,861 km² or 24 per cent of the region (Yukon Geological Survey 2013).

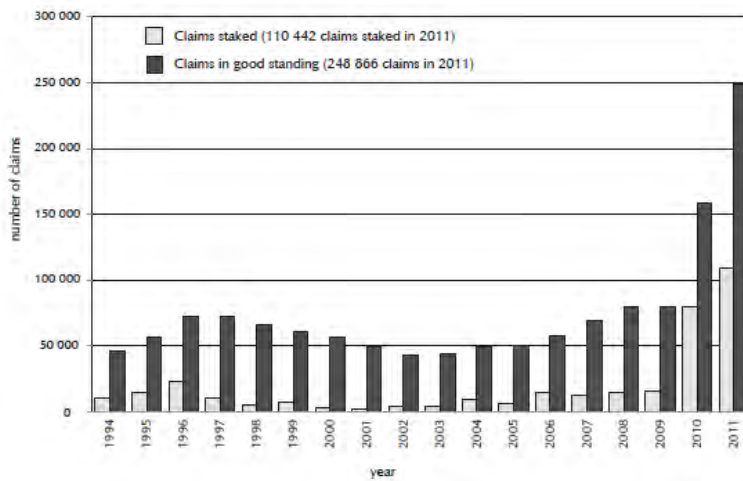


Figure 13-4 Number of hard rock claims staked and claims in good standing in Yukon between 1994 and November 30, 2011 (YGS 2013)

Recent exploration projects near Brewery Creek Mine identified new gold targets for future mine development. Hard rock gold occurrences of a similar type¹⁵ prompted the 2011 staking rush in the White Gold, Dawson Range and areas to the east of the Dempster Highway. Quartz Mineral Claims

¹⁵ Orogenic gold ores related to plutonic intrusions of mid-Cretaceous age.

and Quartz Land Use Permits are shown on the map in **Section 3 – Resource Summary Maps – Quartz Mining Activity.**

13.2.2.4 Mineral Production

The discovery of a deposit does not typically result in a producing mine operation. A profitable process for mineral development requires that a resource be present in adequate quantity and grade to warrant the cost of processing and transporting of a commodity, given current technology. Finding a candidate mineral resource requires extensive exploration and progressive focus on the most promising results. Citing local knowledge of historic exploration activity, the North Yukon Planning Commission reported the likely ratio of mineral discovery to establishment of a mine at 240:1 (North Yukon Planning Commission 2007).

Six open pit and seven underground mines previously in production in the region are listed below in Table 13. 4 (Yukon Geological Survey Integrated Data System 2013):

Table 13-2 Past producing mines, Dawson region

Primary Name	Type of Mine	Principal Commodity	Year First Staked	Timespan of Work
Clinton Creek	above ground	asbestos	1957	1957-2004
Caley	above ground	asbestos	1930	1956-1980
Brewery Creek	above ground	gold	1987	1987-2009
Virgin	underground	gold	1901	1902-2001
Violet	above ground	gold	1901	1905-1994
Moosehorn	above ground	gold, silver	1970	1970-2000
Lone Star	underground	gold, silver	1897	1903-1994
Lerner	above ground	lead, silver	1965	1965-1999
Connaught	above ground	lead, silver	1965	1965-2009
Silvercity	underground	silver	1899	1905-1989
Colliery	underground	coal	1898	1899-1995
Cliff Creek	underground	coal	1895	1900-1903
Sourdough	underground	coal	1896	1903-1913

13.2.2.5 Mine Remediation

Of seven previously operating Type II mines¹⁶ identified in the 2003 Devolution Agreement, two were in the Dawson planning region: Brewery Creek and Clinton Creek. Of those, Brewery Creek was decommissioned, twice winning the Robert E. Leckie Award for outstanding reclamation. It was subsequently purchased and further development work undertaken by another mining company.

Clinton Creek, located 100 km northwest of Dawson, operated as an asbestos mine from 1967 to 1978. Approximately 16 million tonnes of serpentinite rock, containing 940,000 tonnes of asbestos, were removed from three open pits. Over 60 million tonnes of waste rock were deposited over the south slope of Clinton Creek, and over 10 million tonnes of tailings were deposited above the Wolverine Creek Valley. Failure of waste rock in 1974 resulted in blockage of the creek, causing a large, deep lake to form, increasing the risk of downstream flooding of Fortymile in the event of heavy rain or sudden snowmelt. Tailings continue to erode into Wolverine Creek.

Since 2002, Clinton Creek channel has been reconstructed and erosion prevention measures put in place. Additional site remediation includes building demolition and removal of unsafe structures and equipment, monitoring of airborne asbestos levels, construction of berm and barrier ditches,

¹⁶ Type II mines are large mine sites that have significant potential for unfunded environmental liability.

installation of warning signage, and ongoing monitoring of waste rock and tailing pile movement. Government of Yukon took over site management and monitoring in 2003, although the Canadian government continues to provide funding for remediation where activities causing contamination occurred prior to devolution. In August 2006 the Government of Yukon issued an Order in Council (O.I.C. 2006/173) prohibiting entry and staking of new mineral claims over most of the former Clinton Creek Mine site. The order was issued to facilitate the clean up and reclamation of lands damaged by previous mining activity.

13.2.3 Placer Gold

13.2.3.1 Placer Potential

Gold is one of the heaviest minerals. Flowing water washes the gold out of bedrock and further down into the gravel beds until it reaches an impermeable layer such as bedrock or clay. Often, gold is found near the bottom of gravel layers, beneath a considerable depth of sediment and just above bedrock. The gold found in these gravel deposits is known as placer gold. The erosion of orogenic gold deposits in the Yukon-Tanana terrane likely contributed to the Klondike placer deposits. The vast majority of these deposits lie in unglaciated areas. In the absence of scouring by glaciers, placer gold deposits may occur in valley bottoms, alluvial fans, in gulch gravels and as high-level terraces. Economic concentrations of gold are subject to a number of variables, and may occur in a variety of geomorphic and stratigraphic settings (LeBarge 1996).

Placer claims in the Dawson planning region total approximately 1,100 km² and include the drainages of the Klondike, Indian, west Yukon (Fortymile, Sixtymile and Moosehorn Range rivers) and lower Stewart rivers (Figure 13-5). More than 1,900 km of placer streams (i.e., major gold bearing streams with significant mechanized placer mining operations) are found within the planning region.

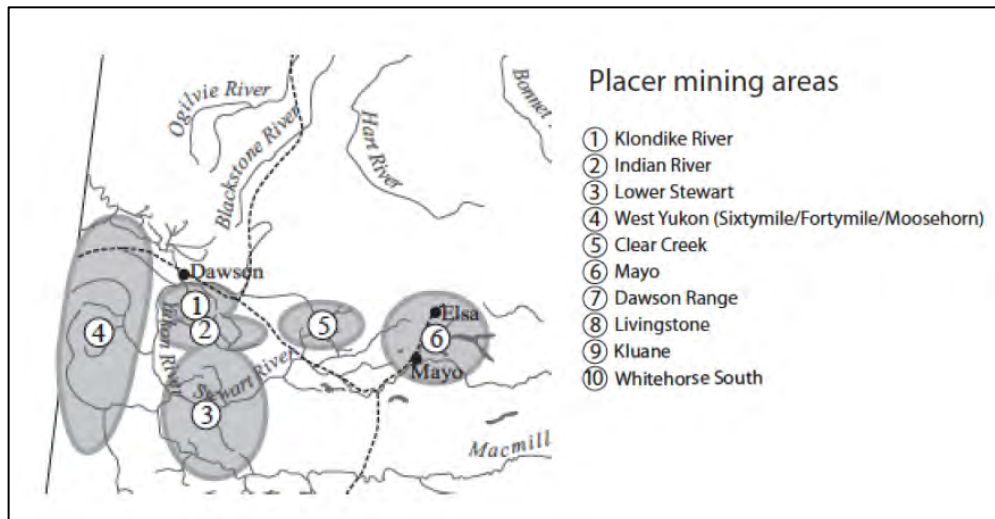


Figure 13-5 Placer mining areas (adapted from Yukon Geological Survey 2013)

Bond (2012) reviewed development status and operational activity, as well as the mineral potential assessment to produce a map of relative placer potential of regional streams. The potential distribution of placer gold within fluvial deposits in the Dawson planning region is shown at **Section 3 – Resource Summary Maps – Placer Gold Potential**. Refer also to **Appendix J – Placer Gold Potential**.

13.2.3.2 Placer Claim Staking

Placer mining operations cannot be conducted without first establishing mineral tenure under the *Placer Mining Act* and obtaining necessary regulatory approvals. Similar to quartz staking, on lands that are open to staking, an individual 18 years of age or older may stake a placer claim by placing posts in the ground in accordance with well established guidelines for claim staking.

A placer claim is a rectangular plot of ground no more than 500 feet in length along a baseline (a surveyed line generally following the direction of the center of the bottom of the creek valley) and 1000 feet perpendicular to it. Prospecting leases may be obtained that provide exclusive right to the staking of claims for up to five miles of length along a creek. Claims must be recorded and fees paid (\$10 per claim) at the Mining Recorder's Office within 15 days of staking. An additional day is added to the deadline for each 10 miles of distance from the claim to the Mining Recorder's office. Once approved, tags are issued and must be affixed to the claim posts.

Claims must be worked individually unless grouped, and grouping must occur before work begins. Work is required to maintain a claim in good standing; such work must be performed in support of mining the claim. Other improvements, such as residential occupation of a claim, are not accepted as work for purposes of renewing a claim. A claim will lapse if adequate representation of placer mining work cannot be provided in accordance with the *Placer Mining Act* and *Placer Mining Regulations*.

13.2.3.3 Placer Mining Operations

Placer mining activities include mineral exploration, construction of a mine site, mine operation and reclamation. Operations are conducted seasonally through the summer and into fall, until cold weather conditions limit the flow of water. Historically, miners used hand tools such as shovels and picks to dig through frozen layers of muck and gravel, often working in narrow shafts and tunnels. Modern mining techniques use heavy machinery to strip soil and gravel layers, then sluice or wash the underlying gravel through large mechanical plants that separate out the gold. Sophisticated earth moving equipment and refinement of techniques enables up to 99% of the gold to be recovered. Unlike the historic gold workings, the use of more efficient technology results in areas being mined and reclaimed; these areas will not be mined again.

Placer gold is mechanically separated from gravel using only water, motion and gravity; no chemicals are necessary in the mining process to extract the gold. Used water flows into settling ponds, where it is retained until fine silt sediments have sufficiently settled to allow discharge of water back into streams. Water may be recycled through an operation many times before discharge.

Placer mines are largely owned and operated by Yukoners, with many smaller placer operations run as a family business. However, placer mining also occurs on a large industrial scale, though not as extensive as dredging operations of the past. In either case, mining operations must be condensed into a short summer season, usually less than 100 days.

During the period from 2007 to 2009, more than 87 per cent of total Yukon placer gold production came from the unglaciated districts of the Dawson region. The Indian River area is the top gold producing drainage in the Yukon (yielding nearly 28,936 ounces over the 2010 and 2011 seasons), followed by the Klondike, West Yukon and Lower Stewart. At the same time, reported gold production from Yukon placer operations continued to decline through 2011 (Figure 13-6). For 2012, total placer gold production was 51,645 crude ounces, about 80 per cent of 2007 production levels.

Regionally, reported gold production decreased significantly in the Klondike and Lower Stewart drainages, while the West Yukon, Indian River and Clear Creek drainages maintained or increased production during the 2011 season.

Recent development in the lower Sixtymile River drainage includes several kilometres of road, an airstrip, and a bridge installed over the Sixtymile River. This improved access is favourable for increased development and testing of nearby drainages such as Twenty Mile Creek and Thirteen Mile Creek, as well as the upstream reaches of the Sixtymile River (Government of Yukon 2011).

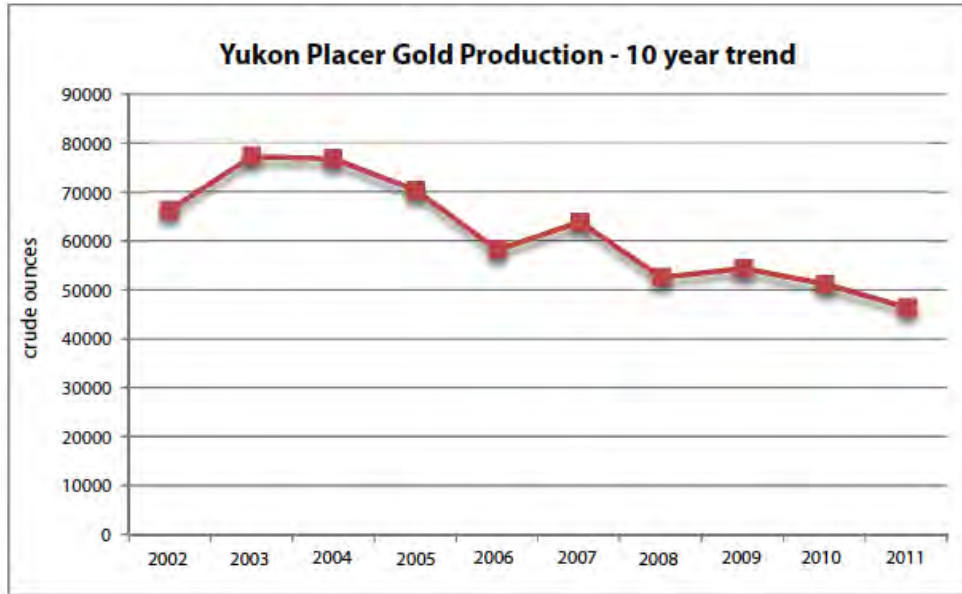


Figure 13-6 Yukon placer gold production, 2002-2011 (Yukon Geological Survey 2013)

Recent improvements to the road network in the southern Stewart River area will be beneficial to smaller operations and facilitate the exploration of Barker, Thistle, Ballarat, Kirkman and other nearby creeks (Government of Yukon 2011).

A substantial increase in placer staking activity in the Lower Stewart occurred during the 2009 season. This was fuelled in part by exploration on the nearby White Gold hard-rock gold discovery north of Thistle Creek. An access road was constructed to the property from Thistle Creek, improving access for nearby placer exploration. Conversely, placer gold occurrences may be used as an aid in exploration for hard rock sources; existing roads, airstrips and landings built to support placer mining may experience increased traffic from hard rock staking and exploration activity (Government of Yukon 2011).

13.3 Resource Values

13.3.1 Natural Values

Development of non-renewable resources is dependent on proper functioning of ecosystem services – for example, the regulation and supply of water, timber and aggregate; flood protection; and natural waste assimilation. Although natural value is depleted by extraction of non-renewable resources, mitigation of impacts from mining activity may minimize loss of natural ecosystem function.

Potential impacts from non-renewable resource development include displacement of wildlife, diminished habitat quality and pollution of natural systems. Of particular concern are the potential cumulative impacts to natural systems over the entire period of exploration, development and production of non-renewable resources.

Quartz claim staking activities, while relatively low impact in and of themselves, when conducted en masse over large areas may lead to wildlife disturbance from helicopter traffic, increased use of airstrips and seasonal campsites, and higher incidence of overlap with other resource users.

Hard rock mineral exploration occurs over large geographic areas, progressively refining the search until possible mine development happens on a relatively small footprint. Early on, staking and soil sampling can be undertaken with air support and minimal footprint. Subsequent exploration requires transport of drilling and trenching equipment, camps and support personnel over access roads. Actual mine footprints, though relatively small, are enduring features.

Placer mining directly impacts creek drainage and fish habitat; mitigation of adverse impacts is required during active operations and restoration is required following mining activity. Streams may be diverted or dammed during operation periods. Water used for sluicing becomes silt laden, and is released to discharge ponds to allow for settling. Reclaimed ponds generally re-vegetate quickly, often providing browse for moose. Operational standards set out by the Yukon Placer Regime to mitigate adverse impact on fish bearing streams relied on authority of Fisheries and Oceans Canada. The impact of recent regulatory changes diminishing the role of Fisheries and Oceans Canada in fish habitat management is not clear.

Access features created to facilitate exploration and mining also contribute to the fragmentation of habitat and may affect interactions between predator and prey species, leading to declines in populations of valued wildlife such as moose, caribou and sheep. Additional loss of natural value may occur where access facilitates other activities unrelated to mineral exploration, such as forestry, hunting, recreational use, or other mineral exploration and development. See **Section 2 – Chapter 17 – Transportation and Access** for further discussion of the consequences of access development on natural value.

Mining and other land use activities that strip the vegetative layer can cause degradation of permafrost and the release of methane, and/or accelerate processes already occurring as a result of climate change.

13.3.2 Traditional Value

Tr'ondëk Hwëch'in citizen comments (Tr'ondëk Hwëch'in 2012):

Intensive mining might affect my salmon fishing.

Mining will always be here so we need to get proper compensation.

We need to respect the land and not strip it all up.

Family placer mines are good.

Hard rock mining is not acceptable.

Mining is ruining the land so that people can get rich.

Miners don't realize that they're polluting so how can you get them to understand?

Viceroy and Clinton Creek are examples of mining gone wrong and the impacts that mining can have.

Gold leaves the Yukon and we are left with the aftermath.

Reclamation is good but won't replace what is lost.

The rapid influx of miners to the region had a significant impact on the traditional values and economic practices of Tr'ondëk Hwëch'in people. Early mining development activities and hunting pressures greatly reduced animal populations, most notably the Fortymile caribou herd. Chief Isaac relocated the traditional community of Tr'ochëk downriver to Moosehide to distance his people from the effects of the gold rush. Gradually, time spent on traditional harvest activities diminished as wage

labour, then residential schools, drew people away from the traditional community lifestyle. The loss of connection with traditional values continues to have consequences to personal and community health, including destruction of family units, poor school performance, substance abuse, addictions and other social problems (Tr'ondëk Hwëch'in 2012).

Mining activity affects the land and streams and has the potential to negatively affect Tr'ondëk Hwëch'in treaty rights. Pursuant to the Tr'ondëk Hwëch'in Final Agreement, Canada and Yukon legislation, and the common law, negative effects upon the land and treaty rights must be minimized, mitigated and compensated. Conflict occurs with traditional value where mining land use or access routes interfere with harvest infrastructure, including trails and harvest areas; where surface or groundwater resources are impacted by mining; or where habitat value for moose, caribou, sheep and other wildlife species is diminished. Access and other surface disturbances related to mineral exploration may directly impact historic or cultural resources, which are widely scattered and poorly documented.

Stripping and trenching results in removal of vegetation and surface layers, placing above ground and buried archaeological and palaeontological heritage assets at risk. In particular, access roads and trails (along with their associated use of vehicles, heavy equipment and machinery) can substantially impact heritage resources, with impacts increasing proportionally to the location of the access and its extent. Access routes are frequently situated in locations with high potential for heritage resources (e.g., flat, well-drained benches, ridges and other elevated features), whereas access constructed on side slopes utilizing cut-and-fill methods are of less concern for heritage resource impacts. New and/or easier access to areas previously inaccessible or isolated increases the potential for damage to heritage resources, as well as potential for looting.

Mineral resource development may contribute to a traditional economy by providing seasonal employment (e.g. environmental monitoring and stewardship roles) and improving access to harvest areas. Tr'ondëk Hwëch'in may enter into direct negotiations with mining companies in an effort to ensure equitable benefit to its citizens from resource development within its Traditional Territory.

13.3.3 Socio-Cultural Value

Stories of gold mining activity in the Klondike are a significant part of Yukon folklore and are often celebrated in art, music and storytelling. The history of the Klondike Gold Rush draws visitors from all parts of the globe. Preservation, conservation and re-creation of Klondike Gold Rush history are central to the retelling of this period of Yukon's historic past. In a description of potential locations on a tentative list of sites for nomination as World Heritage Sites, Parks Canada (2012) observes:

The Klondike represents the most comprehensive and intact of all the cultural landscapes that illustrate life before, during and after the world's great 19th century gold rushes.

Linking the region's stories through history can provide opportunities for enhanced and new tourism experiences, products and partnerships. For example, the relationship between gold mining and the Yukon's ice age history and science is intriguing. Klondike miners unearthed evidence of Yukon's ancient past at the turn of the century and modern Klondike area placer mining produces hundreds of fossils each year. The Klondike is well known around the world for research on ice age paleontology, geology and environmental science and this story is probably of interest to visitors. Linking the current gold rush with the Klondike Gold Rush is a theme worth exploring. In addition to those with an interest in mining history, modern day mining activities (and high gold prices) draw tourists, tour companies and film crews to the region.

Gold mining is recognized as quintessentially "Yukon," aptly demonstrated by adoption of the "goldpanner" as a cultural icon on Yukon vehicle licence plates for the past 60 years (Figure 13-7). The discovery of gold in the Klondike is commemorated annually in the Yukon by a civic holiday held August 17, called "Discovery Day."



Figure 13-7 Yukon goldpanner licence plate

13.3.4 Economic Value

Historic cycles of economic development have occurred in response to global market forces, including fluctuating prices for base and precious metals, fuel costs and the availability of investment capital. Mineral exploration expenditures may vary considerably from year to year, historically ranging from less than \$7 million in 2002 to over \$300 million in 2011 (Yukon Geological Survey 2013). In the late 1990s to 2001, significant declines in the mining sector resulted in reduced exploration spending, lost jobs and population decline. In contrast, high gold prices in 2011 drove mineral staking to record setting levels, resulting in labour and housing shortages.

Like many other activities within the planning region, the pace of activity is largely seasonal, with minimal activity and considerably less expenditure during the winter period. Recent claim staking has resulted in a significant increase in the number of exploration and placer mining projects under review by the Yukon Environmental and Socio-Economic Assessment Board (YESAB). Project activity for the period from January 2010 to April 2012 is shown on the map at **Section 3 – Resource Summary Maps – Recent YESAB Activity**.

Some people working in the placer mining sector work most of the year in some other industry. Seasonal mining activity generates secondary employment through demand for accommodation and food services. Other economic benefits from mineral development take the form of royalty and tax payments.

The creation of access roads for exploration and mining may also improve the economic viability of other development activity, such as forest resource harvesting. Public expenditures to improve access to the Yukon's mineral resources include the Yukon Mining Incentive Program, the Resource Access Roads Framework, and Regional Mineral Resource Assessments.

Increased industrial activity in remote areas results in an increased requirement for safety and environmental monitoring inspections.

13.4 Resource Management

13.4.1 Regulatory Framework

Mining activity is regulated to respect other land interests and to accommodate other users of the land. After claims are staked under the free entry system, most exploration and all mining work can only be done when regulatory permits have been obtained from the Government of Yukon. The rights conveyed to quartz claim holders under Yukon mining legislation only apply to subsurface

mineral interests, and these rights can only be exercised under a system of regulatory approval (Government of Yukon 2007).

13.4.1.1 *Fisheries Act (Canada)*

Sections 34 to 43 of the *Fisheries Act* – entitled *Fisheries Habitat Protection and Pollution Prevention* - are the primary legislation for the protection of fisheries resources and their supporting habitat. Section 35(1) prohibits a person from carrying on any work, undertaking or activity that results in harmful alteration, disruption or destruction of fish habitat, unless permission has been given under 35(2). Amendments made recently to the act as part of Bill C-38 modify the act's applicability to habitat, including renaming sections 34 to 43 as *Fisheries Protection and Pollution Prevention*.

Implementation of the habitat protection provisions of the *Fisheries Act* is accomplished using an adaptive management framework administered by the Yukon Placer Secretariat (YPS), known as the Fish Habitat Management System (YPS 2008). Watershed quality objectives (WQO) are established for entire watersheds, reflecting the suitability of streams and portions of streams as low, moderate or high quality fish habitat. The management system relies on three monitoring protocols to guide a risk-based approach to decision-making: water quality, aquatic health and economic health. Monitoring programs assist in verifying the effectiveness of mitigation measures in meeting WQO. Water quality monitoring determines whether sediment discharge standards are being met. Aquatic health monitoring determines whether stream systems exposed to placer mining remain in the same condition as streams not exposed to human activity (i.e., the “reference condition”). Economic health monitoring assesses changes to the viability of industry attributable to the management system. Traditional knowledge about the fish, fish habitat, water quality and the impact of placer mining on traditional use and sites are also identified as a source of information for an adaptive management response (YPS 2008).

Additional information from placer operators must be submitted with an application to YESAB for project approval, indicating how the design, operation and reclamation associated with placer mining activity will address fish habitat requirements, given a specific fish habitat suitability classification for that portion of the stream.

The Fish Habitat Management System does not affect land use decision-making.

13.4.1.2 *Lands Act and Territorial Lands (Yukon) Act*

All Commissioner's lands are open for staking and mineral exploration unless they are expressly excluded or withdrawn by an Order in Council under the *Lands Act*. Excluded lands include buildings, dwelling houses, cemeteries, agricultural lands, and Settlement Lands. Within the planning region, the Tombstone Territorial Park area is withdrawn from staking under Order-In-Council 2004/202.

Some activities in support of mining occur off claim areas (e.g., a road or an airstrip). Permits for such land use activities are required under the *Territorial Lands (Yukon) Act*.

13.4.1.3 *Environment Act*

Many mine sites, exploration camps, outfitting operations and other land use activities located in remote areas use incineration for waste disposal. This is primarily due to the cost and/or inconvenience of backhauling garbage to approved facilities, as well as the need to eliminate sources of wildlife attractants and reduce wildlife-human conflicts. The *Solid Waste Regulations* do not prohibit incineration of solid waste. Open burning, however, is not recommended and the Government of Yukon recommends it be considered only as a last resort. Burning garbage releases a number of toxic or noxious pollutants and particulate matter into the atmosphere, contributing to global warming and creating a risk to human health from inhalation. Burning also increases the risk of fire damage to

nearby land and property. Facilities that burn garbage must obtain an Air Emissions Permit under the *Environment Act*. Anyone burning garbage generated by commercial or public activities is required to obtain a Solid Waste Permit, and more than 5 kg of solid waste per day also requires an Air Emissions Permit.

13.4.1.4 *Quartz Mining Act and Placer Mining Act*

Four classes of work are established under both the *Quartz Mining Act* and *Placer Mining Act*, distinguished according to the type of activity and threshold for each type of activity. A limited range of work is considered as Class 1 activity, which may be undertaken without further notice or approval. This would include the use of hand tools for line clearing and trenching and limited use of explosives, but not road construction or building of permanent structures. Beyond Class 1 thresholds, notice of work must be provided (Class 2) and approval for work must be obtained (Class 3 and Class 4) from a Mining Lands Officer, following an assessment under the YESAA process. Additionally, Class 4 placer activity requires a Water Licence from the Yukon Water Board.

In recent years, increased levels of mineral exploration have highlighted concerns about the lack of information around Class 1 exploration programs and Class 1 placer land use operations. As well, the December 27, 2012 Yukon Court of Appeal decision in *Ross River Dena Council vs. Yukon Government* declared that the Government of Yukon has a duty to notify and, where appropriate, consult with and accommodate Ross River Dena Council before allowing any mining exploration activities to take place, to the extent that those activities may prejudicially affect asserted Aboriginal rights. Amendments to the legislation must be in force by December 27, 2013 to meet the timeline imposed by the Court of Appeal for implementing the declaration.

From June 3 to July 31, 2013 the Government of Yukon sought feedback on proposed changes to the *Quartz Mining Act* and *Placer Mining Act*. Possible regulatory changes considered in the review were: mandatory reporting to the Chief of Mining Land Use of Class 1 exploration activity; notification, and if required consultation with First Nations to accommodate asserted aboriginal and treaty rights; identification of areas for special operating conditions; and security for Class 1 programs in some situations. Regulatory changes would improve ability of inspectors to confirm compliance with operating conditions and improve information sharing between First Nation and Yukon governments. Areas for special operating conditions would be identified through regional land use planning and zoning. Examples given for special operating conditions include seasonal access and use restrictions. Enhanced environmental protection and monitoring were considered as appropriate multiple resource management strategies for high value and sensitive ecosystems and cultural landscapes (Government of Yukon 2013a).

13.4.1.5 *Yukon Environmental and Socio-economic Assessment Act (YESAA)*

All Class 2, 3 and 4 quartz and placer mining activities are subject to review under YESAA, by assessors independent of decision authorities. Proponents of Class 2 projects must provide notification of proposed activities to the Mining Land Use Officer for approval. Class 3 and 4 require approval of operating plans that specify (Government of Yukon 2007):

- General site layout
- Transportation infrastructure
- Environmental management plan, comprising standard operating procedures for: sediment and erosion control; monitoring; emergency response; wildlife protection; heritage resource management; and worker health and safety
- Reclamation and closure plan

13.4.2 Policy Direction

The Yukon Mining Incentive Program (YMIP) is a funding program designed to support individuals and companies in their search of mineral deposits by shouldering a portion of the risk capital required to explore for mineral occurrences. The YMIP reimburses individual prospectors up to 100% of grassroots program costs; individuals, partnerships and companies are eligible for recovery of up to 75% of focused regional exploration expenses and up to 50% of targeted exploration costs.

A fuel tax exemption is provided for authorized off-road commercial purposes. Authorized activities are mining, logging, outfitting, agriculture, trapping, fishing, hunting, tourism, and generation of electricity.

A Mining and Petroleum Environmental Research Group (MPERG) promote research aimed at a better understanding of issues surrounding mine operations and closure, including mining technology, evaluation of techniques and impacts of mining and public communications about modern mining practices.

The Yukon Mine Site and Closure Policy (2006) provides guidance in implementing the *Quartz Mining Act* and *Waters Act*, to allow consistency respecting aspects of mine reclamation and closure requirements governed by different legislation and delivered by different Yukon government agencies. The policy applies to development, operation and closure of hard rock mines that are on mineral claims, leases and crown grants. Stated goals for the policy are:

- Ensure the development and viability of a sustainable, competitive and healthy quartz mining industry that operates in a manner that upholds the essential socio-economic and environmental values of the Yukon;
- Ensure mine operators manage their mine sites in an environmentally sound manner and reclaim these sites to meet the principles stated in this policy;
- Fully protect public and environmental health and safety and ensure that any potential discharges during mine operation and following mine closure will be managed to prevent harm to the receiving environment or to the public;
- Ensure a government-approved reclamation and closure plan, prepared by the mine operator, to return the mine site to a viable and, wherever practical, self sustaining ecosystem, is in place prior to mine development;
- Ensure any approved reclamation and closure plan is updated by the mine operator periodically to reflect results of new information, such as ongoing environmental and technical studies, changes to operations, and progressive reclamation, and that this updated plan is approved by government and financial security requirements are adjusted accordingly; and
- Ensure mine operators provide financial assurance in the form of security and that the cost of reclamation (including but not limited to shutdown, closure and post-closure, and related environmental monitoring in the approved reclamation and closure plan) is met by the mine operator.

13.4.3 Current Best Management Practices

Best management practices (BMPs) have been developed for the Yukon's mineral resource industry to mitigate potential impacts on wildlife, wilderness tourism and heritage resources.

Staking Guide (2003)

- Provides an example of the proper method of marking a claim and establishing rights to acquire and work a mining claim

Prospecting Lease Guidelines (2003)

- Describes the process of marking and registering a prospecting lease, work requirements for a prospecting lease, staking leases to claims and general requirements of the Waters Act

Schedule of Representation Work and Placer Grouping Guidelines (2003)

- Describes the process for grouping together of placer claims
- Describes work requirements for maintaining placer claims in good standing
- Miner-like work must have a direct bearing on the exploration, mine development and recovery of placer gold and other precious minerals or stones

Mineral Exploration Best Management Practices for Heritage Resources (2010)

Placer Mining Best Management Practices for Heritage Resources (2010)

Objectives of these guidelines are:

- To protect and manage historic sites and resources, and to protect burials outside of known cemeteries.
- To provide information and assistance to the Yukon mining industry to ensure the protection of Yukon's heritage.

Approaches suggested in these guidelines include:

- Obtain heritage information for pre-development planning
- Locate camps in existing cleared areas
- Locate camps at least 100metres from water bodies
- Use existing trails
- Avoid stripping and trenching on edges of defined terraces or ridges (e.g. potential lookouts)

Tr'ondëk Hwëch'in Best Management Practices for Heritage Resources (2011)

Objectives of these guidelines are:

- Protect cultural, heritage, and archaeological resources in Tr'ondëk Hwëch'in Traditional Territory
- Protect First Nation burial sites in Tr'ondëk Hwëch'in Traditional Territory
- Provide insight into First Nation concepts and values pertaining to heritage and culture
- Share information with industries working within Tr'ondëk Hwëch'in Traditional Territory to ensure heritage and cultural resources, as understood by First Nation people, are protected

Heritage resource assessments are identified as the standard tool for determining heritage potential in a project area, and are required where sites have previously been recorded, in landscapes where the potential for heritage resources is high, or for high impact activities such as stripping, trenching and drilling. Standard mitigation strategies include:

- Avoidance –complete avoidance of an area is recommended for heritage artifact sites, places of spiritual importance, important harvest and wildlife areas, or areas identified as having heritage importance to Tr'ondëk Hwëch'in.
- Buffering – stay a minimum of 30 metres from any known or found heritage resource
- Study – systematic collection and analysis of heritage values prior to partial or total destruction of a site by development

13.5 Risks and Uncertainty

13.5.1 Pace of Development

Economic viability of mineral resource development is driven by many factors external to the planning region and Yukon. Global supply and security issues well beyond the Yukon's border drive fluctuations in the pricing of base metals such as gold, as well as the cost of inputs like gasoline and diesel fuel. Exploration projects require considerable private investment and compete with other investment opportunities in a volatile stock market. While staking of claims may occur over a short burst of activity, the pace of follow-on exploration activity will largely be determined by short to mid-term market conditions. The ebb and flow of staking and exploration activity creates difficult financial and social circumstances for further economic development.

13.5.2 Climate Change

Most exploration and placer mining activities are limited by way of need for overland access or flowing water to short summer operating seasons. Changes in timing and duration of snow cover, wet ground conditions, flooding, and disruption of permafrost are all potential changes arising from climate change that could have an impact on long-term operations and reclamation programs.

Effects of climate change could have both positive and negative consequences. Reduction in permafrost cover would make placer mining easier and cheaper, but reduced ice-road seasons could increase access constraints. Maintaining water balance is a critical element at all stages of mine operations, and changes in precipitation could make it more difficult to manage water quality. Lack of water could halt placer mining altogether (Government of Yukon 2013*b*).

Increasing disturbance of land cover can promote permafrost degradation and exacerbate or accelerate shifts occurring as a result of climate change.

13.5.3 Technology

Continuous improvement of techniques and tools for exploration, sample analysis and metal recovery can have a significant impact on the economic viability of mining operations. For example, low-impact, high-volume soil sampling programs allow extensive coverage of prospective ground without the need for reclamation, allowing subsequent exploration to more quickly focus on better targets. Areas considered too sensitive or marginal economically under current methods may become more accessible with improved technology. Low-impact access technology could encourage development in more remote areas, placing heritage and sensitive ecological resources at risk.

Improved technology for monitoring may identify new vulnerabilities requiring mitigation.

13.5.4 Access to Resources

Mineral resources are neither evenly nor predictably distributed in the planning region. Finding resources in sufficient quantity and quality to allow economic recovery requires extensive exploration over large areas to find and demarcate mineral deposits with potential for development. Withdrawal of areas from resource exploration, before resource values can become known and quantified, limits the extent of exploration and risks placing high value mineral deposits outside of economic reach.

Limits to access, either through land withdrawal or imposition of restrictions on surface or air access, may constrain economic potential for mining by increasing costs or placing resources out of reach.

13.5.5 Cumulative Effects

In reviewing project proposals, YESAB assessors are required to consider the potential for cumulative effects. No thresholds have been established for surface or linear disturbance to guide

decision-making. Assessors may assess the potential for cumulative effects on key wildlife species by considering consequences of project activities on annual allowable harvest of moose and loss of key habitat areas (e.g., lambing areas for sheep and winter habitat for caribou).

During the exploration seasons in 2010 and 2011, a high number of projects were proposed for quartz exploration in the White Gold area of the planning region. Potential for cumulative environmental and socio-economic effects arise from exploration related activities, including land clearing, aircraft over-flights, drilling, line cutting, road/trail improvements, camps, and/or development. In a study of the potential for cumulative effects of 44 proposed mining exploration or development projects in the White Gold district, a relatively strong correlation was found between trail/road density and river access, and moose harvest (EDI Environmental Dynamics Inc. 2011). If access features are a cause of increased harvest pressure, the proposed exploration activity will further increase moose harvest in game management areas already experiencing unsustainable harvest levels.

Quantifiable thresholds for surface disturbance at a landscape level could provide more certainty that projects meet environmental requirements and decrease assessment timelines (Pelchat 2012).

13.6 Chapter References

- Bond, J. 2013. *Placer Potential Map, Dawson Land Use Plan*. Yukon Geological Survey. Whitehorse, Yukon, Canada.
- EDI Environmental Dynamics Inc. 2011. *White Gold Cumulative Effects Report – Version 2.1*. Whitehorse, Yukon, Canada.
- Government of Yukon. 2007. *Quartz Mining Claims/Leases, Production Licenses and Surface Leases*. Interpretive Bulletin 2007-02. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada.
- Government of Yukon. 2010. *Quartz Mining License Application Guide*. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada.
- Government of Yukon. 2011. *Yukon Placer Mining Industry Report 2007-2009*. W.P. LeBarge and M.G. Nordling (compilers), 2011. Yukon Geological Survey. Whitehorse, Yukon, Canada.
- Government of Yukon. 2012a. *Minerals Management Activity Report – April 2011 – March 2012*. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada.
- Government of Yukon. 2013a. *Quartz Mining Act and Placer Mining Act Review – Class 1 Mining Land Use Discussion Paper*. Mineral Resources Branch, Energy Mines and Resources. Whitehorse, Yukon, Canada.
- Government of Yukon. 2013b. Yukon Water Website, Understanding Yukon Water, Water Use, Industry and Natural Resource Sectors, Mining. Available at: <http://yukonwater.ca/UnderstandingYukonWater/WaterUse/Industry.aspx>.
- Hogan, B. 1995. *Thematic Analysis of the Klondike Goldfields*. Government of Yukon, Heritage Branch. Whitehorse, Yukon, Canada.
- Kilby, W.E. 2013. *Dawson Land Use Planning Mineral Potential Assessment*. Yukon Geological Survey, Miscellaneous Report 8. Whitehorse, Yukon, Canada.
- LeBarge, W.P. 1996. *Placer Deposits of the Yukon: Overview and Potential for New Discoveries*. Pages 1-12 in W.P. LeBarge (editor) *Yukon Quaternary Geology Volume 1*. Exploration and Geological Services Division, Northern Affairs Program, Yukon Region.

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- North Yukon Planning Commission. 2007. *North Yukon Planning Region Resource Assessment Report*. Whitehorse, Yukon, Canada. Available at: http://www.planyukon.ca/index.php/documents/cat_view/81-north-yukon-planning-commission-documents/99-resource-assessment-report-maps-a-posters.html.
- Parks Canada. 2012. World Heritage Sites Website, Canada's Tentative List for World Heritage Sites, The Klondike. Available at: <http://www.pc.gc.ca/progs/spm-whs/page08/site06.aspx>.
- Pelchat, G. 2012. *White Gold Area Cumulative Effects*. Presentation to Yukon Land Use Planning Conference. January 2012. Dawson City, Yukon, Canada.
- Tr'ondëk Hwëch'in. 2012. *Tr'ondëk Hwëch'in Resource Report*. Submitted to the Dawson Regional Planning Commission, May 2012.
- Yukon Geological Survey. 2011. *Yukon MINFILE*. Online: <http://data.geology.gov.yk.ca>. (accessed June 20, 2011)
- Yukon Geological Survey. 2011. *Yukon Placer Mining Industry 2007 to 2009*. W.P. LeBarge, W.P. and M.G. Nordling (compilers). Department of Energy Mines and Resources. Whitehorse, Yukon, Canada.
- Yukon Geological Survey. 2013. *Yukon Exploration and Geology Overview 2012*. K.E. MacFarlane and M.G. Nordling (eds.), 2013. Department of Energy Mines and Resources. Whitehorse, Yukon, Canada.
- Yukon Placer Secretariat (YPS). 2008. *Fish Habitat Management System for Placer Mining – Adaptive Management Framework*. Yukon Placer Adaptive Management Working Group. Whitehorse, Yukon, Canada.

14 ENERGY

14.1 Highlights

- Heating and transportation are the major sectors for energy consumption in the Yukon
- Currently no dispositions for coal, oil or natural gas in the planning region
- Hydrocarbons continue to be a major source of energy despite the availability of hydroelectric power
- Demand on existing hydroelectric infrastructure continues to rise with new construction and major mining projects
- Biomass energy (fuelwood) is an important resource for heating in the region. There will likely be increased demand for wood energy over the short and long term
- Solar energy for heating and electricity is a viable seasonal option.
- Limited assessment of sources and options for wind and geothermal energy in the region.
- Future energy requirements in the planning region will depend on population trends, energy efficiency of municipal and territorial infrastructure, and the level and type of economic development activities

14.2 Description of Resource

The *Energy Strategy for Yukon* notes that according to a 2005 analysis, transportation and heating of residential, commercial, and institutional buildings are the major sectors for energy consumption in the Yukon (Government of Yukon 2009). Demand on the existing energy infrastructure continues to rise. Imported petroleum products remain the fuel of choice for transportation and heating of buildings, but much new construction is utilizing electricity for heating. With a growing population and new mines set to open in the near future, governments and industries are actively seeking new sources of energy, including potential new sites for hydroelectric projects and the possibility of using liquefied natural gas.

The geographic setting and relative isolation of the planning region have a major effect on energy supply and consumption. Energy costs in the region are high, with heating fuel and transportation costs substantially higher than Whitehorse. Older homes and buildings are often poorly insulated and inefficient to heat in winter temperatures, which can reach below -50 C.

Despite the availability of hydroelectric power, energy from hydrocarbons continues to be a major source of energy for heating and electricity. Diesel powered generators are still used as a supplement to existing hydro capacity, both as a backup in case of failure and as a supplementary source when demand on the grid is excessive (e.g., during winter). Many households and businesses in the Dawson region utilize fuel oil for heating and some also use propane, especially those living off the grid, for heating and household appliances such as fridges and stoves.

Economic growth in the Yukon is increasing the demands for energy. In particular, continued development of the mining sector is placing additional pressure to identify adequate and cost-effective local sources of energy production. In response to these pressures, Government of Yukon's Department of Energy, Mine and Resources and Yukon Energy Corporation (YEC) are actively examining the feasibility of developing the Yukon's natural gas resources to meet current and future energy demands. However, with no gas infrastructure in place, significant capital will be required to bring the gas to market.

Retail residential heating fuel prices are substantially higher in the Dawson area. As of November 14, 2012, the average price of furnace oil was \$1.397/L, arctic stove oil was \$1.376/L, and propane \$0.79/L based on a 500 gallon tank (Government of Yukon 2012a).

These factors, as well as a desire to reduce dependence on fossil fuels and take action on climate change by reducing greenhouse gas emissions, have highlighted the importance of investing in local renewable energy sources. Improving efficiency of existing energy infrastructure, designing new construction to more energy efficient standards, and retrofitting existing buildings are also important initiatives to reduce consumption. Territorial and federal government incentives and rebates are available for the purchase of energy efficient appliances and heating systems, as well as loans for retrofitting existing homes (e.g., adding insulation), and homeowner financial investments often quickly pay off in energy bill savings.

14.2.1 Non-Renewable Energy Resources (Hydrocarbons)

Hydrocarbons are a class of organic compounds consisting of only hydrogen and carbon and are the basis of coal, crude oil and natural gas.

This section summarizes hydrocarbon reserves and resource potential in the planning region as well as past activity, existing dispositions, future anticipated activity and management considerations. Units of measure used are Mt (million tonnes) for coal; Bcf (billion cubic feet) and Tcf (trillion cubic feet) for natural gas volume; and MMbbls (million barrels) for oil volume.

14.2.1.1 Coal

Coal is a combustible sedimentary rock usually occurring in rock strata in layers or veins (i.e., coal beds or seams). Coal is essentially fossilized carbon and has been used throughout history as a fuel source for electricity and heat, as well as for industrial purposes such as refining metals. Coal is extracted from the ground through mining, either with shafts underground or at ground level with open pits.

Coal is found in Mississippian, Jurassic, Cretaceous and Tertiary non-marine geological sequences, which underlie as much as 37,000 km² of the Yukon. The largest deposits and those with the greatest potential are located within the mid-Cretaceous to Eocene strata of the Bonnet Plume Basin in northeastern Yukon. This basin, located approximately 130 km east of the Dempster Highway (outside the planning region boundary), contains an estimated 660 Mt of high volatile bituminous coal in seams of mineable thickness. The coal is of low sulphur content, potentially clean-burning and suitable for conversion to clean gaseous or liquid fuels (Government of Yukon 2008a).

The Tintina Trench and Indian River areas are known locations of coal deposits within the planning region. Coal has been mined in the Dawson and Carmacks areas since the turn of the century and used for domestic heating, to power riverboats and to dry concentrate at the Keno and Faro mines. Coal was used to generate electricity for the dredges in the Klondike region from 1907 until approximately 1913, when the North Fork hydro plant was opened. Coal from the same deposit was also used to power riverboats and for domestic heating in Dawson City (Government of Yukon 2008a).

There are no dispositions for coal in the planning region or surrounding areas, and it is unlikely that coal will be pursued for exploration or development anywhere in the planning region. Although the Bonnet Plume basin to the east of the region has significant coal reserves, its remote location and subsequently high costs for development work and transportation to markets is a significant deterrent.

14.2.1.2 Oil and Natural Gas

Crude oil is a naturally occurring flammable liquid consisting of a complex mixture of hydrocarbons found in geologic formations beneath the Earth's surface. It is formed when large quantities of dead organisms, usually zooplankton and algae, are buried underneath sedimentary rock and undergo intense heat and pressure. Studies of structural geology and sedimentary basins can characterize petroleum reservoirs. After extraction, usually by drilling, it is refined and separated into fuels like gasoline and kerosene, as well as into chemical reagents used in manufacturing a wide variety of materials such as plastics and pharmaceuticals.

Natural gas is a naturally occurring hydrocarbon gas mixture consisting primarily of methane; it is found in deep underground natural rock formations or associated with other hydrocarbon reservoirs (e.g., in coal beds). It is an important energy source for heating and electricity, as well as fuel for vehicles. Before marketable use, it must be processed to clean the gas and remove impurities. Natural gas is a leading source of heat and electricity throughout Canada, and is typically regarded as a "cleaner" energy option than coal or diesel because it has a higher efficiency when burned (i.e., emits less carbon dioxide). As well, natural gas has a relatively low price compared to oil derivative fuels.

The Yukon is located in the northern portion of the Cordillera geologic province, consisting of relatively young mountain belts and a diverse array of rock types that record more than one billion years of Earth's history (see **Section 1 – Chapter 5, subsection 5.1** for a description of regional geology). In the northern part of the Yukon, there are five different structural and sedimentary basins that are suitable for the formation and preservation of hydrocarbons. Geology within the basins northeast of the Tintina Fault is essentially the same as that in the Western Canada Sedimentary Basin (Government of Yukon 2008*b*).

The northern section of the planning region includes portions of two sedimentary basins with identified potential for oil and natural gas resources: the Eagle Plain and Kandik basins (see **Section 3 – Resource Summary Maps – Oil and Gas Basins**).

Additional geological knowledge is required to adequately delineate and quantify petroleum resources, including both subsurface (i.e., well sampling data) and surface (i.e., stratigraphy, reservoir characterization, surface outcrops and hydrocarbon seeps).

Oil and gas resource assessments for various exploration areas have been completed by the National Energy Board and the Geological Survey of Canada and are periodically updated to incorporate new geological field information. Most areas have little or no well information (Government of Yukon 2008*b*).

Eagle Plain Basin

The Eagle Plain basin consists of two sub-basins, Bell in the north and Eagle in the south, separated by the east-west trending Eagle Arch.

Mean petroleum resource estimates for the entire Eagle Plain Basin are 436 MMbbls oil and 6,054 Bcf gas (Government of Yukon 2012*b*). The extreme southwest portion of the basin (six per cent or 1,315 km²) occurs in the planning region, and estimates for that portion are 28 MMbbls oil and 385 Bcf gas.

The majority of historical oil and gas exploration activities took place in the 1960s and 1970s. Three significant discovery licences resulted at the Chance, Blackie and Birch fields in the Eagle Plain basin, all of which are located outside of the planning region.

These activities also resulted in the development of seismic lines, winter roads and trails, airstrips and abandoned well sites. Many of these linear disturbance features are still readily visible on the landscape today.

Kandik Basin

The Kandik basin straddles the Yukon-Alaska border, with approximately 60 per cent located in Alaska.

In 2000, a resource assessment was conducted for the basin based on very limited subsurface geological data. In order to adequately assess the petroleum resource potential of the basin, substantial subsurface data, including well data and seismic data, and a better understanding of the rock units from surface outcrops would need to be obtained (Government of Yukon 2011*b*).

There are no discovered reserves in the Kandik basin. From 1970 to 1972, three exploration wells were drilled in the Yukon portion of the Kandik basin but none encountered gas or oil. A reflection seismic survey of approximately 180 km was also conducted in the area in 1971 (Government of Yukon 2011*b*).

Mean petroleum resource estimates for the Yukon portion of the basin are 99.3 MMbbls oil and 649 Bcf gas (Government of Yukon 2011*b*). These values are based on conceptual plays in an area where no defined pools or discoveries have been made. The southeast portion of the basin (44 per cent or 2,538 km²) occurs in the planning region, and estimates for that portion are 44 MMbbls oil and 288 Bcf gas.

Recent project proposals to the Yukon Environmental and Socio-economic Assessment Board by Northern Cross (Yukon) Limited include both winter and summer drilling activity at existing well sites and new exploration wells, winter access roads, and construction of a 49-person camp and fuel storage facility in the Eagle Plains area.

14.2.1.3 Liquefied Natural Gas (LNG)

LNG consists of 90 per cent or more methane with the remainder being small amounts of ethane, propane and butane. Natural gas is cooled in a cryogenic liquefaction plant and becomes liquid at a temperature of -162 C. In the process, the volume of natural gas shrinks by 630 times. The resultant super-cooled liquid can be transported in trucks or ocean tankers that have thermos-style insulation.

Liquefied natural gas (LNG) provides options for transportation without pipeline infrastructure in place. In the near term, LNG retains flexibility and diversity for energy use opportunities (e.g., for electricity generation locations and for end use sectors such as transportation) similar to that provided today by diesel fuel, but with reduced costs and reduced greenhouse gas emissions. Over the next 20 years, abundant natural gas supplies in British Columbia and Alberta could be transported by truck to LNG liquefier facilities in the Yukon at volumes and costs competitive with current diesel supplies. Longer term development of natural gas supplies in the Yukon, such as through the Alaska Highway Pipeline Project or Eagle Plain sources, would allow direct access to gas as well as the opportunity to supply LNG to other locations. Hydro and other renewable resource development could be developed as legacy projects (YEC 2012*b*).

YEC has stated that LNG is the only near-term supply option that can meet all of the forecasted energy demand without the need for significant diesel generation. LNG provides an opportunity to utilize natural gas reserves which are “stranded” without a pipeline. If a micro-LNG plant (i.e., 11 to 61 kilotonnes per day) was constructed at Eagle Plain, between two and seven trucks per day would be required to transport the LNG to demand centres (Fekete Associates Inc. 2011).

14.2.1.4 Unconventional hydrocarbons

Unconventional hydrocarbons are hydrocarbon resources such as shale gas, natural gas in coal, and “tight” gas that are chemically identical to conventional gas, but are considered “unconventional” because they are contained in geological formations that require more involved production techniques (e.g., hydraulic fracturing) to release the gas and achieve economic production

(Government of Yukon 2013*a*). Shale gas has not been explored for in the Yukon; however, future oil and gas projects will most likely consider shale gas reservoirs as potential targets (Government of Yukon 2013*a*).

Government of Yukon is not proceeding with coal bed methane or coal policy developing or permitting at this time.

14.2.2 Renewable Energy Resources

14.2.2.1 Hydroelectricity

Hydroelectric power generation converts the energy of moving water into electrical power. 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 generate power. In general, there are two types of hydroelectric facilities: (1) dam and reservoir projects that store water for use during periods of low flow; and (2) run-of-river projects that use minimal or no storage. These developments can vary in scale from micro-hydro facilities of less than 0.5 megawatts (MW) to large scale (i.e., greater than 100 MW). The Yukon's mountainous terrain and wealth of rivers and lakes is ideal for hydroelectric generation; however, few sites exist with a significant drop in elevation (head) and with significant flow, especially during winter months for large scale projects (North Yukon Planning Commission 2007).

Yukon Energy Corporation (YEC) is the main bulk supply provider, generation and transmission, of electrical energy in the Yukon, currently accounting for over 90 per cent of annual Yukon power generation. YEC owns and operates two independent high voltage (i.e., 69 kilovolt (kV) or higher) transmission systems: the Whitehorse-Aishihik-Faro (WAF) grid and the Mayo-Dawson (MD) system. YEC serves approximately 11 per cent of Yukon's customers directly, the majority located in and around Dawson City, Mayo and Faro. YEC's wholesale customer, Yukon Electrical Company Ltd. (YECL), distributes power to the remaining customers and manages its own maintenance and distribution lines. YECL also owns and operates some lower voltage lines (i.e., 25 to 34.5 kV). The MD system was completed in 2002 and is composed of a 223-km, 69 kV transmission line extending from the Town of Mayo to the City of Dawson and connecting Stewart Crossing. The annual energy capability of the Mayo hydro station under long-term average water flows is 42 gigawatt/hours (GWh), well above current loads of about 25 GWh per year (YEC 2006).

The transmission line from Mayo to Dawson City completed in 2003 allows the Mayo dam's excess power to displace Dawson City's previously diesel generated electricity. This reduces greenhouse gas emissions by up to 16,800 tonnes per year and contributes to a significant savings in diesel fuel. By 2004, only six per cent of MD generation was by diesel (Government of Yukon 2011*c*).

Construction of large hydro facilities in the Yukon has almost always been driven by new mining developments that promised significant power sales over a long period of time. The first hydropower plant in the Yukon was built in the Dawson area at Twelve Mile River to power the dredges during the Klondike Gold Rush; the North Fork Klondike River hydro plant also operated from 1911 to 1966. The 1989 closure of the United Keno Hill Mine and the 1998 permanent shutdown of the Faro mine, which had been the single largest power consumer for many years, meant there was an excess of power. The MD transmission line was constructed to utilize some of this surplus. However, new mines (including the reopening of the Keno mine), an increasing Yukon population, and increasing use of electricity for heating homes and businesses has strained capacity on the existing system. A new Mayo B powerhouse was constructed in 2011 with a capacity of an additional 10 MW (YEC 2013). Future growth capacity will likely come from smaller developments such as hydro sites near communities and energy transmission corridors in various parts of the territory. There is also potential for micro-hydro projects where water is drawn from a higher location and piped to a lower

hydro turbine, and the resulting head (i.e., the power of the falling water) is used to generate power (Government of Yukon 2011c).

In a submission to the Dawson Regional Planning Commission dated August 26, 2011, YEC stated that there are several potential sites of interest for future hydroelectric projects within the planning region. The North Fork Hydro Project is identified as a specific provision in Chapter 7, Section 7.8 of the Tr'ondek Hwech'in Final Agreement; the terms for a land exchange between the Government of Yukon and Tr'ondek Hwech'in (TH) relating to this project are set out in Schedule B of Chapter 9. YEC also continues to maintain an interest in the potential development of hydro resources on several other waterbodies including the Chandindu River, Rock Creek, Fifteen Mile River, North Klondike River, Forty Mile River, Yukon River, Indian River, Sixty Mile River and Stewart River. The exact locations of these sites are considered commercially sensitive information and were not identified to the Commission.

A presentation by AECOM, a technical and management support services company, at the Yukon Energy Charrette (March 2011) contains a map showing the Yukon's hydro site inventory of 171 known potential hydro sites. The portion of the map approximately covering the Dawson planning region is shown below in Figure 14-1. Note that many potential hydro sites have not undergone detailed assessment and therefore their viability is uncertain. However, the presentation notes that of the sites reviewed in the past 10 years, locations with small site potential (i.e., less than 10 MW) include Rock Creek, North Fork Klondike River, and Chandindu River.

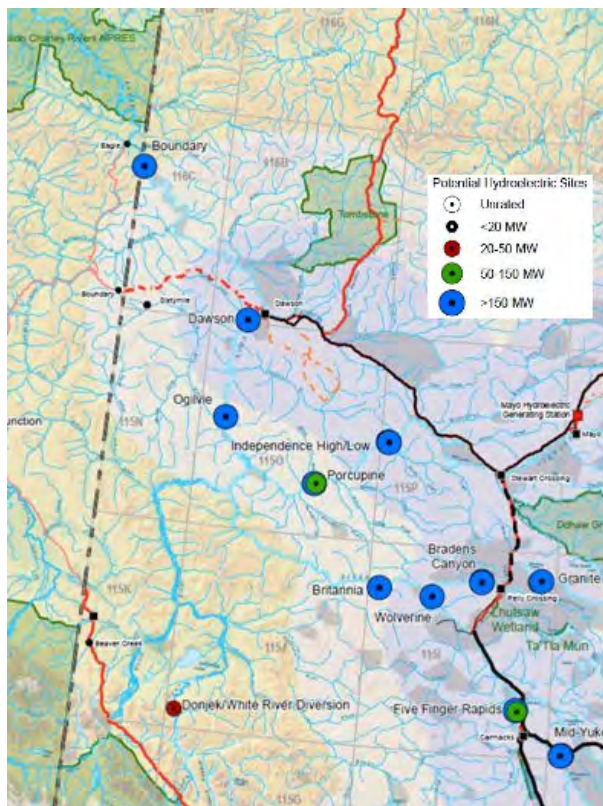


Figure 14-1 Potential hydro sites in the Dawson area (AECOM 2010)

14.2.2.2 Bioenergy (Biomass and Biofuels)

Bioenergy is the production of energy by releasing stored chemical energy in biomass (i.e., vegetation, primarily trees). Vegetation grows using solar energy, nutrients and minerals from the soil as well as

carbon dioxide from the atmosphere, and it stores some of this energy from photosynthetic activity. When a tree is burned, energy stored as carbon combines with oxygen from the atmosphere in a chemical reaction that produces heat and light and releases carbon dioxide.

In the past, timber was harvested as fuelwood for the steamboat industry. Steamers traveling between Whitehorse and Dawson City required one to two cords of wood per hour. Fuelwood camps were set up along the Yukon River, and steamers would stop every four to five hours to refuel. Between 1898 and 1956, approximately 300,000 cords of wood were harvested along the Yukon River for consumption by sternwheelers (Dawson Forest Management Planning Team 2013). Today, 25 per cent of Yukoners, compared to about 5.4 per cent of the population nationwide, rely solely on wood to heat their homes (Government of Yukon 2011*d*). Many more Yukoners use wood heat as a back up or supplementary heating fuel. Cordwood is the most commonly used form of biomass in the planning region because it is readily available, but wood chips, briquettes and pellets can also be burned. The major sources of fuelwood are dry wood from recent forest fires or white birch stands surrounding Dawson.

There are existing commercial operations that support a local green energy market in Dawson. For example, solid wood boilers offset heating costs for some businesses in Dawson and there is potential for the increased use of chips, sawdust and shavings as feed stock for central heating. Strategic directions for the local fuelwood market include developing fuelwood harvesting opportunities within Flat Creek, Dempster Highway and North Fork Road accessible burns. Key areas for potential white birch harvesting are Hunker Creek, Bonanza Creek and the Top of the World Highway (Dawson Forest Management Planning Team 2013).

A recent bioenergy project in Dawson utilizes wood waste from Arctic Inland Building Products forestry operations (Government of Yukon 2012*b*). The first phase of the project involves installing a wood chip boiler and heating Dawson's water supply and sewage treatment plant. The second phase includes adding boiler capacity to produce heat for a district heating plant to heat neighboring buildings. This project has the capacity to reduce diesel fuel consumption in Dawson by 600,000 L per year. Projects of this type are expanding within the territory as the desire for energy independence and high heating costs drive people to utilize wood biomass for heating. There will likely be increased demand for wood energy over the short and long term.

Biomass can also be converted directly into liquid biofuels (e.g. ethanol, biodiesel) for use in vehicles. There are a number of biofuel projects underway in the Yukon (none in the planning region). For example, the Government of Yukon Energy Solutions Centre is working with the Agriculture branch to test the feasibility of growing several biodiesel crops, and funding the conversion of a vehicle to use waste vegetable oil collected from local restaurants. Although well established in southern climates, there are still issues with the practicality of these systems in extreme cold (Government of Yukon 2011*e*).

14.2.2.3 Solar

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/m²). At any particular time, the available solar energy is primarily dependent upon how high the sun is in the sky (i.e., 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 (North Yukon Planning Commission 2007).

Although it is seasonal, the Yukon receives close to the same amount of sunshine annually as many other regions of Canada. Most fixed array solar panels are installed facing south, at a tilt equal to the

array's latitude plus 20 degrees. This makes allowance for winter conditions, when there is the least sunshine, at the lowest angle relative to the horizon (Government of Yukon 2011*e*).

There are a number of people using small-scale solar energy in the Yukon, including within the planning region. Households utilize solar thermal energy for hot water heating and photovoltaic arrays to generate electricity. Batteries can temporarily store energy captured by the modules and provide the user with electricity on demand. The swimming pool in Dawson City is heated by solar panels during its summer operating season. Telecommunications businesses, highway maintenance camps, park interpretive centres, camps, and research facilities are other examples of places where solar energy is being used.

The Dawson region receives on average approximately 2.66 kWh/m² of solar radiation in any given day, making solar energy a viable technology for producing both heat and electricity (Government of Yukon 2011*b*). A report has been completed documenting the potential for solar domestic hot water heating systems in Whitehorse and Dawson (Thevenard 2008). Interactive maps of photovoltaic potential in Canada have been developed by the Canadian Forest Service (Great Lakes Forestry Centre) in collaboration with the CANMET Energy Technology Centre (Government of Yukon 2011*e*). The region may see an increase of solar projects associated with residential and commercial development, although given the long periods of reduced winter daylight, backup alternative systems are still required.

14.2.2.4 Wind

Wind energy converts kinetic energy (i.e., energy of motion) into other forms of energy such as electricity or mechanical energy. Wind energy is a pollution-free, infinitely sustainable form of energy that is utilized successfully in many parts of Canada and the world. Wind energy is typically harnessed by a windmill or wind turbine. The most cost-effective turbines are located in the windiest areas and, since wind speed is affected by local terrain and increases with height above ground, wind turbines are usually mounted on tall towers to maximize wind velocities (North Yukon Planning Commission 2007).

One major operational issue in extreme northern climate conditions is the formation of rime ice. Rime icing is a white, frost-like buildup that can be seen on branches and trees around open water, and often occurs on Yukon mountains when a cloud contacts the mountain or ridge. Under these conditions, solid objects accumulate ice that “grows” into the wind, making it very difficult for wind turbines to operate (Government of Yukon 2012*e*).

The Yukon Energy Corporation, Energy Solutions Centre (a branch of the Government of Yukon's Department of Energy, Mines and Resources), industry and private individuals continue to evaluate Yukon sites for their wind generation potential. There has been limited assessment of wind energy sources and options in the planning region. The Government of Yukon has noted that wind speed has been measured at approximately six sites in the planning region and all sites have shown a poor wind regime, with wind speeds under five metres per second (Government of Yukon 2012*b*). This does not mean that there are no suitable sites in the region.

14.2.2.5 Geothermal

Earth's crust contains a large amount of energy, in the form of heat. Geothermal energy uses steam or hot water in Earth's crust to power turbines and to heat or cool air 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 (North Yukon Planning Commission 2007).

A number of geothermal projects are in operation elsewhere in the Yukon. However, Dawson City is considered to have low to moderate potential for geothermal projects (Gartner Lee Limited 2003). Fine grained, ice-rich soil is common and the impact of permafrost on heat pump technology is not well known.

14.3 Resource Values

14.3.1 Natural Value

Sustainable development of non-renewable resources is dependent on proper functioning of ecosystem services such as the regulation and supply of water, timber and aggregate; flood protection; and natural waste assimilation. Potential impacts from non-renewable resource development include displacement of wildlife, diminished habitat quality and pollution of natural systems. Of particular concern are the potential cumulative impacts to natural systems over the entire period of exploration, development and production of hydrocarbons.

Aggregates are a critical resource for the development of transportation and industrial infrastructure in northern permafrost landscapes. Large amounts of gravel would be required for the construction and maintenance of infrastructure associated with oil and gas development (e.g., access roads, well pads, compressor stations and work camps). Future requirements would be in addition to existing requirements for the community of Dawson, regular highway maintenance or any future highway upgrades. Even if the projects occur outside of the planning region, aggregate sources within the region would likely be developed, with all associated impacts, due to potentially limited resources in Eagle Plain (see **Section 2 – Chapter 17 – Transportation and Access** for more detail on potential impacts of gravel extraction and quarrying activities).

Water is an essential requirement for oil and gas exploration and development activities (e.g., 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. Most oil and gas exploration activities would occur in winter, when maintenance of fish over-wintering populations is considered to be a critical issue for fish populations, and depends on adequate water flow, depth and quality. Increasing industrial 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.

Potential impacts from industrial oil and gas activity include decreased slope and soil stability, especially in the case of surface disturbance in permafrost areas; greenhouse gas emissions from compressor stations; noise and human activity disturbance to wildlife; habitat loss and alteration from construction of camps, roads, pipelines, seismic lines and other linear features; pollution and toxicity from spills of oil and contaminants such as process chemicals; impacts of sedimentation on fish habitat and water quality at river and stream crossings; noise and vibration disturbance from rigs, wells and compressor stations; and impacts of explosives used during seismic exploration (Yukon Fish and Wildlife Management Board 2002).

While hydroelectric power is a renewable energy source, large and mid-size dam and reservoir projects can 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.

In general, the use of renewable forms of energy results in substantial decreases in greenhouse gas emissions. Biomass energy is considered carbon neutral (no net contribution to greenhouse gas emissions), although inefficient burning in wood stoves can contribute to local air quality issues. In

some areas of the world, concerns have been raised about birds striking wind turbines. These are mostly in areas where turbines are located directly in flight paths or migration routes.

14.3.2 Traditional Value

Tr'ondëk Hwëch'in citizen comments (Tr'ondëk Hwëch'in 2012):

The northern part of the territory should be left alone.

Surface disturbance may result in damage or loss of integrity to heritage resources. Impacts to natural values may also have indirect effects on traditional economic activities that rely on them. Roads for development into areas not previously accessible may place heritage resources and sensitive wildlife populations at risk. Any negative impacts on the Porcupine caribou herd from hydrocarbon resource development projects would be felt within the planning region.

In a few cases, community travel and subsistence use/harvesting have benefited from oil and gas development (e.g., where historical seismic lines and winter roads are used as travel routes).

Vuntut Gwitchin and Tr'ondëk Hwëch'in governments have both declared that their Traditional Territories (hence the planning region) should be kept “frack-free” until such time as the practice of hydraulic fracturing can be proven not to adversely affect groundwater and drinking supplies.

Small-scale renewable energy systems are generally compatible with traditional economic activities. As noted above, large-scale hydroelectric systems involving dams and reservoirs can have significant ecological impacts.

14.3.3 Socio-Cultural Value

Oil and gas development could negatively impact visual quality and experiences for wilderness tourists, but increasing road access could have positive impacts on mineral exploration, forestry and other tourism and recreation markets. The greatest potential land use conflicts are likely to occur between future oil and gas activities and wilderness/cultural tourism and subsistence harvesting activities in the vicinity of Eagle Plains, the Dempster Highway and major river corridors.

Secondary impacts from oil and gas development may include increased demand for housing, community and commercial services.

Renewable energy systems are vital for those people who choose to live ‘off the grid’ and for those wishing to offset the high costs of petroleum fuels and electricity. They can contribute to self-sufficiency for the region and the Yukon, with less reliance on imported fossil fuels and less susceptibility to fluctuating global market prices.

14.3.4 Economic Value

Between 2007 and 2010, 16 permits for oil and gas exploration were issued in north Yukon totaling \$29.4 million in work commitments (Adilman 2011). Although these oil and gas dispositions are located outside of the planning region, it is likely that any future developments would utilize existing transportation networks through the region (e.g., Dempster Highway) and that any potential socioeconomic benefits and/or impacts would affect the region and its residents. As well, portions of both the Eagle Plain and Kandik basins extend into the planning region, as described in Section 14.2.1.2.

Development of potential oil and gas pipelines and infrastructure would depend on access to potential industrial customers (e.g., Casino mine), additional infrastructure and navigating the complex regulatory system, which would cross both federal and territorial jurisdictions. Potential economic benefits from oil and gas development and pipeline construction include employment opportunities (from construction, operations, and ongoing exploration and production) and revenues

from resource royalties. Based on the natural gas scenario described by Fekete (2006), resource royalties could represent contributions of several million dollars annually to First Nation governments, and much higher levels to the Government of Yukon (as cited in North Yukon Planning Commission 2007).

Pipeline costs remain the major hurdle to commercial development of the Yukon's natural gas resources. A 12-inch pipeline capable of transporting 69 MMcf/d of gas (all of the Yukon's electrical demand) over 500km (Eagle Plains to Stewart Crossing) would cost in the order of \$864 million (Fekete 2011). The major portion of pipeline costs are associated with route preparation and excavation, so the cost of a smaller pipe reduces the total cost by only about 15 per cent. Small diameter pipes laying directly on the ground may further reduce transmission costs.

Natural gas power plants can be relatively easily integrated into the Yukon system as conversion or replacement of current diesel generation plants. They require relatively low capital costs compared with hydro development and have options for "scalable" generation over a wide range of sizes. Natural gas power utilizes proven technology that is readily available and can be reliably operated over an economic life of 20 to 25 years. Power units can also be located at load centres to minimize transmission requirements (YEC 2012*b*).

The Dawson Forest Resources Management Plan states that there are several personal fuelwood suppliers in Dawson, with an estimated combined annual harvest of approximately 600 to 700 m³, and that from 1999 to 2008 there were an average of 10 commercial fuelwood permits issued each year (Dawson Forest Management Planning Team 2013). Each winter, around 3,500 m³ or 1,600 cords of fuelwood are used in the Dawson area. The supply of fuelwood in the Yukon has been valued at approximately \$4 million a year in direct employment and import substitution (Government of Yukon 2011*d*).

Hydroelectric development is costly. Hydro plants can have capital costs from 3-10 times greater than diesel plants, and 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 and environmental and social impacts are important considerations. However, operation and maintenance costs are relatively low, there are no ongoing fuel requirements (or risk of fuel cost escalation and variability), and most facilities have a very long service life, greater than 60 years (AECOM 2011).

YEC's *Overview of Yukon Energy's Resource Plan Submission* (2006) states that the feasibility of new infrastructure opportunities to displace diesel generation typically requires effective use over relatively long time periods, in other words 20 to 30 years or more. Accordingly, a large new mine load that lasts only five or 10 years likely will not, by itself, sustain cost effective new diesel displacing projects. In contrast, a smaller new industrial load expected to be sustained for 20 years or more may create very real opportunities for cost-effective new hydro developments. The plan details near and long-term energy forecasts for various base-load and industrial-load growth scenarios, and concludes that most smaller projects as well as larger projects with a short life will likely continue to use on-site diesel power generation (YEC 2006).

There is potential for the development of micro or small hydro sites (i.e., less than 20 MW) or run-of-river facilities that do not regulate river flow and cause few alterations to the natural river system. However, because they do not utilize water storage, they would be useful primarily for seasonal operations (summer only). Estimated capital costs (2009) for construction of various small hydro sites in the planning region range from approximately 25-30 million dollars for Rock Creek and North Fork Klondike River to closer to 100 million dollars for Chandindu River (AECOM 2011).

Other renewable energy systems may be viable options for producing at least some of the electricity and heating required for industrial operations located in remote areas. The costs of solar technologies are becoming more competitive with conventional electrical generation, and after the initial capital cost has been recovered, solar energy is virtually free and requires very little maintenance (largely because there are no moving parts). There are numerous opportunities for expanded use of solar technology in seasonal operations and camps, where the operating season coincides with the highest amount of annual availability of solar energy. Larger scale renewable energy projects require capital investments, and the ability to produce power at costs equivalent to competing technology such as diesel generators.

14.4 Resource Management

The following sections note legislation, regulations and policy that specifically address energy sector development. Other acts and regulations dealing with land disposition, resource extraction, water use, access, and other industrial activities may also include measures to manage land use. Additional protocols and requirements may also apply if work is being conducted on Settlement Land.

14.4.1 Regulatory Framework

14.4.1.1 First Nation Final Agreements

Several definitions are provided in Chapter 1 of Final Agreements with respect to mineral rights for non-renewable resources:

"Minerals" means precious and base metals and other non-living, naturally occurring substances, whether solid, liquid or gaseous, and includes coal, Petroleum and Specified Substances;

"Petroleum" means Oil or Gas;

"Oil" means crude oil, regardless of gravity, produced at a well head in liquid form, and any other hydrocarbons except coal and Gas and, without limiting the generality of the foregoing, includes hydrocarbons that may be extracted or recovered from deposits of oil sand, bituminous sand, oil shale or from any other type of deposits on the surface or subsurface;

"Gas" means natural gas and includes all substances other than Oil that are produced in association with natural gas.

Chapter 18 – Non-Renewable Resources sets out required considerations for the exercise of mineral rights for Petroleum, including provisions regarding the need for consent for access to mineral rights, and standards of performance where reasonable access is permitted without a requirement for consent of the affected First Nation.

14.4.1.2 *Tr'ondëk Hwëch'in Oil and Gas Act (Draft)*

This act (in draft form as of August 2013) will, when enacted, will trigger reciprocal Consultation duties under Section 14 of the Yukon *Oil and Gas Act*. The draft wording states that TH shall Consult the Minister before publishing a call for bids for the sale of oil or gas rights, or executing an instrument granting oil or gas rights, on its Category A Settlement Land. 'Consultation' will have the same meaning as in the TH Final Agreement.

14.4.1.3 Oil and Gas Act

The *Oil and Gas Act* (RSY 2002, c162) establishes the management regime for exploration, drilling, pipelines, facilities and production activities associated with oil and gas. Regulations established under the act include:

- *Oil and Gas Disposition Regulations* – Dispositions are granted by the responsible Minister through a competitive disposition process. The regulation establishes the rules regarding the issuance and management of rights in Yukon and sets out requirements for permits, leases, fees and rentals.
- *Oil and Gas Drilling and Production Regulations* – Regulates drilling operations, well operations, field facility construction and operations, and production. Also contains terms and conditions for these activities and standards for minimizing environmental disturbances and construction activities.
- *Oil and Gas Geoscience and Exploration Regulation* – Responsible for the regulation of petroleum exploration activities and specifies requirements for authorization, operation and reporting of all exploration activities in Yukon. Geoscience involves all aspects of preliminary surface and near-surface exploration such as geological field studies, aerial magnetic and gravity surveys and seismic programs. The regulation contains terms and conditions of the geoscience operation, environmental protection, equipment, procedures, tests and analysis and sets out standards for minimizing environmental disturbances from water use and wastes.

If there is a conflict between a provision of the *Territorial Lands (Yukon) Act Land Use Regulation* and the *Oil and Gas Act* or a regulation under it, the provision of the *Oil and Gas Act* prevails.

14.4.1.4 Yukon Development Corporation Act

The act and its regulations direct Yukon Development Corporation (YDC) and its wholly-owned subsidiary, Yukon Energy Corporation (YEC), to “participate in the economic development of Yukon by ensuring there is a continuing and adequate supply of energy in the territory in a manner consistent with sustainable development” (YEC 2012a). YEC owns and operates the electrical energy generation, transmission and distribution assets and the electrical rate structure is subject to the authority of the Yukon Utilities Board. YEC and YDC negotiate an annual protocol with the Government of Yukon, which outlines what is expected each year from the corporations.

14.4.2 Policy Direction

14.4.2.1 Yukon Oil and Gas Rights Disposition Process

Pursuant to the *Oil and Gas Act* and *Oil and Gas Disposition Regulations*, the rights to Yukon oil and gas are obtained through a competitive disposition process conducted twice annually. Each process involves the following stages (Adilman 2011):

- “Requests for Postings” (RFPs) are issued for locations in which industry is interested in exploring for oil and gas;
- RFP review during which the public, First Nations and government agencies may submit presentations with respect to environmental, socio-economic and access concerns related to the requested locations;
- “Call for Bids” where industry is invited to submit bids on posted locations; and
- Issuance of oil and gas permits to successful bidders.

A successful bidder is required to submit a work deposit equal to 25 per cent of their work commitment bid (minimum bid is \$400,000). The work deposit is refunded proportionally as work is completed. The initial term of a permit is six years, and may be extended for a further four years if a

qualifying well is drilled during the initial term. Companies are required to obtain all regulatory approvals and undergo environmental screening through YESAB prior to any activity, and companies are also expected to adhere to best management practices as outlined by Government of Yukon Oil and Gas Resources (OGR) (Adilman 2011).

In addition to legislative amendments, OGR is updating and improving a number of regulations (the *Royalty Regulations, Drilling and Production Regulations, Disposition Regulations, Licence Administration Regulations, and Geoscience Exploration Regulations*) and developing new pipeline regulations (Adilman 2011).

New as of July 2013 is the *Gas Processing Plant Regulation* (O.I.C. 2013/162). This regulation will apply to all gas processing facilities in the territory, including LNG facilities which may be developed by utilities or mining companies choosing to use LNG to generate electricity instead of diesel. The regulation will reference the most comprehensive standard in Canada for the safe construction, operation and decommissioning of LNG facilities (Government of Yukon 2013b).

14.4.2.2 Government of Yukon Energy Strategy

The development of the Yukon's natural gas resources is a priority action in the Government of Yukon's *Energy Strategy for Yukon* (Government of Yukon 2009). The strategy promotes sustainability, energy security, self-sufficiency, optimizing benefits, climate change coordination, leadership and partnerships (YEC 2012a).

Government of Yukon considers that developing Yukon gas resources would provide clean and reliable energy as well as create numerous economic development opportunities, as relying on expensive diesel fuel for energy is a major disincentive for the development and operation of mining projects in Yukon (Adilman 2011).

However, the *Energy Strategy for Yukon* also identifies increasing use of renewable energy sources as a priority to reduce fossil fuel use and greenhouse gas emissions. This includes replacing fossil fuels with cleaner energy sources where possible, investing in research and development for new technology, encouraging small scale renewable energy production, and developing a bioenergy industry by building a local market for wood energy technologies and wood fuel products. It also promotes energy conservation and efficiency (Government of Yukon 2009).

14.4.3 Current Best Management Practices

Best management practices (BMPs) have been developed for the Yukon's oil and gas industry to mitigate potential impacts on wildlife, wilderness tourism and heritage resources. Approaches include reducing overall landscape footprint, using meandering narrow cutline and non-mechanical cutting methods, utilizing existing infrastructure and access routes, operating in winter only, and minimizing disturbance of soil and ground cover. Other strategies include avoiding sensitive wildlife areas and times of year, and reducing conflict with wilderness tourism operators by considering seasonal restrictions on activities, avoiding over flights of key travel corridors (e.g., Yukon River and Dempster Highway), and implementing visual buffers or setbacks from exploration and development projects (Government of Yukon, date unknown).

The goals of the oil and gas BMPs are to conserve wildlife and fisheries habitat, vegetation and surface soil, and to avoid sensitive landscape and habitats. Specific considerations are preventing and minimizing permafrost degradation; restricting activities in wetlands to winter operating seasons; ensuring a healthy and vibrant Yukon trapping industry; protection of historic resources throughout the territory; use of "Low Impact Seismic" practices; and reduction in conflict with wilderness tourism operations (Government of Yukon 2011b).

14.5 Risks and Uncertainty

14.5.1 Energy Resources and Climate Change

Oil, natural gas and coal are fossil fuels. Burning of fossil fuels releases pollutants and greenhouse gases such as carbon dioxide into Earth's atmosphere.

Yukon's energy requirements are currently met almost entirely by hydroelectric facilities and imported oil. Diesel generators are also used as a back up in communities serviced by the hydro grid, and as a supplement in winter when demand on the grid increases. Access to natural gas energy for the residential and commercial sectors could displace the use of diesel for power generation and heating, and would significantly help advance northern resource development, particularly in the mining sector. It would also likely result in cost savings and reductions in greenhouse gas emissions.

The use of renewable forms of energy results in substantial decreases in greenhouse gas emissions. Hydroelectric power produces very low greenhouse gas emissions, mostly limited to the first three to five years after creating a reservoir, after which time they reduce to levels consistent with natural lakes (AECOM 2011).

Climate change could have major impacts for hydroelectric energy planning and infrastructure in the region. Known potential effects include changes to water flow, quantity and quality; increases in mean air temperature; changes in snow depth; and changes in weather patterns. These changes could result in melting of permafrost, changes to winter flow in streams, reduced stability of structures, engineering challenges and increases in construction costs, shifts in operational costs, and changes in accessibility on land and rivers.

There are a number of potential renewable energy sources that could become more important in the future, but these will likely be on a small scale and a primarily seasonal (summer only) basis. However, there are excellent opportunities to integrate hydro with other intermittent renewable energies such as wind and solar, thereby responding to variability in generation and improving overall reliability. "The Yukon is fortunate to have significant hydro assets as this can accommodate and complement wind power without requiring natural gas electrical generation" (AECOM 2011).

Bioenergy is considered a carbon neutral fuel and not a net contributor to greenhouse gas emissions, since no more carbon dioxide is produced than was consumed by the tree during its growth. As long as new trees are allowed to grow in place of those harvested, a carbon balance is maintained. There are concerns about the contribution of wood smoke to air quality issues, mostly because of inefficient burning that results in harmful particles and chemicals released into the atmosphere. Public education about proper burning techniques, chimney size and location, and the availability of higher efficiency wood stoves are helping to reduce this problem (Government of Yukon 2011*d*).

Energy efficiency and energy conservation are particularly important for the Yukon due to its cold climate and long distances separating it from other parts of the country. The Government of Yukon has committed to achieving a 20 per cent increase in energy efficiency by the year 2020. The *Energy Strategy for Yukon* identifies a number of priorities to meet this goal including reducing energy consumption in buildings, reducing energy consumption for transportation, promoting the use of energy efficient products, and improving energy efficiency for Government of Yukon operations. Options for reducing energy consumption include providing incentives for energy efficient retrofits and new construction, piloting heat pumps and other technologies, investing in agriculture infrastructure to support production of Yukon grown food, developing more efficient public transportation networks, providing rebates for Energy Star certified appliances and upgrades to more efficient heating systems, and setting targets for government vehicle fleet use and fuel consumption (Government of Yukon 2009).

14.5.2 Other Risks and Uncertainties

The demand on the Yukon's electrical grid is expected to outstrip the supply of renewable energy from existing Yukon Energy hydro facilities within the next few years, and potential new mines will require 200 megawatts of reliable and competitively priced electricity by 2021 to enhance their economic viability (Adilman 2011).

Although the use of liquefied natural gas as a source of electricity is promoted as a "cleaner" option than diesel (i.e., generates less greenhouse gas emissions), there are major public concerns with the potential for contamination of groundwater if hydraulic fracturing, or fracking, techniques are utilized for extraction. As well, some transportation options for LNG (e.g. trucking) would generate additional greenhouse gas emissions which may offset any potential benefits..

Exploration and future development of hydrocarbon resources is dependent on access, both short-term (e.g., for exploration) and long-term (e.g., for infrastructure corridors). Any access restrictions to an area with petroleum potential will affect the ability to identify and achieve an economic and sustainable land base for resource development.

Development of oil and gas resources in, and north of, the planning region is dependent on access to potential industrial customers in the south, such as the mining belt in the southern portion of the planning region. Consideration of an access and energy corridor traversing the region is required.

14.6 Chapter References

- Adilman, B. 2011. *Yukon Oil and Gas Overview 2011*. Pages 83-90 in K.E. MacFarlane (editor) *Yukon Exploration and Geology Overview 2011*. Yukon Geological Survey. Available at: <http://www.geology.gov.yk.ca/ygsids.html>.
- AECOM. 2010. *2009 Large Hydro Stage 1: Initial Evaluation*. Prepared for Yukon Energy Corporation. Whitehorse, Yukon, Canada. Project Number 60158164.
- AECOM. 2011. *Yukon's Hydroelectric Resources*. Prepared for Yukon Energy Corporation's planning charrette. Whitehorse, Yukon, Canada, March 6-9, 2011. Project Number 60196946. Available at: http://www.yukonenergy.ca/downloads/charrette/docs/papers/HYDRO_YEC_Background_Paper2.pdf.
- CBC News. 2012, November 20. *Oil Railway through Yukon headed toward public consultation*. CBC News North. Available at: <http://www.cbc.ca/news/canada/north/story/2012/11/20/north-yukon-railway.html>.
- Dawson Forest Management Planning Team. 2013. *Dawson Forest Resources Management Plan*. Prepared for Government of Yukon, Department of Energy, Mines and Resources, Forest Management Branch. Whitehorse, Yukon, Canada. Available at: http://www.emr.gov.yk.ca/forestry/dawson_frmpl.html.
- Fekete Associates Inc. 2011. *Opportunities for Utilization of Natural Gas for Electrical Generation*. Prepared for Yukon Energy Corporation planning charrette. Whitehorse, Yukon, Canada, March 6-9, 2011. Available at: http://www.yukonenergy.ca/downloads/charrette/docs/papers/NATURAL_GAS_YEC_Background_Paper.pdf.
- Francis, D. 2012, November 16. *Alaska-bound rail project could solve Canada's oil sands problems*. Financial Post. Available at: <http://opinion.financialpost.com/2012/11/16/alaska-bound-rail-project-could-solve-canadas-oil-sands-problems/>.

-
- G7G Ltd. 2012. *First Nations and Alaskan tribes show support for Alberta-Alaska rail link*. News Release, November 14, 2012. Available at: <http://unfnrailco.com>.
- Gartner Lee Limited. 2003. *Yukon Groundwater and Ground Source Heat Potential Inventory*. Prepared for Energy Solutions Centre. Whitehorse, Yukon, Canada. Reference: GLL 22-680. Available at: http://www.energy.gov.yk.ca/pdf/yukon_groundwater_heat_potential_study2003.pdf.
- Government of Yukon. 2008a. *Yukon Energy Resources: Coal* (brochure). Departments of Economic Development and Energy, Mines and Resources.
- Government of Yukon. 2008b. Oil and Gas Resources Website, Oil and Gas Resource Assessments, Yukon Oil and Gas Exploration Regions. Department of Energy, Mines and Resources. Available at: http://www.emr.gov.yk.ca/oilandgas/oilgas_resource_assessments.html.
- Government of Yukon. 2009. *Energy Strategy for Yukon*. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada. Available at: www.energy.gov.yk.ca/pdf/energy_strategy.pdf.
- Government of Yukon. 2010. *Energy for Yukon: The Natural Gas Option, Eagle Plain Case Study 2010*. Prepared for Department of Energy, Mines and Resources, Oil and Gas Resources Branch. Whitehorse, Yukon, Canada. Available at: <http://www.emr.gov.yk.ca/oilandgas/pdf/eagleplain.pdf>.
- Government of Yukon. 2011a. Yukon Geological Survey Website, Energy Geology, Basin Geology, Eagle Plain Basin. Department of Energy, Mines and Resources. Available at: http://www.geology.gov.yk.ca/eagle_plain_basin.html.
- Government of Yukon. 2011b. *Technical Report on Issues and Interests*. Compiled by the Corporate Policy and Planning Branch of the Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada. Available at: http://www.emr.gov.yk.ca/lands/pdf/regionallanduse/drlup_issues_and_interests_technical_report.pdf.
- Government of Yukon. 2011c. Energy Website, Renewable Energy Resources, Water. Department of Energy, Mines and Resources. Available at: <http://www.esc.gov.yk.ca/water.html>.
- Government of Yukon. 2011d. Energy Website, Renewable Energy Resources, Biomass. Department of Energy, Mines and Resources. Available at: http://www.energy.gov.yk.ca/biomass.html#Wood_Energy_and_Air_Quality.
- Government of Yukon. 2011e. Energy Website, Renewable Energy Resources, Solar Energy. Department of Energy, Mines and Resources. Available at: <http://www.energy.gov.yk.ca/solar.html>.
- Government of Yukon. 2011f. Energy Website, Renewable Energy Resources, Geothermal Energy. Department of Energy, Mines and Resources. Available at: <http://www.energy.gov.yk.ca/geothermal.html>.
- Government of Yukon. 2011g. Oil and Gas Resources Website, Pipelines. Department of Energy, Mines and Resources. Available at: <http://www.emr.gov.yk.ca/oilandgas/pipelines.html>.
- Government of Yukon. 2011b. *Overview of Legislation and Policies Pertaining to Regional Land Use Plans in the Yukon*. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada.
- Government of Yukon. 2012a. Energy Website, Yukon Retail Fuel Prices. Department of Energy, Mines and Resources. Available at: <http://www.energy.gov.yk.ca/fuel.html> (accessed November 14, 2012).
-

- Government of Yukon. 2012*b*. *Information Submission to Resource Assessment*. Submitted to the Dawson Regional Planning Commission. Whitehorse, Yukon, Canada.
- Government of Yukon. 2012*c*. Yukon Geological Survey Website, Energy Geology, Basin Geology, Eagle Plain Well Assessment. Department of Energy, Mines and Resources. Available at: http://www.geology.gov.yk.ca/energy_petrophys_analysis.html.
- Government of Yukon. 2012*d*. *Yukon Economic Outlook 2012*. Department of Economic Development. Whitehorse, Yukon, Canada. Available at: http://economics.gov.yk.ca/Files/Economic%20Outlook/Outlook2012_Final.pdf.
- Government of Yukon. 2012*e*. Energy Website, Renewable Energy Resources, Wind Energy. Department of Energy, Mines and Resources. Available at: <http://www.energy.gov.yk.ca/wind.html>.
- Government of Yukon. 2013*a*. Oil and Gas Resources Website, Exploration and Development, Yukon's Unconventional Resources. Department of Energy, Mines and Resources. Available at: http://www.emr.gov.yk.ca/oilandgas/exploration.html#Yukons_Unconventional_Resources.
- Government of Yukon. 2013*b*. *Yukon government seeks feedback on draft of gas processing plant regulation*. News Release, March 8, 2013. Department of Energy, Mines and Resources. Available at: <http://www.gov.yk.ca/news/13-048.html#UgBrWqW6W-I>.
- Government of Yukon. Date unknown. *Yukon Oil and Gas Best Management Practices*. Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada. Available at: http://www.emr.gov.yk.ca/oilandgas/best_management_practices.html.
- Hayes, B.J.R. and H.B. Archibald. 2012. *Scoping study of unconventional oil and gas potential, Yukon*. Yukon Geological Survey, Miscellaneous Report 7. Whitehorse, Yukon, Canada. Available at: http://ygsftp.gov.yk.ca/publications/miscellaneous/Reports/YGS_MR-7.pdf.
- National Energy Board (NEB). 2010. *National Energy Board to Release Mackenzie Gas Project Reasons for Decision*. News release, December 15, 2010. Available at: <http://www.neb-one.gc.ca/clf-nsi/archives/rthnb/nws/nwsrsls/2010/mddvsrmcknzgsprjct-eng.html>.
- National Energy Board (NEB). 2011. *National Energy Board issues Certificate of Public Convenience and Necessity for Mackenzie Valley Pipeline*. News release, March 10, 2011. Available at: <http://www.neb-one.gc.ca/clf-nsi/archives/rthnb/nws/nwsrsls/2011/nwsrsls07-eng.html>.
- North Yukon Planning Commission. 2007. *North Yukon Planning Region Resource Assessment Report*. Whitehorse, Yukon, Canada. Available at: http://www.planyukon.ca/index.php/documents/cat_view/81-north-yukon-planning-commission-documents/99-resource-assessment-report-maps-a-posters.html.
- Osadetz, K.G., Z. Chen and T.D. Bird. 2005. *Petroleum Resource Assessment, Eagle Plain Basin and Environs, Yukon Territory, Canada*. Geological Survey of Canada, Open File 4922. Available at: <http://geoscan.ess.nrcan.gc.ca/cgi-bin/starfinder/0?path=geoscan.download.fl&id=fastlink&pass=&format=FLDOWNLOADE&search=R=222501>.
- Thevenard, D. 2008. *Solar Domestic Hot Water System Sizing for Whitehorse, YT and Dawson, YT*. Prepared by Numerical Logics Inc., Waterloo, Ontario, Canada. Available at: <http://www.housing.yk.ca/pdf/YHCESCSolarDHW-080829.pdf>.
- Tr'ondëk Hwëch'in. 2012. *Tr'ondëk Hwëch'in Resource Report*. Submitted to the Dawson Regional Planning Commission, May 2012.

-
- Yukon Energy Corporation (YEC). 2006. *Overview of Yukon Energy's Resource Plan Submission*. Whitehorse, Yukon, Canada.
- Yukon Energy Corporation (YEC). 2012a. *Yukon Energy: Strategic Plan 2012-2013*. Whitehorse, Yukon, Canada. Available at: <http://www.yukonenergy.ca/about/business/strat/>.
- Yukon Energy Corporation (YEC). 2012b. *LNG Transition Option*. Background Paper, Yukon Energy Company, LNG Workshop. Whitehorse, Yukon, Canada. Available at: http://yukonenergy.ca/downloads/db/1102_LNG%20Background%20Paper%20January%202012.pdf.
- Yukon Energy Corporation (YEC). 2013. Yukon Energy Website, Energy in Yukon, Our Facilities, Hydro Facilities. Available at: <http://www.yukonenergy.ca/energy/facilities/hydro/>.
- Yukon Fish and Wildlife Management Board. 2002. *The Effects of Oil and Gas Industry Activity on Fish and Wildlife: a review of selected scientific literature*. Whitehorse, Yukon, Canada. Available at: <http://www.yukonconservation.org/Effects%20of%20Oil%20and%20Gas%20Industry%20Activity%20on%20Fish%20and%20Wildlife.pdf>.

15 AGRICULTURE

15.1 Highlights

- The Dawson planning region contains some of the most (potentially) productive agricultural soil in Yukon
- High quality soils are associated with the floodplains and terraces of the major rivers
- West Dawson, Sunnydale, Henderson’s Corner, and the Klondike Valley also contain large areas of suitable agricultural land
- Self-sufficiency in food production is valued as a key factor for sustainable communities
- Commercial production in the planning region is limited and geared towards the local market
- Agricultural development may impact traditional activities and disturb heritage resources
- Improper management practices can result in adverse impact to wetlands and wildlife habitat
- Yukon’s agriculture policy states that no significant loss of key wildlife habitat will occur as a result of new agricultural land development

15.2 Description of Resource

This section summarizes agricultural potential in the region including soil capability; climate; water considerations; historical, existing and future potential production; and economic and strategic planning considerations.

Agriculture is generally used in this section to refer to crop production and livestock. However, since 1991 the definition of an agricultural operation for Yukon and the Northwest Territories has also included herding wild animals (e.g., caribou and muskox), breeding sled dogs, horse outfitting and rigging, and harvesting indigenous plants and berries (Government of Yukon 2007).

15.2.1 Agriculture Capability

In *Yukon Agriculture 2008-2009 Interim Report “An Assessment of Leading Indicators”* (Government of Yukon and Agriculture and Agri-Food Canada 2010), it is noted that less than two per cent of the Yukon’s 483,450 km² is suitable for agriculture development because of limitations of geography, climate and soils. The mountainous terrain limits soil-based agriculture to major river valleys including the Yukon, Takhini, Pelly, Stewart and Liard (Figure 12-1).

Climate is one of the major determinants of northern growing conditions. There must be sufficient heat available to germinate seeds and promote growth. Adequate water, sunshine and frost-free days are also necessary to ensure rapid growth and to bring the crops to maturity. The Dawson region’s climate is continental subarctic with short summers and long winters, and temperature ranges are wide throughout the year (i.e., over 30 C in the summer to as low as -50 C in the winter). Long hours of daylight in the summer (i.e., up to 20 hours in June) somewhat compensate for the shorter overall growing season, although locations such as the Dawson City townsite are bounded by sharply rising cliffs that reduce the available sunlight (McCracken and Revel 1982). The Dawson region is considerably warmer in the summer months than elsewhere in the Yukon. Climatic data indicates a frost-free period of more than 80 days per year, a vegetative period in excess of 110 days, and an average number of growing degree days greater than 1,200 (Hennessey et al. 2009).

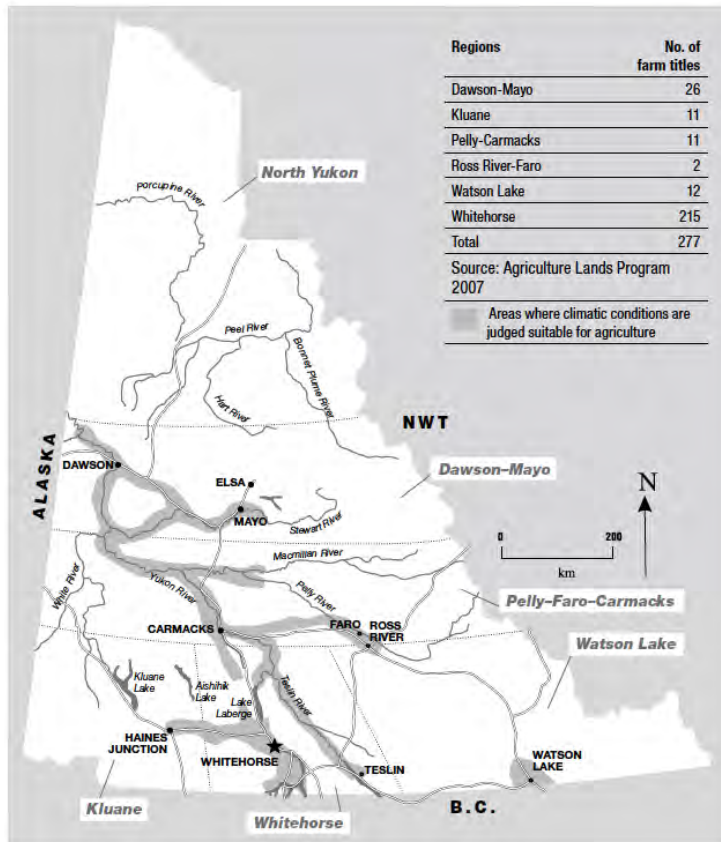


Figure 15-1 Areas in the Yukon with suitable climate for agriculture (Government of Yukon and Agriculture and Agri-Food Canada 2008)

Annual precipitation varies in the region, with the majority coming in the form of showers and thunderstorms during June to August. The Dawson region is noted to have more predictable rainfall in the spring, alleviating problems found elsewhere in the Yukon where dry conditions impact seed germination, and sufficient quantities of irrigation water are available from the rivers. The planning region is located in the northern section of the discontinuous permafrost zone. Despite warm air in the spring, cold soils can damage plant roots, slow seed germination and subsequent growth, and cause some crops to “bolt” (i.e., produce flowers or seeds prematurely) (McCracken and Revel 1982). The thaw of discontinuous permafrost also creates uncertainties related to developmental timelines. Removal of vegetation precipitates melting of ground ice and, depending on depth of frost and soil texture, it is difficult to predict when cleared land will be dry enough to farm.

Within the Dawson planning region lies some of the most productive (potentially) agricultural soil in the Yukon. High quality soils are associated with the floodplains and terraces of the major rivers. There are extensive areas suitable for agriculture on islands in and along the banks of the Yukon River (both upstream and downstream of Dawson City), the lower Stewart River, the Indian River, and the Klondike River. Most of these areas are accessible only by boat. More easily accessible subdivisions near the Dawson townsite (i.e., West Dawson, Sunnyside, Henderson Corner, and the Klondike Valley) also contain large areas of suitable agricultural land.

Government of Yukon’s Agriculture Branch uses a standardized classification system when determining lands suitable for agriculture purposes (Figure 15-2).

Class 1	1400-1600 EGDD	These lands have no significant limitations that restrict the production of the full range of common Canadian agricultural crops.
Class 2	1200-1400 EGDD	These lands have slight limitations that restrict the range of some crops but still allow the production of grain and warm season vegetables.
Class 3	1050-1200 EGDD	These lands have moderate limitations that restrict the range of crops to small grain cereals and vegetables.
Class 4	900-1050 EGDD	These lands have severe limitations that restrict the range of crops to forage production, marginal grain production and cold-hardy vegetables.
Class 5	700-900 EGDD	These lands have very severe limitations that restrict the range of crops to forages, improved pastures and cold-hardy vegetables.
Class 6	<700 EGDD	These lands have such severe limitations for cultivated agriculture that cropping is not feasible. These lands may be suitable for native grazing.
Class 7		These lands have no capability for cultivated agriculture or range for domestic animals.

Figure 15-2 Soil suitability for agriculture classification, Yukon (Government of Yukon and Agriculture and Agri-Food Canada 2008)

An exploratory soil mapping survey of about 10,000 km² was completed in 1977 by the Saskatchewan Institute of Pedology (Rostad et al. 1977). The project mapped highway corridors and lands near communities as well as portions of the Yukon, Stewart, Pelly and Liard River valleys at a reconnaissance scale (1:125,000). Soil mapping was also done in the Klondike Valley in 1987 at a 1:20,000 scale. The 1977 mapping exercise estimates about 25,000 ha of Class 3 and 4 lands in the Dawson/Mayo region. In contrast, the Whitehorse region was estimated to have no Class 3 or 4 lands because of climate limitations related to heat units (Government of Yukon 2011a).

Many Tr'ondëk Hwëch'in (TH) Settlement Land parcels are also suitable for agriculture. TH has noted several parcels south of Dawson City near the Yukon River that are suitable for grain crops (Class 3) and seeded forages (Class 5), as well as one site near the Stewart River. Parcels in the Klondike River valley (including the old Strachan's farm), land in the Henderson's Corner area, and some parcels along the Yukon River near the Canada/USA border were also deemed suitable.

15.2.2 Agricultural Production

15.2.2.1 Historic Food Supply and Production

Yukon First Nations populations successfully obtained a healthy diet through a semi-nomadic lifestyle of hunting, fishing, and gathering plants and berries. However, fur traders, explorers and prospectors who began arriving on the Yukon River watershed in the mid-1800s brought in most of their food. Hudson's Bay Company (HBC) fur traders were dependent on supplies from headquarters, although each outpost was expected to be self-sufficient. Inconsistent food supplies from headquarters, as well as from hired First Nation hunters and fish camps, resulted in many HBC traders becoming the first to plant and cultivate crops in Yukon (Robinson 2010). Traders such as Robert Campbell made various attempts with potatoes, turnips, Scotch kale, lettuce, barley and hay but were usually frustrated by varying rainfall and unpredictable frosts. This was mainly because the early HBC posts were located for trading purposes at sites chosen for their proximity to First Nations camps, and not for their suitability as agricultural sites (Robinson 2010).

The 1898 Klondike Gold Rush saw a major increase in agricultural production. A large stable population created a viable market for the development of commercial gardens and farms, and a more reliable transportation network allowed farmers to choose the most fertile land (i.e., in the river valleys) even if it was farther away from the larger communities. Although roads had improved, they were mainly winter routes, carrying first class mail and small amounts of freight. Sternwheelers, however, were capable of carrying tons of freight, and farmers along the rivers had a cheap and easy way to get their produce to market and be supplied with provisions (Robinson 2010).

15.2.2.2 Early Twentieth Century (1900-1950s)

As described in Robinson 2010 (p.153-159), following the Klondike Gold Rush the Yukon's population fell from over 27,000 people to around 8,500 between 1901 and 1911. Less food was imported and there was a steady increase in cultivated land to supply the remaining population's demand for produce. In 1906, almost all the turnips, carrots, beets and celery in Dawson City were locally grown and potato crops were in the hundreds of tons. About 200 acres of land was under cultivation near Dawson by 1911, more than during the Gold Rush era. The White Pass & Yukon Route sternwheelers and railway connections continued to provide a reliable and relatively cheap transportation option.

In 1917, the Canadian Department of Agriculture set up an experimental station on the farm of J.R. Farr at Swede Creek, on the west bank of the Yukon River less than 10 km south of Dawson. Soil improvement, crop rotation, and tests for grains, grasses and vegetables were undertaken. A variety of forage and cereal crops as well as vegetables and flowers were grown successfully, with yields and quality comparable to southern Canada. The station closed in 1925, but the farm continued to produce vegetable crops until 1945.

From the late 1940s on, the Canadian Department of Mines and Resources was not encouraging agricultural settlers, as it believed the future of Yukon agriculture would be closely linked with the development of other resources and mining.

15.2.2.3 Modern Day (1960s to present)

A small number of farms continued to supply central Yukon in the 1950s and 1960s, but the southern Yukon became dependent on imported produce, and farmers there focused more on forage crops and other sources of income.

Current commercial agricultural production in the Dawson region is limited and is geared towards the local market. In 2011, there were only two commercial operations in the area, one at 9 Mile Island in the Yukon River and one at Henderson's Corner, and between them had only 2.5 acres in cultivation (Conservation Klondike Society 2011). With the addition of a Rock Creek commercial operation, today the total area may be adjusted to 3.5 acres (Government of Yukon 2012).

Only one agricultural reservation is currently registered in the Dawson planning region, totaling 974.3 ha. This reservation is to restrict spot land applications near Flat Creek, in part due to Tr'ondëk Hwëch'in trapping interests in the area. The draft West Dawson/Sunnydale Local Area Plan also designates 130 ha for agriculture (Government of Yukon 2012).

Direct sales are the most common, either at the farm gate or at the weekly farmers' market in the summer. The majority of sales are for fresh vegetables and eggs, although bedding plants are also key sales early in the season.

Hay production is the single largest agriculture product grown in the Yukon, although the Dawson area has few livestock and horses so there is a very small market for these types of crops. Straw is used as bedding for sled dogs and poultry, and some big-game hunting outfitters produce their own hay for the horses used in their operations.

15.2.2.4 Potential for Agricultural Production

In the 2011 *Dawson Community Food Survey*, local produce was found by consumers to be desirable and reasonably priced. However, respondents indicated that supply is inconsistent and not in sufficient quantities to meet demand and this is a major purchasing barrier. Some local restaurants and grocery stores attempt local food sourcing, but many are faced with limited or no available supply. Other potential markets such as mining companies and camps, many of which source their orders through

the local grocery stores, also need consistent supplies and quality (Conservation Klondike Society 2011).

Opportunities exist in value-added production, where primary agriculture products are further processed or developed into products like jams, pickles and preserves, bread, cheese, wool clothing and crafts, and jerky. This practice diversifies operations to increase profitability, captures new markets and enables more year-round income.

The great majority of Yukon agriculture is currently situated within 80 km of Whitehorse and, with the current emphasis on livestock production, central Yukon is the natural place to look to for a Yukon-grown livestock ration, consisting of grains (Government of Yukon 2011a).

15.3 Resource Values

15.3.1 Natural Value

Agricultural activities are dependent on many ecosystem services, including pollination, biological pest control, maintenance of soil fertility and structure, nutrient cycling and hydrological services. In turn, agriculture provides services such as the regulation of soil and water quality, carbon sequestration and biodiversity (Power 2010).

Some agricultural practices have the potential to diminish natural value. Clearing and burning of land can reduce available habitat for wildlife including large mammals, birds and furbearers. Fencing and cross-fencing of agriculture land dispositions can disrupt movement corridors for wildlife. Agricultural crops can be an attractant for some wildlife species and result in human-wildlife conflict. Wildlife mixing with livestock can also increase the risk of disease transmission (e.g., Chronic Wasting Disease). Clearing of land can increase erosion and sedimentation, potentially impacting aquatic systems and waterfowl habitat if near wetlands. Materials such as fertilizers can also be an attractant to wildlife. Imported seed stock and livestock feed have the potential to introduce invasive plant species.

15.3.2 Traditional Value

Tr'ondëk Hwëch'in citizen comments (Tr'ondëk Hwëch'in 2012):

Farming is good because we will need to produce food locally in the future.

Many of the Tr'ondëk Hwëch'in Settlement Land parcels with agriculture potential were also selected for traditional economic resource pursuits and include heritage resources. For example, R-12A near Stewart River is suitable for Class 3 and Class 5 agriculture but was primarily selected for being a traditional river encampment.

Conflicts may occur between agricultural development and harvesting activities. *Wildlife Act* regulations prohibit hunting within one kilometre of a residence without permission of the occupants.

Clearing of land, use of heavy equipment and other ground disturbance may damage heritage resources, traplines or other harvest infrastructure and impact on traditional economic activities.

15.3.3 Socio-Cultural Value

Self-sufficiency in food production is valued as a key factor for sustainable communities. Food security is a major area of vulnerability since only a small percentage (about eight per cent) of the food needs of the community are produced locally (Conservation Klondike Society 2011).

Many area residents invest in home gardens for personal and family use and, like most Yukoners, share their gardens.

Agriculture can provide educational, recreational and tourism opportunities. Farmers markets are regularly held during the summer, and many items quickly sell out.

15.3.4 Economic Value

The agriculture industry contributes to the Yukon economy as a whole through the purchase and sale of farm products, machinery and land as well as other transactions such as wages and processing fees. The state of the industry report for 2008-09 (Government of Yukon and Agriculture and Agri-Food Canada 2010) states:

It is anticipated that the agriculture industry will make a net positive contribution to the Yukon economy by 2016 [i.e., total industry income greater than total industry expenses]. In the 2006 census, there was a total of \$4.1 million in gross sales and \$4.3 million in operating expenses; this will be reassessed once the 2011 census data is available. It is anticipated that there will be a 200% increase in the production and sales of Yukon-grown agriculture products by 2016 [projected gross sales \$12.3 million].

Major limitations for large-scale operations include high start-up and operating costs such as investment in machinery, equipment and facilities as well as costs of seed, fertilizer and labour. Most producers are unable to generate sufficient income to farm full-time and have to take on other jobs (Government of Yukon and Agriculture and Agri-Food Canada 2010).

15.4 Resource Management

The following sections note legislation and regulations that specifically address agriculture. Other acts and regulations dealing with land development, water use, or other industrial activities may also include measures to manage agricultural land use. Additional protocols and requirements may also apply if work is being conducted on Settlement Land.

15.4.1 Regulatory Framework

15.4.1.1 *Lands Act and Territorial Lands (Yukon) Act*

The Government of Yukon's Department of Energy, Mines and Resources, Agriculture Branch has the mandate to dispose of Crown Lands (under the *Lands Act* Section 3.1 and the *Territorial Lands (Yukon) Act* Section 6). The Agriculture Branch accepts applications for Yukon Land providing that the land is unencumbered by any other use. The use must be soil-based agriculture (e.g., hay crop or market garden), which requires arable soil at the application site for the application to be successful. The minimum parcel size for an agriculture land application is six hectares and the maximum is 65 hectares.

15.4.1.2 *Yukon Environmental and Socio-economic Assessment Act*

Agricultural land applications are subject to review under the *Yukon Environmental and Socio-economic Assessment Act*.

15.4.1.3 Other Acts

- *Pounds Act* and *Highways Act* – livestock control
- *Brands Act* – brands inspection
- *Agriculture Products Act* – meat inspection
- *Animal Health Act* and *Animal Protection Act* – animal health and protection

15.4.2 Policy Direction

15.4.2.1 Government of Yukon

The overall goal of the 2006 *Yukon Agriculture Policy* (Government of Yukon 2006) is:

To encourage the growth of a Yukon agricultural industry that produces high quality products for local consumption in a manner which is environmentally sustainable, economically viable, and contributes to community well being.

The policy states that the government will give priority to planning for new development in agricultural subdivisions where there is sufficient demand, and a policy target is in place to make 25 per cent of new farmland available through planned development areas by 2016. Approximately 130 ha of land were identified west of Dawson with potential for an agricultural subdivision (Government of Yukon 2006).

The policy framework also has a target stating that there will be no significant loss of key wildlife habitat as a result of new agricultural land development. It advocates best management practices for maintaining wildlife habitat along farm edges, leaving wildlife corridors, maintaining riparian buffers, and preventing disease transmission between domestic animals and wildlife. A key issue is the ability of biologists to quantify carrying capacity, or indicator-species density estimates, of wildlife habitats that are of interest for agriculture so that population-level impacts of trade-offs in land disposition can be estimated and brought forward to environmental assessment reviews.

15.4.2.2 Other Stakeholders

Non-government organizations with expressed objectives for research and development in Yukon agriculture and local food security include the Yukon Agricultural Association and Conservation Klondike Society.

15.4.3 Current Best Management Practices

In addition to the best management practices noted in the *Yukon Agriculture Policy* above, best management practices for riparian management should be followed to ensure conservation of riparian and associated floodplain and valley- bottom dependent wildlife (notably beaver, river otter, waterfowl, and songbirds).

15.4.3.1 Fencing to Contain Horses on Yukon Government Grazing Agreements

The purpose of this guideline is to provide fencing construction specifications that will contain horses on grazing agreements and help keep wildlife safe. Although the purpose of the document is to recommend fencing on grazing agreements, Government of Yukon endorses these recommendations for any situation where horses need to be contained.

15.4.4 Monitoring Activity

15.4.4.1 Monitoring Agencies

Agreements for sale and grazing agreements are monitored by the Government of Yukon's Agriculture Branch personnel to ensure compliance with Farm Development Agreements and grazing management plans. However, once title is obtained, there is no further monitoring or requirement to continue agricultural production (although parcels that are zoned as agriculture remain so).

15.4.4.2 Research Networks

Research, science and innovation are also key initiatives for future agriculture. Crop production research has been undertaken at the Gunner Nilsson and Mickey Lammers Research Forest outside

Whitehorse since 1988. A variety of crops, soil conservation techniques, soil enrichment practices, irrigation and new technologies are tested for suitability in the Yukon.

15.5 Risks and Uncertainty

15.5.1 Agriculture and Climate Change

Changing temperatures, precipitation, and evaporation conditions will affect agriculture most strongly through the amount of irrigation water required to produce a crop. Increased water demand from a progression towards higher-value crops and changing streamflow regimes could become an issue for smaller creeks.

Future climate change could bring longer, warmer, wetter springs and an increased number of frost-free days. This could create greater opportunities for agriculture with a longer growing season and potential for increased crop yields and new crop varieties. However, this could also bring new challenges such as more erratic and unpredictable weather (e.g., more lightning and fires, high winds, and extreme events) and new insect pests and diseases.

Warming climate conditions that allow for expansion of agricultural areas may increase the potential for conflict between agriculture and other land users (e.g., industries such as placer mining and tourism and recreation that would also have extended seasons).

15.5.2 Other Risks and Uncertainties

There is the potential for spills and contamination of soil and water from the storage and handling of fuels and pesticides (if used).

Some areas in the planning region with high agricultural potential are already being utilized by other land users. For example, one large polygon on the Indian River was identified in the 1977 soil survey as having high potential, but the entire valley bottom has since been staked and placer mined. At the same time, placer mining presents a unique opportunity for agriculture development. At the closure and restoration end of the placer cycle, provided that fine texture materials and organics are preserved for redistribution over the gravels, revegetation may provide a transition to agriculture uses (Government of Yukon 2011*a*).

Future industrial demand for water is expected to increase, which may impact both water quality and quantity. Water management decisions (e.g., issuance of water licences) need to take into account discrepancies between the needs of water users and the current and future supply.

Water quality concerns associated with agriculture arise mostly from non-point-source pollution resulting from various agricultural practices and from precipitation runoff. Yukon's semi-arid climate, limited summer precipitation, and riparian setbacks have, to date, prevented intensively used agricultural areas from impacting waterways (Government of Yukon 2011*b*).

A recent agriculture application (YESAB 2012-0117) in the Clear Creek area shows the potential for conflict between an agricultural application and other land uses. The proposed lot is located near a Tr'ondëk Hwëch'in Settlement Land parcel; accessed via the Clear Creek Road, which is heavily used by the placer and quartz mining industry as well as by hunters, trappers and other land users; and overlaps with a Registered Trapping Concession. Clear Creek also provides year-round habitat and a migration corridor for many species including bear, moose, furbearers, small game and migratory birds and the creek itself is known for grayling and other fish species. Standard mitigation measures were suggested and the project was recommended by YESAB to proceed with terms and conditions.

15.6 Chapter References

- Brabets, T.P., B. Wang and R.H. Meade. 2000. *Environmental and Hydrologic Overview of the Yukon River Basin, Alaska and Canada*. Water Resources Investigations Report 99-4204. United States Geological Survey, Anchorage.
- Conservation Klondike Society. 2011. *Dawson Community Food Survey and Market Expansion Strategy*. Prepared by Across the River Consulting. Dawson City, Yukon, Canada.
- Government of Yukon and Agriculture and Agri-Food Canada. 2008. *Yukon Agriculture State of the Industry, 2005-2007*. Department of Energy, Mines and Resources, Agriculture Branch and Agriculture and Agri-Food Canada. Whitehorse, Yukon, Canada. Available at: <http://www.emr.gov.yk.ca/agriculture/publications.html>.
- Government of Yukon and Agriculture and Agri-Food Canada. 2010. *Yukon Agriculture 2008-2009 Interim Report "An Assessment of Leading Indicators."* Department of Energy, Mines and Resources, Agriculture Branch and Agriculture and Agri-Food Canada. Whitehorse, Yukon, Canada. Available at: <http://www.emr.gov.yk.ca/agriculture/publications.html>.
- Government of Yukon. 2006. *Vision for Yukon Agriculture: 2006 Yukon Agriculture Policy*. Department of Energy, Mines and Resources, Agriculture Branch. Whitehorse, Yukon, Canada. Available at: <http://www.emr.gov.yk.ca/agriculture/index.html>.
- Government of Yukon. 2007. *Census of Agriculture: Census 2006*. Executive Council Office, Bureau of Statistics. Information Sheet #C06-03. Whitehorse, Yukon, Canada. Available at: <http://www.eco.gov.yk.ca/pdf/agriculture06.pdf>.
- Government of Yukon. 2011a. *Technical Report on Issues and Interests*. Compiled by the Corporate Policy and Planning Branch of the Department of Energy, Mines and Resources. Whitehorse, Yukon, Canada. Available at: http://www.emr.gov.yk.ca/lands/pdf/regionallanduse/drlup_issues_and_interests_technical_report.pdf.
- Government of Yukon. 2011b. *Yukon Water: An Assessment of Climate Change Vulnerabilities* (and Summary Report). Department of Environment, Water Resources Branch. Whitehorse, Yukon, Canada. Available at: http://www.env.gov.yk.ca/publications-maps/documents/yukonwater_climatechange_report.pdf.
- Government of Yukon. 2012. *Information Submission to Resource Assessment*. Submitted to the Dawson Regional Planning Commission. Whitehorse, Yukon, Canada.
- Hennessey, R., S. Jones, F. Duerden and S. Swales. 2009. *Dawson Climate Change Adaptation Plan*. Northern Climate Exchange, Yukon Research Centre, Yukon College, Whitehorse, Yukon, Canada.
- McCracken, C. and R.D. Revel. 1982. *Domestic and Commercial Vegetable Gardening in Dawson City, Yukon Territory, 1980*. Arctic 35(3):395-402.
- Power, Alison G. 2010 *Ecosystem services and agriculture: tradeoffs and synergies*. Philosophical Transactions of Royal Society Biological Sciences 27 September 2010 vol. 365 no. 1554 2959-2971
- Robinson, S. 2010. *Humble Dreams: An Historical Perspective on Yukon Agriculture Since 1846*. The Northern Review 32:135-167.
- Rostad, H.P.W., L.M. Kozak and D.F. Acton. 1977. *Soil Survey and Land Evaluation of the Yukon Territory*. Saskatchewan Institute of Pedology Publications S174. Saskatoon, Saskatchewan, Canada.

Tr'ondëk Hwëch'in. 2012. *Tr'ondëk Hwëch'in Resource Report*. Submitted to the Dawson Regional Planning Commission, May 2012.

Westland Resource Group. 1987. *Soil Survey of the Klondike River Valley Yukon Territory*. Prepared for Yukon Territorial Government, Lands Branch and Indian and Northern Affairs Canada, Northern Land Use Planning. Available at:
http://sis.agr.gc.ca/cansis/publications/surveys/yt/ytkrv/ytkrv_report.pdf.

16 TOURISM and RECREATION

16.1 Highlights

- The Dawson region has a long history as a tourism destination and therefore an important contributor to regional and territorial economies
- Scenery, wildlife viewing, Klondike Gold Rush history, and historical attractions are repeatedly identified as key tourism attributes of the region
- Historic resources and attractions tied to gold rush history are concentrated in and around Dawson City
- Strong visitor interest in outdoor destinations, adventure/leisure-oriented products and winter season activities (dog sledding, northern lights viewing)
- Other opportunities for growth include lodge-based tourism, First Nation cultural interpretation tours, and ecotourism
- Areas with high potential for new and expanded recreation activities include the Yukon River Corridor and Forty Mile area; Ogilvie Mountains and Dempster Highway Corridor; the Yukon Ditch trail network; and the Top of the World Highway
- Increased resident and visitor use of popular routes and destinations may impact environmental and cultural values and resources
- Best management practices and cross-industry cooperation are key to maintaining a quality wilderness and/or cultural tourism experience

16.2 Description of Resource

The Dawson region is an important destination for visitors to the Yukon. Well-known historical and cultural attractions, along with wilderness destinations such as the Yukon River and Tombstone Territorial Park and road-accessible tundra landscapes, continue to attract visitors looking to explore Yukon history, cruise and paddle historic and wild rivers, hike through sub-arctic landscapes, and learn about the cultural heritage of the Tr'ondëk Hwëch'in.

Dawson City (i.e., municipal boundaries) is excluded from the planning region but is a critical component of the region's tourism sector. With well-established tourism attractions, accommodation, infrastructure and tourism services, facilities and businesses, Dawson is a destination for nearly all highway and backcountry visitors and is an important factor in tourism growth in the region. While most tourists visit in the summer, Dawson has a growing winter tourism season anchored by outdoor and cultural events and activities that attract both visitors and media.

The region has a long history as a tourism destination and as an important contributor to regional and territorial economies. Today, tourism is an integral part of a diversified economy for the region, and maintaining economic diversity will be important for continued economic growth and stability.

Tourism is a resource-based industry typically grouped into eight sectors (Government of Yukon 2013*a*):

- Accommodations
- Food and beverage
- Transportation
- Adventure tourism and recreation
- Events and conferences

-
- Travel trade
 - Attractions
 - Tourism services

Tourism activities, businesses, viability and growth potential depend on recognition and consideration of tourism interests in land and natural and historical resources. Emerging opportunities include natural and cultural heritage tours, paragliding, wilderness hiking (air-supported), and winter hiking/camping.

Many tourism activities are seasonal in nature:

- *Summer*: hiking and backpacking, canoeing, rafting, fishing/angling, power boating, motorboat touring, mountain biking, hunting, wildlife viewing, biking, berry picking, photography, paragliding, and 4WD/ATV touring
- *Winter*: snowmobiling, cross-country skiing, dog-sledding, skijoring, snowshoeing, downhill skiing and snowboarding

Areas of high recreation features significance correspond to areas of high tourism value or potential. The report *Klondike Regional Plan: Outdoor Recreation Data Review* (EDI Environmental Dynamics Inc. 2010) notes several areas of high potential for new and expanded recreation activities, including the Yukon River Corridor and Forty Mile area; Ogilvie Mountains and Dempster Highway Corridor; the Yukon Ditch trail network; and the Top of the World Highway (Figure 16-1). See also **Section 3 – Resource Summary Maps – Yukon Wilderness Tourism**.

Tourism provides seasonal and year-round jobs for local residents, as well as seasonal jobs for transient summer workers.

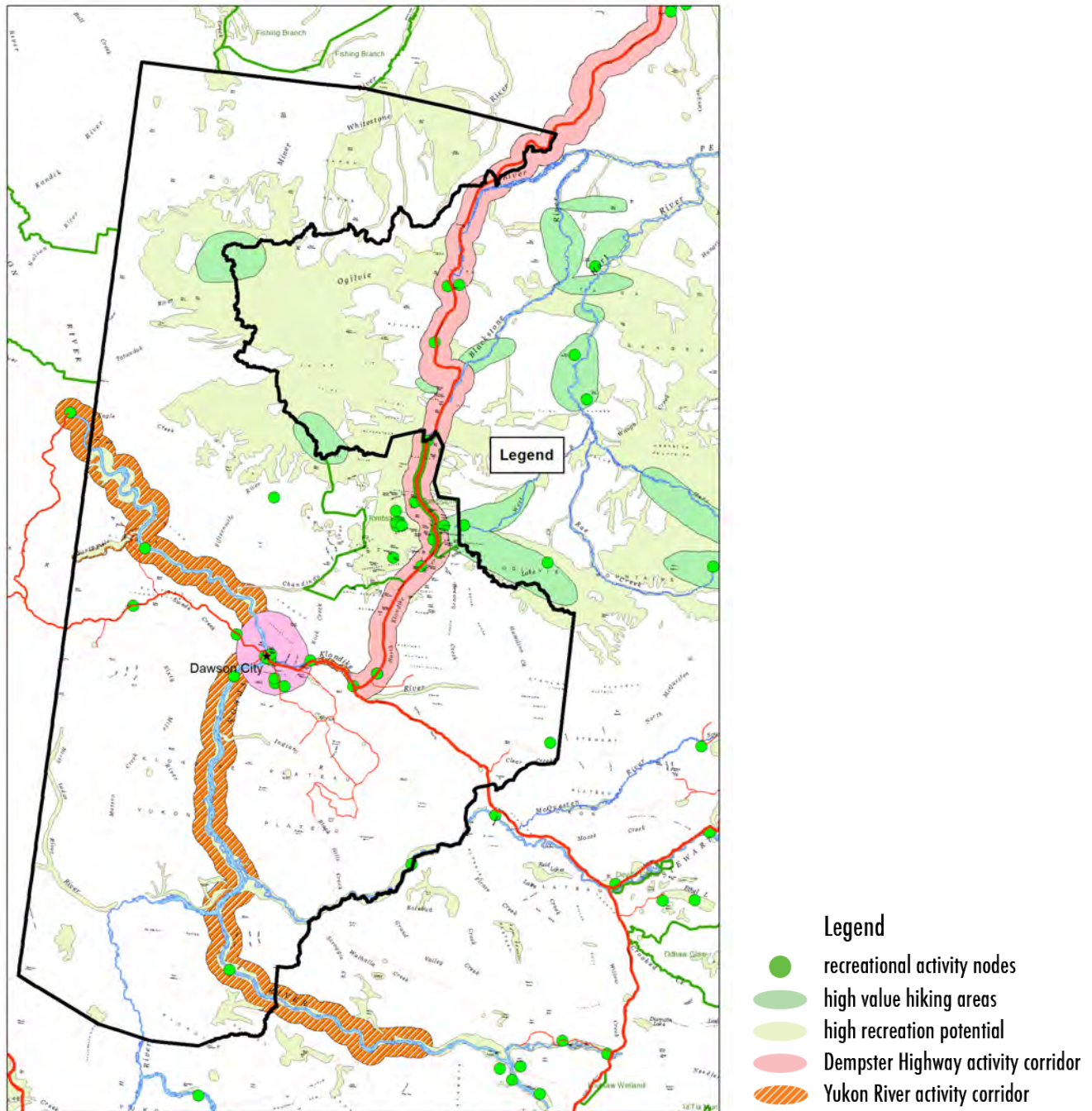


Figure 16-1 Tourism values in the Dawson planning region

16.2.1 Visitation Data

According to the *Yukon Economic Outlook 2012* (Government of Yukon 2012a) recent tourism activity in the Yukon has been steady, with annual international border crossings totaling about 310,000 in the past two years. Annual international border crossings of 309,863 were recorded in 2011, down slightly from 311,542 in 2010, but still above the almost 283,000 recorded for 2009 (Figure 16-2).

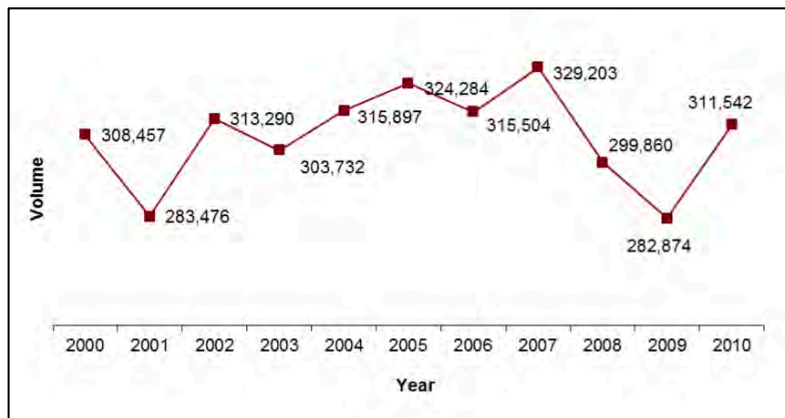


Figure 16-2 1999 to 2009 Yukon Border Crossing Trends

Yukon’s tourism sector was affected by the economic downturn of 2008 and 2009, but recovered fairly quickly compared to other Canadian jurisdictions (Government of Yukon 2011a). Overall visitation to the Yukon was down one per cent in 2011 compared to 2010; however, summer visitation (i.e., May to September) was up one per cent. While the Yukon’s tourism sector is stable and strong, shifts in visitor origin are occurring that reflect emerging economies such as China and India.

The U.S. ranks first as a visitor market for the Yukon, accounting for 77.4 per cent of total visitation in 2011. However, many Americans are travelling through the Yukon on their way to Alaska, and as a result spend considerably less time and money in the Yukon per party than other groups of visitors.

Canada is the second largest tourism market for the Yukon and the region, and Germany, Switzerland and Austria (collectively described as ‘German-Speaking Europe’) form the Yukon’s largest overseas market and the third largest market overall. There is a strong awareness of the Yukon as a travel destination, assisted by media coverage of events like the Fulda Yukon Challenge and a new Yukon exhibit at the Hanover Zoo. Condor Airlines provides direct weekly flights in the summer between Frankfurt and Whitehorse. The United Kingdom is also a strong overseas market, and visitors from Japan continue to grow as more companies offer activities such as aurora viewing. Other growing markets include Australia, the Netherlands, France and South Korea (Government of Yukon 2011b).

The last comprehensive regional visitor survey (Government of Yukon 2006a) was conducted in the summer of 2004 when 60,350 tourists visited the Klondike Region. About 60 per cent travelled by private vehicle, 30 per cent by motor coach, and the remainder by boat and aircraft. Summer visitors to the region spent about \$8.7 million while in the Yukon; record-breaking forest fires had a noticeable adverse effect on visitation and visitor spending in the summer of 2004. Canada Customs border crossing data from Little Gold on the Top of the World Highway and marine border crossings for the Yukon River indicate a general downward trend in regional visitation between 2007 and 2010 and a slight increase in 2011. Numbers from the Dawson City Visitor Information Centre, compiled from voluntary visitor sign-in sheets from May to September, show a decrease from 26,881 in 2010 to 24,400 in 2011.

16.2.2 Tourism Future Potential

Freeman (1983) defines tourism potential as “the maximum number of tourists that could visit a region if every feasible type use for the region is provided” and notes the difference between theoretical potential (i.e., the number of tourists predicted by supply and demand alone) and actual potential (i.e., what can be achieved after constraints have been taken into account such as tourism

company objectives or government laws and regulations). Freeman also notes that markets are not infinite, so supplying more services or building more facilities does not necessarily mean that more tourists will come. As well, not all of the supply may be usable (e.g., tourists may not want to share a dining table with strangers even if there is space, and campsites may be closed because they are too near eagle nests or being frequented by bears). Since success of the tourism industry depends on customer satisfaction, it is essential that tourism potential analyses consider quality as well as quantity (Freeman 1983).

In 2009, Mammoth Mapping (in association with Across the River Consulting) prepared a *Final Report: Land Asset Identification and Analysis* for the Tourism Industry Association of the Yukon. The purpose of the study was to develop an analysis model based on existing resource data that could help tourism businesses and investors identify potential Yukon tourism assets for their tourism business projects. The study identifies several significant factors that restrict the model's accuracy, including lack of comprehensive data for key criteria such as scenery and wildlife as well as apparent emphasis on areas already used by the tourism industry, as opposed to new areas with potential.

The study identified 10 major criteria used for decision-making in the overall development of tourism locations (Mammoth Mapping 2009):

1. Scenery
2. Wildlife
3. Accessibility
4. Activity-based
5. Cultural heritage and interpretation
6. Near environment
7. Infrastructure, services and amenities
8. Access to existing market
9. Wilderness
10. Conflict with industry

“Scenery” is repeatedly identified as one of the Yukon’s key tourism attributes, both from visitor feedback and industry surveys. Highly diverse topography, mountainous terrain, vast views or vantage points (i.e., higher elevation than surrounding area), and visibility of large waterbodies are considered most positive. Roads (especially highways and high-traffic roads but also limited-use roads and trails), forest harvesting areas, and views of other infrastructure (e.g., power lines, built-up areas, pipelines, cutlines, towers and runways) are considered negative.

Tourism operations are more likely to be developed in areas with high wildlife viewing opportunities, especially for the “charismatic megafauna” (i.e., caribou, bears, moose, wolves and sheep) as well as raptors and waterfowl. Ideal locations are in close proximity to navigable waterbodies, trail networks or backcountry routes, and places of historic and cultural importance, as well as interpretive signage or tours. Proximity to existing market locations is also important (e.g., highway networks or well-branded places like national parks). Physical aspects of locations (e.g., winter sun horizon and amount of southern exposure) and forest damage from insects and/or recent fires (considered negative) can also influence trip-planning decisions.

The Yukon is marketed primarily as a wilderness destination, so areas with high levels of industrial activity are not considered desirable. In the Mammoth Mapping (2009) study, both potential and actual conflict with industry was identified as an issue. In the mineral development sector, helicopter traffic and landscape damage were identified as the primary impacts on tourism potential. Advanced stage and multi-year projects were considered to have greater impact, and active placer and quartz claims were considered to have equal but additive impact. Forestry roads and harvesting operations, as well as oil and gas activities (e.g., active dispositions, proximity to wells, and exploration licences

with significant possibility of future development), also make areas less desirable for tourism operations (Mammoth Mapping 2009).

All areas in the Yukon are potentially accessible by road, air, water and/or on foot. However, the ease of accessibility and the desirability of increased access will vary depending on the specific location, type of tourist experience being sought, type of operation and the season. Typical infrastructure that support tourism operations include accommodations, restaurants, logistics, supplies, shopping, fuel, power, potable water, communications, activities and attractions, and medical services. Depending on the location and time of year, these may be available only seasonally or be limited in quality and/or quantity, and may or may not be required depending on the type of tourism activities.

A capacity study undertaken by Burke (2003) utilizing information from Yukon wilderness tourism operators identified the winter season as an area with potential for more growth. It was noted that existing activities such as dog sledding and northern lights viewing could be expanded, as well as new activities such as skijoring, ice fishing, and ski trips with overnight stays in cabins. Some operators felt that the lack of infrastructure and services were a barrier for winter season expansion, particularly the minimal restaurants and hotels open year-round and less options for air travel scheduling. Other opportunities for industry growth (non-season specific) included lodge-based tourism, First Nation cultural interpretation tours, ecotourism with a focus on environmental education, and finding ways to encourage visitors to stay longer.

The Burke (2003) study also asked operators what they considered as barriers to business growth or reaching full capacity; almost all operators noted land use and access as a major factor. Access to wilderness lands was a priority for their business, including the ability to build cabins, lodges and other infrastructure to attract more clients, but initial land costs are too high for remote locations and there is uncertainty about land tenure. Competition on popular established trails and increasing traffic on the Yukon River has created congestion and some conflict between operators.

The majority of overseas marketing targets retention of German-speaking European tourists, with more focus now on Asian markets for the target niche of aurora viewing. The *2011-2012 Tourism Yukon Situation Analysis* (Government of Yukon 2011b) identifies several categories of tourists with the greatest potential to visit Yukon, and towards whom marketing strategies are targeted. These include the “Adventure Challenger,” the “Scenic Outdoor Traveller” and the “Cultural Explorer.” These people are generally middle-aged, employed full time, and with a strong preference for outdoor destinations and a wide variety of activities.

The Government of Yukon’s Department of Tourism and Culture has defined the following vision for its “Yukon – Larger Than Life” marketing strategy, focused on long-term sustainable economic growth by creating and maximizing opportunities for tourism revenue (Government of Yukon 2012b):

We see a future where Yukon is a sought-after travel destination, world- renowned for its scenic beauty and pristine wilderness, the richness of its history and the diversity of its culture. Yukon’s tourism industry is prosperous and proudly delivers experiences that celebrate the Yukon’s natural assets, people and culture for the benefit of residents and visitors alike.

The tourism sector has been a consistent employer and economic generator in the planning region and will continue to be an important contributor to regional economic growth, stability and diversity. Tourism provides a range of employment opportunities including entry-level seasonal employment, lifestyle businesses, and entrepreneurial opportunities for profitable and viable tourism businesses.

Potential for growth in regional tourism opportunities exists due to strong interest in outdoor destinations, adventure/leisure-oriented products, touring, cultural pursuits and experiencing natural

phenomena. Travel interests change over time and tourism destinations (including the Yukon) regularly update and assess market information and marketing approaches.

16.3 Resource Values

16.3.1 Natural Value

“Wilderness” is any area in the Yukon in a largely natural condition in which ecosystem processes are generally unaltered by human activity. It may include areas of visible human activity that don’t detract from wilderness tourism (Government of Yukon 2008).

The Dawson region is a popular destination for many Yukon and Alaska visitors including summer and winter wilderness adventure travellers. Wilderness adventure events like the Yukon Quest International Sled Dog Race, Arctic Ultra, Fulda Challenge and the Yukon River Quest support and promote year-round tourism in the region. A variety of wilderness day tours and activities are offered out of Dawson City, and the town is the staging point for wilderness groups venturing into Tombstone Territorial Park, other backcountry areas off the Dempster Highway, and elsewhere in the region.

The Yukon’s wilderness, history and culture attract people to the territory, and people are looking for experiences that include scenic beauty, open spaces, wildlife and history. Regardless of how they travel, visitors consistently rank scenery as the single most positive aspect of their Yukon visit. History, wildlife and outdoor activities were the most sought-after experiences during their visit (Government of Yukon 2006*a*). The Yukon’s wide-open landscapes, scenic beauty, culture and history continue to attract visitors today. The opportunity for peace, quiet and connecting with nature are important features for many activities.

Thanks to several major assets – the Yukon River, Tombstone Territorial Park, the Dempster Highway and Klondike National Historic Site – along with an established trail network in and near Dawson City, the region is one of the Yukon’s most active wilderness tourism areas. Hiking, canoeing, motorboat tours, rafting and biking are the most popular day trip activities and canoeing and backpacking are the most popular multi-day activities. Wildlife viewing is a highlight in many activities and a primary motivator for others, particularly along the Dempster Highway.

The Tintina Trench is a dramatic migration corridor in May and September for sandhill cranes, tundra swans, peregrine falcons and numerous other bird species. The riverside cliffs, wetlands, marshes and muskegs provide suitable nesting sites and plenty of food. The flight of the sandhill cranes is the most obvious and spectacular of the migrations as over 200,000 birds pass through the valleys on their way to and from their tundra nesting grounds. The Tintina Trench is also home to a large number of wildlife species year-round, with a particularly large population of lynx, and the Porcupine caribou herd migration can be observed from Dempster Highway locations. The numerous river tributaries that drain into the trench provide migration routes and spawning grounds for salmon. Winter activities include dog-sledding, skiing and snowmobiling. Heritage routes, such as the Ridge Road Heritage Trail, and historic sites are often featured and interpreted in wilderness activities (Government of Yukon 2011*d*).

The Yukon River’s blend of scenery, wildlife, history, easy access and paddling makes it the most popular canoe route in Yukon and in Canada’s North. In the planning region the route features remote wilderness, wildlife viewing, camping spots, and historic sites and features that showcase First Nations and Klondike Gold Rush history. About 15 mostly Yukon-based operators guide approximately 350 clients on multi-day canoe trips each year, and about 1,300 self-guided non-resident tourists rent canoes for Yukon River trips each summer. The river corridor has recreational, historical and educational value.

The Yukon River is the tenth longest river in the world and the fourth longest in North America. The Canadian section comprises the upper 35 per cent of its 3,200 km length. Most canoe trips take place between Whitehorse and Dawson (approximately 14 days) or there are shorter trips that start or stop in Carmacks. Travellers see old wooden buildings, steamboats and other relics of an era when up to 250 paddlewheelers transported trappers, goldseekers, miners, tourists and supplies up and down the river until the mid-1950s when the Alaska Highway and the Klondike Highway put them out of business (Government of Yukon 2008).

The main categories of Yukon River travellers in the planning region are guided motorboat tour clients on day trips out of Dawson City, as well as both guided and self-guided multi-day canoe clients going downstream to the Alaska border. A 1997 survey of visitor use of the Yukon River revealed that 62 per cent of travellers used rental canoes and 12 per cent were guided, leaving approximately 26 per cent as self-guided with their own equipment (Government of Yukon 2008). More than 50 per cent of the travellers came from Europe and the rest from Canada, USA and Japan. Motorboat tours were the most popular wilderness tourism activity in 2004 with over 17,000 clients, and operated almost exclusively on the Yukon River. Up to 11 licensed operators offered guided motorboat tours, most from permanent bases in Whitehorse and Dawson (Government of Yukon 2008).

Other wilderness-based events in the Dawson area draw major media attention that raises awareness of, and interest in, Yukon and the region as a tourism destination. The Yukon Quest, Arctic Ultra, Fulda Challenge and Trek Over the Top helped raise the profile of Dawson as a winter tourism destination. The Yukon River Quest – the longest annual canoe and kayak race in the world – attracts several hundred paddlers each June.

16.3.2 Traditional Value

Tr'ondëk Hwëch'in citizen comments:

It is good to show people the land and to tell our stories.

Tourism is ok if people are just viewing the land.

People who come from the outside don't know how to take care of the land. Accidents can happen when people do not know what they're doing. Accidents to themselves and to the land, like forest fires.

Elders are concerned that too many people will have an adverse impact on the land. In addition, Elders worry that tourists are not educated properly about the land and living outdoors. This may cause damage to the land or create accidents where people are hurt. Solutions may include increased education about how to care for the land as well as guided activities. Some tourism activities can create meaningful economic opportunities, especially given the desire for cultural experiences that tourism demands. Elders feel that any new developments must be small-scale and leave a small footprint (Tr'ondëk Hwëch'in 2012).

Activities such as berry picking and hiking are both recreational (i.e., for personal enjoyment) and serve to reinforce traditional values (e.g., subsistence on traditional foods, use of traditional trail networks and sharing family values).

First Nations values related to recreation are described in the *Klondike Regional Plan: Outdoor Recreational Data Review* (EDI Environmental Dynamics Inc. 2010) as follows:

Like other residents of the Klondike Planning Region, the Tr'ondëk Hwëch'in are very involved with outdoor activities throughout the year. The Tr'ondëk Hwëch'in participate in a wide variety of outdoor activities, including boating, fishing, hunting, snowmobiling, and dog-sledding. However, some differences do exist between First Nations and other local residents in perceptions of recreation. These differences in perception by local First Nations lie in the unique link between cultural and subsistence activities with recreation activities.

Consumptive activities such as fishing, hunting and berry-picking are more than a form of recreation to the Tr'ondëk Hwëch'in; they are an important means of subsistence and a traditional part of their culture. The subsistence value of these consumptive activities can lead to challenges when discussing recreational values with First Nations. Many activities (camping, boating, and nature-viewing) typically identified as recreational activities coincide with these subsistence activities, and are often seen as inseparable.

The Tr'ondëk Hwëch'in also had a unique perspective when identifying areas of particular recreational value. These interests often focused around areas of cultural and heritage value within their community (Government of Canada, 1998). Areas that were identified of particular importance were Tr'ochëk (also known as Lousetown), Moosehide Village, R-22 (healing camp), and Forty Mile.

There is a strong relationship between history and tourism in the planning region. The region's history and its visible and interpreted historic resources remain key visitor attractions, and there are opportunities to enhance and build on that relationship in the future. Visitors are interested in learning about Yukon's history and culture through experiences, stories and interpretation of the features and landscapes around them. There is a positive relationship between conserving historic and cultural resources and enhancing visitors' experience – conservation enables the experience; experience generates appreciation, support and economic benefits from visitors, which in turn reinforces the value of conservation and interpretation of those resources.

The most well-known historic resources and attractions are tied to Dawson's gold rush history and are concentrated in and around Dawson City. Evidence of the region's history can be seen beyond highway corridors, especially along major rivers and hiking routes. Historic routes like the Yukon River, the Dawson Overland Trail, the Ridge Road Trail and Yukon Ditch support tourism activities and events, and historic sites and features enrich visitor experience by adding a cultural and interpretive component to outdoor activities and tours.

Linking the region's stories through history can provide opportunities for enhanced and new tourism experiences, products and partnerships. For example, the relationship between gold mining and the Yukon's ice age history and science is intriguing. Klondike miners unearthed evidence of Yukon's ancient past at the turn of the century and modern Klondike area placer mining produces hundreds of fossils each year. The Klondike region is well known around the world for research on ice age palaeontology, geology and environmental science and this story is probably of interest to visitors.

16.3.3 Socio-Cultural Value

The Dempster Highway is a unique and well-known touring route with an international reputation as one of the last wilderness highways in North America. It is Canada's only highway to the Arctic and it enables viewing and study of tundra landscapes, arctic ecology, birds and wildlife that are not accessible by road anywhere else in Canada. The highway also provides access to canoeing and rafting on the Blackstone and Klondike rivers and to Tombstone Territorial Park.

Touring by vehicle is the main activity along the Dempster, complemented by wilderness-based activities like hiking, mountain biking, camping, photography and nature study. Wildlife and bird watching is of particular interest to Dempster Highway visitors, and guided and recreational birding trips are available. Most are independent motorists touring in RVs, trucks or cars, and tour operators offer guided highway tours in vans and buses.

About 15 tour companies include the Tombstone area and the Dempster Highway as a day trip or part of a Yukon or Yukon/Alaska highway tour. Half a dozen of these companies offer guided van tours to the Arctic Circle and beyond. In the summer of 2004, about 8,000 tourists travelled the highway into the North Yukon planning region, almost double the number who visited in 1994 (Government of Yukon 2008).

The Dempster Highway passes through three land use planning regions, but from a traveller’s perspective, the highway is viewed as a whole. The Dempster’s signature views – mountain ranges and open expanses of colourful subarctic tundra – draw thousands of visitors each year up the highway. Cooperative efforts are needed to protect and manage these views to ensure that the values that attract visitors are maintained.

Tombstone Territorial Park is within the Dawson planning region but a separate management plan is in place for the park. It is an important tourism destination for day and multi-day wilderness trips and for highway travellers. Nearly all visitors access the park by the Dempster Highway, and most park visitors also travel to other destinations in the planning region. Over 80 per cent of non-water based wilderness tourism activity in the “Klondike region” (as defined by Government of Yukon 2008) takes place in the park. Hikers and photographers are attracted by tundra walking with dramatic views, unusual landforms and craggy peaks. Wildlife watchers are rewarded by a diversity of species including large mammals and an array of arctic and subarctic birds. Exploring Tombstone Territorial Park can involve everything from short hikes off the highway to multi-day backpacking and mountaineering trips in the backcountry (Government of Yukon 2008).

The park is an iconic Yukon destination, known for beautiful scenic vistas, diverse wilderness landscapes, spectacular mountain features and rich and varied wildlife and vegetation. Rugged, challenging terrain and remote wilderness with few signs of human intrusion appeal to backcountry travellers while road-accessible trails, a government campground and an interpretive centre attract highway travellers and day trip parties.

Visitation to the park is increasing. Visits to the Tombstone Interpretive Centre have increased from 1,500 in 1986 to about 12,000 today. Increased use of remote helicopter access sites, new enquiries from operators regarding air-access hiking trips, and increased use of backcountry campsites indicate good potential for managed growth in the park (Government of Yukon 2008).

Popular activities in the region include hiking and backpacking, canoeing, fishing, boating, biking, photography, berry picking, snowmobiling, cross-country skiing, dog mushing, skijoring, snowshoeing, downhill skiing and hunting. Emerging activities include natural and cultural interpretation, paragliding, wilderness hiking, and winter hiking and camping. Desirable locations for expansion (of trails and supporting facilities) include the Yukon Ditch trail network, Yukon River corridor, Top of the World Highway, Dempster “buffer zone” and Forty Mile area (EDI Environmental Dynamics Inc. 2010).

The Klondike Active Transport and Trails Society (KATTS), based in Dawson City, seeks to develop and promote non-motorized recreation trails in the Klondike region “in order to promote healthy, safe and spiritually rewarding outdoor activities and showcase our regions rich cultural and natural resources” (KATTS 2013) [sic]. Current KATTS projects include construction and maintenance of the 9th Avenue Trail skirting Dawson City, developing a GIS-based trails inventory, and further developing the trails network in Tombstone Territorial Park (KATTS 2013).

In a Dawson Regional Planning Commission workshop held in Dawson City in February 2013, the Commission heard from participants about a wide range of activities that occur within the planning region (Dawson Regional Planning Commission, unpublished data):

Wood cutting	Hunting	Snowmobiling
Recreation	Trail development	Fishing
Berry picking	Trapping	Hiking

Golfing	Camping	Dog sledding
Backcountry airstrips	Film/TV locations	Archaeological research
Sightseeing	Wildlife viewing	Mineral exploration
Off-road 4x4	River tours	Canoeing
Big game outfitting	Guiding	Residential development
Agriculture/farming	Sap collection	Mushroom picking
Traditional medicines	Historic sites	Heritage sites
Cultural camps	Ecotourism	

16.3.4 Economic Value

In 2010, tourism contributed \$103.4 million to the Yukon's total Gross Domestic Product and \$178.8 million to total private sector revenue. As well, 29.8 per cent of Yukon businesses reported that at least a portion of their gross revenue in 2008 was derived from tourism, and of these, 31 per cent reported that more than half of their gross revenues were attributable to tourism. Many of these businesses were in the accommodation, food services and retail trade sectors (Government of Yukon 2011*b*).

According to the *Yukon Economic Outlook 2012* (Government of Yukon 2012*a*), the outlook for visitation to the Yukon remains generally positive given the well-established and unique tourism products. However, it is also noted in the report that the strength of the Canadian dollar relative to the US dollar, economic and political uncertainty abroad, and increasing fuel prices all have potential to negatively impact visitation in the near-term. Tourism revenues are affected by many uncertain global factors such as economic recessions, volatile fuel prices, stock markets, health concerns like the H1N1 flu or SARS, wars and terrorism.

Recreational events also contribute to the Yukon's economy. For example, the Government of Yukon states that the 2006 Yukon Quest race resulted in an estimated increase in spending of \$214,000 in the Yukon; an estimated \$107,000 increase in the Yukon GDP; and 10 full-time equivalent jobs (Government of Yukon News Release #07-247).

As outlined in *Regional Economic Development Plan Traditional Territory of the Tr'ondëk Hwëch'in: Community based projects implementation 2013-14* (Klondike Development Organization 2013), planned community-based projects include promotion and expansion of Tr'ondëk Hwëch'in heritage tourism. Tr'ochëk National Historic Site of Canada, Forty Mile Heritage Site, Tombstone Territorial Park, and Dänojà Zho Cultural Centre combined have the critical mass to act as the foundation of a unique First Nation heritage tourism feature that will appeal to new and existing visitor markets, including the important cultural traveller segment. However, the correctly positioned visitor products are not in place. The project aims to support heritage tourism business opportunities that can deliver the key accommodation, transportation, interpretive guide and other experiential services that meet the demonstrated demand.

16.4 Resource Management

16.4.1 Regulatory Framework

16.4.1.1 First Nation Final Agreements

Tr'ondëk Hwëch'in and Vuntut Gwitchin First Nation Final Agreements require tourism values and resources to be identified and considered in project assessments, land use plans, and fish and wildlife management plans. Tourism activities and tourism potential based on heritage resources and natural areas are important to economic development.

16.4.1.2 *Parks and Land Certainty Act*

The protection and management of representative areas of territorial significance provides recreational opportunities for Yukoners and visitors, and encourages public appreciation of Yukon's natural environment as a legacy for future generations. Protecting these resources supports tourism activities and opportunities and manages visitor activities, including the development and maintenance of campgrounds, recreation areas and other facilities.

16.4.1.3 *Wilderness Tourism Licensing Act*

Maintenance of the quality of Yukon lands and waters is central to the wilderness tourism sector. The act requires operators to obtain a licence to conduct wilderness tourism activities, adhere to minimum impact camping standards, and report statistics about commercial trips and rentals.

The act and regulations allow for activity-specific regulations and may limit commercial activity to achieve conservation objectives or ensure sustainability of the wilderness resource.

16.4.1.4 Various Transport Canada Legislation

Various laws and regulations under Transport Canada apply to a variety of tourism activities. These include the *Marine Liability Act* and *Canada Shipping Act* (river rafting and other small vessel regulations), as well as various regulations pertaining to aviation.

16.4.1.5 *Historic Resources Act*

This act promotes appreciation of Yukon's historic resources and provides for their protection and preservation as well as study and interpretation. It allows for appropriate visitor opportunities and historic sites.

16.4.1.6 *Environment Act*

Part 5 of this act refers to Integrated Resource Planning and Management, and recognizes the inherent value of wilderness as a resource. The act also allows for the designation of a 'wilderness management area'.

16.4.2 Other Stakeholders

16.4.2.1 Tourism Industry Association of the Yukon (TIA Yukon)

TIA Yukon aims to “influence, promote and assist the development of tourism in the Yukon” by acting as the territory's common voice for the visitor industry association (TIA Yukon 2013). In addition to advocating for the tourism industry in Yukon, the association hosts a number of programs that provide opportunities for organizations to receive awards in tourism excellence as well as apply for funds for training, marketing and supporting post-secondary tourism students (TIA Yukon 2013).

16.4.2.2 Wilderness Tourism Association of the Yukon (WTAY)

Founded in 1993, the Wilderness Tourism Association of the Yukon was originally developed to provide adventure tour operators and guides an avenue in which to discuss, investigate, lobby and represent any issues that uniquely affect the wilderness tourism sector. Today WTAY is responsible for various initiatives such as facilitating educational seminars to increase knowledge and training; making available relevant research and communications; developing and promoting Yukon as a year-round travel destination; acting as a liaison with the territorial, federal and First Nations governments as well as other associations; and managing the Yukon Wild Cooperative Marketing Partnership (WTAY 2012).

WTAY also continues to work with Government of Yukon towards a Commercial Wilderness Lands Policy. Most other resource-based industries have access to land through policy or legislation (e.g., agriculture, mining, forestry, oil and gas). Wilderness tourism operators and investors currently have no mechanism to apply for backcountry land on which to develop tourism products and facilities (e.g., lodges, cabins and other infrastructure). WTAY is concerned that suitable locations for backcountry tourism development are becoming very limited, especially on lakes and rivers, and that economic opportunities for industry growth are being lost (WTAY 2012).

16.4.2.3 Klondike Visitors Association (KVA)

The Klondike Visitors Association focuses on visitation to Dawson City with a marketing emphasis on the area's unique past, present and future. As described in the *Regional Economic Development Plan* (Klondike Development Organization 2013), the KVA is looking to improve its tourism marketing strategy:

Klondike is an iconic Gold Rush brand that has long resonated with key travel markets, in Canada, the US and Europe. KVA has invested heavily in the *Klondike* theme as the anchor for its marketing activities but wants to expand its focus to include the diverse sources of Dawson's richness as an attraction, including Tr'ondëk Hwëch'in heritage, the arts culture scene and wilderness adventure... This re-visioning of the *Klondike* brand sets the stage for the UNESCO World Heritage Status application.

16.4.2.4 Inter-Jurisdictional Initiatives

In partnership with the private sector, non-government organizations and other governments, the mandate of the Government of Yukon's Department of Tourism and Culture is to (Government of Yukon 2011):

- Generate long-term economic growth and revenues for the benefit of Yukon people through the development and marketing of Yukon's tourism industry.
- Generate long-term economic growth and maximize socio-cultural benefits for Yukon residents and visitors through the preservation, development and interpretation of historic resources, visual, literary and performing arts and cultural industries in the Yukon.

The Klondike region is on a shortlist of just eight Canadian sites qualified by Government of Canada for consideration as a UNESCO World Heritage Site, recognizing its outstanding universal value (Klondike Development Organization 2013). The regional tourism industry identifies the designation as the primary opportunity for growth in the sector going forward and the economic benefits may be significant. The nomination has been studied locally for many years, and in 2013-14, a feasibility study and strategic plan for nomination advancement will be completed. A Steering Committee will be established to lead the process, undertake a cost-benefit analysis, and make recommendations to the public and regional governments on whether to proceed with pursuing the nomination. Other partners include Government of Yukon, Parks Canada, TIA Yukon and private sector businesses.

16.4.3 Current Best Management Practices

The Wilderness Tourism Association of the Yukon (WTAY) has developed a set of guidelines explained in the brochure *Code of Conduct for Operating Wilderness Tours* (WTAY 2002). These guidelines were prepared by WTAY in consultation with tourism operators, First Nations, non-government organizations, and several Government of Yukon departments. WTAY promotes the definition of ecotourism as “responsible travel that conserves natural environments and sustains the well being of local people.” The Code of Conduct describes best practices for guide standards, etiquette, visitor safety, bear safety, wildlife viewing and leave no trace principles. It also describes how wilderness tourism operators can promote conservation of wilderness and biodiversity, promote protection of historic and archaeological sites and maximize local benefits. Becoming a member of WTAY is contingent on compliance with the Code. By adhering to the principles, operators demonstrate that their company maintains the highest standards of outdoor and business ethics and are also able to educate clients and Yukon visitors about low impact wilderness recreation.

WTAY also promotes its *Best Environmental Practices on Yukon Rivers* (WTAY 2013) to minimize river travellers’ impacts on the environment and on other travellers (including tourists, residents, First Nations people, hunters, trappers and fishers). These best practices include pre-trip preparation to reduce waste, proper waste disposal, minimizing impact of campfires, focusing activity on existing campsites and trails or other durable surfaces, leaving artifacts and existing structures in place, wildlife viewing safety, and basic etiquette for sharing the river with other people (WTAY 2012).

Wilderness tourism operators and big game outfitters often operate in remote regions where aircraft is required to transport clients, equipment and supplies. Best management practices for reducing disturbance from aircraft to wildlife have been developed and are utilized by the tourism industry including:

- *Flying in Sheep Country: How to minimize disturbance from aircraft* (Government of Yukon 2006b)
- *Flying in Caribou Country: How to minimize disturbance from aircraft* (Government of Yukon 2010)

A Memorandum of Understanding (MOU) was signed in 2008 between the Yukon Chamber of Mines (YCM), Klondike Placer Miners Association (KPMA), and TIA Yukon. The MOU recognizes that all parties depend on access to land in order to create wealth from the Yukon’s land base and promotes communication and cooperation between the industries to avoid potential conflict and resolve differences (YCM, KPMA and TIA Yukon 2008).

The purpose of this MOU is to provide a foundation of mutual recognition, respect, education, open dialogue and cooperation between businesses in order to foster healthy development and minimize conflict. Where conflict does occur, the MOU provides a forum in which to defuse tensions and resolve differences cooperatively (Government of Yukon 2011c).

Best management practices for protection of heritage resources include educating clients about legislation (e.g., no removal of artifacts), reporting any discoveries, practicing no-trace camping, using existing trails and avoiding new trail development on landscape features with high potential for heritage sites (e.g., edges of terraces or ridges and riparian zones) or utilizing a buffer of 60 to 100 m from these features.

A written manual, developed as an aid to interpretation of First Nation heritage along the Yukon River, provides a guide for respectful consideration for the land when travelling (Beaumont et al. undated). Government of Yukon (2007) has also developed the document *Handbook for the Identification of Heritage Sites and Features* with pictures and text describing brush camps, hunting blinds, cabin remains, traps and other heritage features that may be found in the Yukon.

16.5 Risks and Uncertainty

16.5.1 Tourism and Climate Change

Climate change could create uncertainty around snow and weather conditions, potentially impacting plans for tourism expansion in the winter season.

Heritage and cultural sites that occur in permafrost areas may deteriorate as a result of ground shifting. Sites adjacent to river shorelines are particularly susceptible to slumping and erosion from increased melting of permafrost.

16.5.2 Compatibility with other Land Use

Freeman (1983) states that the carrying capacity of an area's resources for tourist use can be defined as "the maximum use level for developments when both environmental quality and user satisfaction are maintained." Freeman goes on to note that carrying capacity is determined by three factors:

1. The biophysical characteristics of the resource that affect the resource's sensitivity to use;
2. The user's expectations of the resource's condition, which affect the amount of resource degradation tolerated by users; and
3. Management actions that upgrade the resilience of an area to overuse (e.g., paving trails), change user expectations (e.g., promote an overused tent campground as an RV campground), or balance biophysical characteristics with user demand (e.g., regulating fishing season and catch limit).

New access to remote areas could open up possible tourism opportunities. In a written submission to the Dawson Regional Planning Commission (2012), Government of Yukon notes that while historic ground access is important for tourism in the planning region, new ground access may or may not be useful or beneficial to tourism and should be part of a comprehensive assessment of potential conflicts. Key factors include:

- Desirable and undesirable tourism features or destination accessed by a route;
- Impact of increased use on wilderness resources and other resource uses;
- Environmental and economic sustainability of new tourism opportunities; and
- Practical and safety considerations associated with public use of new backcountry industrial roads (e.g., potential industry responsibility for capital and operational costs of road infrastructure).

Depending on the tourism product and intended market, new opportunities could also arise utilizing trail, river or air access.

Tourism is a resource-based industry, and continued success and growth depends on maintaining those resources (e.g., opportunities for sport fishing, both recreational and commercial, are dependent on healthy fish stocks). Areas which could potentially be impacted by other land use and development activities include aesthetics, water quality and safety considerations along the Yukon River corridor; Tombstone Territorial Park values; guided hunting activity values of wilderness and wildlife; scenic viewscales and access to recreational activities (particularly along the Dempster Highway and Yukon River corridors); and impacts of new ground access on the Yukon Quest route (e.g., Dawson Trail may have potential for all-season access to the White Gold mining region).

Increased resident and visitor use of popular routes and destinations may impact environmental and cultural values and resources. Level of use in some recreational areas can become so high that the quality of the recreational experience is diminished (i.e., "loving it to death"). Use of motorized vehicles may disrupt wildlife and damage sensitive ecosystems (e.g., alpine plateaus). Also, there may be a conflict between tourism activities and traditional harvesting activities occurring in the same

areas or utilizing the same resources; for example, large numbers of hunters (guided and independent) from outside the region could impact wildlife populations also used by local First Nations and resident hunters for subsistence. The majority of Tr'ondëk Hwëch'in trapping concessions are located between Km 1 and Km 266 of the Dempster Highway; the highway corridor is also a major wildlife movement corridor and is used for traditional harvesting activities of moose, caribou and sheep. The Yukon River valley is also a vital area for traditional salmon fishing and wildlife harvesting. Wilderness tourism activities such as backcountry hiking, campsites, trail development, and infrastructure development can potentially impact heritage resources.

Conflicts may also arise between tourism and the resource development sector. Resource development activities may affect the aesthetic, or visual, quality of recreational use (e.g., the sight of mining activities or pipelines on the ground or helicopters flying overhead would disturb a wilderness experience). On the other hand, resource development activities can also provide increased opportunities for recreation, particularly through the development of new roads by providing access to areas previously accessible only by air. Visually scenic areas or viewsapes could be identified where limited activity would be permitted; this could, in turn, impact resource development activities such as timber harvesting or mineral exploration.

Conflicts may occur between commercial users and independent tourists/public users, between different types of recreational users (e.g., motorized versus non-motorized), and/or between resource development and recreational/tourism activities.

16.6 Chapter References

- Beaumont, J., Edwards, M., compilers. undated *An Introduction to First Nations Heritage Along the Yukon River*. Tr'ondëk Hwëch'in and Government of Yukon. Whitehorse, Yukon, Canada.
- Burke, T. 2003. *Wilderness Tourism Capacity Study Results*. Prepared for the Wilderness Tourism Association of the Yukon and the Government of Yukon's Department of Tourism and Culture.
- Dawson Regional Planning Commission. Unpublished data. Public Meeting and Planning Workshop. February 13-14, 2013. Dawson City, Yukon, Canada.
- EDI Environmental Dynamics Inc. 2010. *Klondike Regional Plan: Outdoor Recreation Data Review*. Prepared for Government of Yukon, Department of Environment. Whitehorse, Yukon, Canada. EDI Project No. 09-YC-0047.
- Freeman, M.J. 1983. *Yukon River tourism potential: resource capacity methodology and assessment*. M.Sc. thesis, University of British Columbia, Vancouver, British Columbia, Canada. Available at: <https://circle.ubc.ca/handle/2429/23935>.
- Government of Yukon. 2006a. *2004 Yukon Visitor Exit Survey Klondike Region*. Department of Tourism and Culture and Yukon Bureau of Statistics. Whitehorse, Yukon, Canada. Available at: http://www.tc.gov.yk.ca/fr/pdf/Klondike_VES2004_Apr14.pdf.
- Government of Yukon. 2006b. *Flying in Sheep Country: How to minimize disturbance from aircraft*. Revised edition, second printing 2006. Mining Environment Research Group. Whitehorse, Yukon, Canada.
- Government of Yukon. 2007b. *Handbook for the Identification of Heritage Sites and Features*. Revised edition. Department of Tourism and Culture, Cultural Services Branch, Heritage Resources Unit. Whitehorse, Yukon, Canada. Available at: http://www.tc.gov.yk.ca/heritage_guidelines.html.

-
- Government of Yukon. 2008. *Yukon Wilderness Tourism Status Report*. Department of Tourism and Culture, Product Development and Research Unit. Whitehorse, Yukon, Canada. Available at: http://www.tc.gov.yk.ca/publications/Yukon_Wilderness_Tourism_Status_Report_2008.pdf.
- Government of Yukon. 2010. *Flying in Caribou Country: How to minimize disturbance from aircraft*. Revised edition, second printing 2010. Mining Environment Research Group. Whitehorse, Yukon, Canada.
- Government of Yukon. 2011a. *Yukon Visitor Statistics Year-End Report 2011*. Department of Tourism and Culture, Product Development and Research Unit. Whitehorse, Yukon, Canada. Available at: http://www.tc.gov.yk.ca/Stats_and_Figures.html.
- Government of Yukon. 2011b. *2011-2012 Tourism Yukon Situation Analysis*. Department of Tourism and Culture, Tourism Branch. Whitehorse, Yukon, Canada. Available at: www.tc.gov.yk.ca/publications/Situation_Analysis_2011_2012.pdf.
- Government of Yukon. 2011c. *Draft Dawson Regional Land Use Plan Information Report: Tourism Branch*. Submitted to the Dawson Regional Planning Commission by the Department of Tourism and Culture, Tourism Branch. Whitehorse, Yukon, Canada.
- Government of Yukon. 2012a. *Yukon Economic Outlook 2012*. Department of Economic Development. Whitehorse, Yukon, Canada. Available at: http://economics.gov.yk.ca/Files/Economic%20Outlook/Outlook2012_Final.pdf.
- Government of Yukon. 2012b. *2012-2015 Tourism Marketing Strategy*. Department of Tourism and Culture, Tourism Branch. Whitehorse, Yukon, Canada.
- Government of Yukon. 2013a. Department of Tourism and Culture Website, Tourism, Tourism Industry Services, Starting a Business, Tourism Sectors. Available at: http://www.tc.gov.yk.ca/isu_sectors.html.
- Government of Yukon. 2013b. *Yukon Economic Review 2012*. Department of Economic Development. Whitehorse, Yukon, Canada. Available at: http://economics.gov.yk.ca/Files/Outlook2012_review.pdf.
- Klondike Active Transport and Trails Society (KATTS). 2013. KATTS Website, Home, Projects. Available at: <http://www.katts.ca/index.html> (accessed August 6, 2013).
- Klondike Development Organization. 2013. *Regional Economic Development Plan Traditional Territory of the Tr'ondëk Hwëch'in: Community based projects implementation 2013-14*. Dawson City, Yukon, Canada.
- Mammoth Mapping. 2009. *Final Report: Land Asset Identification and Analysis*. Prepared in association with Across The River Consulting for the Tourism Industry Association of the Yukon. Dawson City, Yukon, Canada.
- Tourism Industry Association of the Yukon (TIA Yukon). 2013. TIA Yukon Website, About Us, Programs, Advocacy. Available at: <http://www.tiayukon.com> (accessed August 7, 2013).
- Tr'ondëk Hwëch'in. 2012. *Tr'ondëk Hwëch'in Resource Report*. Submitted to the Dawson Regional Planning Commission, May 2012.
- Wilderness Tourism Association of the Yukon (WTAY). 2002. *Code of Conduct for Operating Wilderness Tours: WTAY Guidelines* (brochure). Whitehorse, Yukon, Canada. Available at: <http://wtay.com/resources/code-of-conduct/>.
-

Wilderness Tourism Association of the Yukon (WTAY). 2012. WTAY Website, Who We Are, Resources, Best Environmental Practices. Available at: <http://wtay.com>.

Wilderness Tourism Association of the Yukon (WTAY). 2013. *Best Environmental Practices on Yukon Rivers: A minimal impact guide for river travellers*. Whitehorse, Yukon, Canada. Available at: <http://wtay.com/resources/best-environmental-practices/>.

Yukon Chamber of Mines (YCM), Klondike Placer Miners Association (KPMA) and Tourism Industry Association of the Yukon (TIA Yukon). 2008. *Memorandum of Understanding*. Whitehorse, Yukon, Canada. Available at: <http://www.kpma.ca/assets/files/kpma-mining-tourism-mou.pdf>.

17 TRANSPORTATION and ACCESS

17.1 Highlights

- Access is essential for human movement across the landscape
- Access enables all economic, cultural and recreational activity
- Intelligent design of traditional trail networks provide the basis for a traditional economy
- River corridors are important economic, cultural and ecological corridors
- Shared corridors provide economic and ecological advantages; advance planning is necessary but route selection for new all-season corridors is difficult without full cost accounting and consideration of potential environmental, social and cultural impacts
- Many of the impacts that result from industrial land uses, particularly to ecological integrity and fish and wildlife populations (and by extension traditional economic activities), are a result of the direct and indirect effects of roads and other forms of access and people's use of them
- The impact of access on ecological integrity and wildlife varies with the size and extent of access features, level of activity associated with those features and success of mitigation measures designed to minimize these impacts
- Development of new access features, other than temporary trails, requires review under YESA
- Limits to access affect the ability of resource users to pursue economic, recreational or cultural activities
- Climate change presents risk to the stability of transportation features and uncertainty in route planning to avoid permafrost areas

17.2 Description of Resource

Regional access and transportation networks are vital for the movement of people, food, freight, construction materials, fuel, and other goods and supplies. Transportation networks and infrastructure also have a major influence on the pattern of land use and economic development within the planning region. In the following section, various types of land-based, water-based and air-based access are identified. Aggregates are also included in this chapter because their primary purpose in the planning region is as a key resource vital for construction and maintenance of the modern road transportation network.

17.2.1 Traditional and Modern Trail Networks

For the purposes of this report, trails are distinguished from other types of land-based access and are defined as “ground access that is constructed with very little movement of earth and rock” (Tr’ondëk Hwëch’in 2013a).

Traditional trails were developed over long periods of time, with many used more intensively during certain times of the year to access seasonal harvesting opportunities as well as for other travel and trade purposes. They were worn smooth and kept open mainly through this ongoing use, and they remain a key infrastructure asset that requires little maintenance effort other than the clearing of deadfall. Trails were networked together following major drainage systems, looping around mountains and lakes, and interconnecting with each other. Principles of intelligent design are embedded within trail routes as they are selected to maximize efficiency, reduce distances between locations, avoid natural hazards (e.g., landslides), and utilize terrain advantages (e.g., gradual slopes,

stable ground and good drainage). Trails facilitated travel in a more efficient manner than random movement throughout the landscape and defined the extent of the traditional territory.

Trail networks were a key component of the traditional economy. Trails combined with water routes provided by the navigable rivers and lakes to link together much of the traditional territory and provide access to key harvest locations. This transportation system also provided social and cultural connections, shaping people's perspective on the world and bringing people together. Trails link various natural resource values (e.g., harvesting opportunities), traditional camping locations, important landscape features (e.g., lookouts), and other significant locations (e.g., gathering places). First Nations people viewed their traditional territories and landscapes within the context of trail networks and marine routes, as shown by place names and stories. Animals also frequently moved along trails, and certain trails served as trade corridors by providing passage to adjacent traditional territories. Many trails and routes continue to be used today for the same purposes (Tr'ondëk Hwëch'in 2012).

The Tr'ondëk Hwëch'in (TH) Final Agreement identifies a number of traditional travel routes with particular cultural and heritage significance, including: Eagle to Old Crow; Dawson to Fort McPherson; Hän migration; Dawson to Tetlin; and Dawson to Moosehide (TH – DIAND 1998, Chapter 13, Schedule C). The TH Heritage Department also recently announced a new research project about TH ways of navigation and moving on the land. Information will be gathered on specific trails and travel routes, as well as taking a broader look at where, how and why people navigated throughout the landscape and how this movement created relationships with the land and animals (Tr'ondëk Hwëch'in 2013*b*).

There is a large network of trails and winter roads throughout the planning region, of varying condition and ability to be upgraded to all-season roads. Some are situated along potential corridors that could become developed to service resource development projects, although many winter trails may not be suitable for year-round development access, primarily because of lack of relief (i.e., low-lying, wet ground) (Access Consulting Group 2003).

17.2.2 Roads and Access Corridors

Roads and access corridors are the most predominant type of access in the planning region and includes highways, secondary roads, cutlines, power transmission lines, seismic lines, pipelines, airstrips, railway lines and bridges. For the purposes of this report, we categorize all of these as “linear features” on the landscape.

The Klondike and Dempster highways are the main multi-use transportation corridors that are utilized and maintained year-round, linking the planning region with areas to the north and south. The Top of the World Highway is an important scenic route linking Yukon and Alaska, and is accessible only during summer months when the ferry is in operation across the Yukon River at Dawson City. Government of Yukon, Department of Highways and Public Works (YG-HPW) is responsible for annual maintenance of major highways and roads, and also has land tenures for road building and maintenance facilities, gravel pits and quarries.

There are also numerous other roads and trails in the planning region (some maintained year-round, others only seasonally, and others not at all) that provide access to residential, commercial, and industrial properties as well as recreational and cultural use areas. The annual maintenance of major highways and roads is gazetted, but other roads and trails may be covered by the *Highways Act* even if they are not gazetted, so YG-HPW has jurisdiction over both maintained and unmaintained highways (Government of Yukon 2013*a*).

Private resource roads, where industry companies have paid for construction and maintenance, are less common in the Yukon than in other jurisdictions like British Columbia. Responsibilities for

construction and maintenance are with the owner during the time of operations, but once decommissioned to the standards outlined in the permitting process, the area reverts back to Crown land.

Existing levels of linear and surface disturbance in the planning region are highest in the Goldfields, especially in the vicinity of gold-bearing creeks. Forest Management Units (FMU) in the Goldfields have levels of surface disturbance approaching four per cent. In contrast, the FMU in which hard rock mining is occurring around Brewery Creek has a relatively small footprint, less than 0.2 per cent. See sections 6.5.1 to 6.5.3 of this report for more information on current levels of surface disturbance, linear features density and disturbance indicators for the planning region.

The potential for rail access through the Yukon has been discussed in the past, as well as more recently, specifically in regards to the transportation of liquid natural gas (see **Section 2 – Chapter 14 – Energy**). During the Second World War, the U.S. Army Corps of Engineers surveyed a potential rail route through the Yukon to Alaska, primarily through the Tintina Trench in central Yukon. A shortage of steel precluded its development, and the Alaska Highway was constructed as an alternate transportation route. A Canadian firm, Canadian Arctic Railways Ltd., has also discussed the potential for rail connection from the continental rail system through the Yukon to interior Alaska. U.S. political support for the construction of this route resulted in the passage of the *Rails to Resources Act* (2001) by the U.S. Congress, and some discussions between Canada and the U.S. about conducting further feasibility studies (Access Consulting Group 2003).

17.2.2.1 Access corridors

Shared access corridors to areas of economic opportunity or demand (e.g., energy transmission, oil and gas pipelines, mineral exploration, mining, forestry or tourism) have advantages in terms of economic savings, efficiency and reduced linear disturbance on the landscape. Identifying potential resource access corridors can inform investment decisions by natural resource developers and can help avoid public/private land use conflicts.

Access Consulting Group prepared a *Conceptual Study to Identify Potential Natural Resource Infrastructure Access Corridors* for the Government of Yukon, Department of Energy Mines and Resources in 2003. This was a desktop-level study aimed not at proposing access routes, but rather at identifying the most probable locations where access corridors may need to be developed, based on natural resource potential and developments that would require infrastructure access corridors in order to be economically viable over the intermediate to long-term. The report recognizes that detailed engineering studies would be required prior to final selection of routing and construction of any corridor (Access Consulting Group 2003).

All known areas of natural resource potential were documented and compiled (i.e., minerals, forestry, oil and gas, and electrical energy) along with existing mineral deposits and occurrences, coal dispositions, oil and gas dispositions, and timber harvest areas. Existing transportation infrastructure (i.e., highways, secondary roads, trails, airstrips, railways, and currently proposed infrastructure such as pipeline routes) and existing Settlement Lands, protected areas and known heritage resources were also compiled on 1:250,000 scale maps (Access Consulting Group 2003).

The criteria used to evaluate potential access corridors included (Access Consulting Group 2003):

1. Maximize resource potential – This was the paramount consideration, to identify potential access to areas with the strongest likelihood of resource development, preferably for more than one resource sector per corridor. One basic criterion was that individual resource development projects would have no further than 50 km of spur access to reach the existing and/or potential corridor network.
2. Minimize construction cost – Methods of cost reduction that were considered included:
 - a. reduce overall corridor length to the minimum necessary to access the resource;

- b. reduce number of river crossings to the minimum necessary and cross at the narrowest possible point;
 - c. reduce rock cuts;
 - d. avoid permafrost where feasible and identify routes on south or west facing landscapes;
 - e. target areas more likely to contain gravel borrow sources;
 - f. reduce number of stream crossings to the minimum necessary (this avoids costly measures for fish habitat impact mitigations); and
 - g. vertical alignment variations (to reduce mass haul requirement for cut and fill construction).
3. Minimize potential maintenance cost – Where possible avoid areas where excessive drifting snow is likely; minimize river and creek crossings (bridges, culverts and multiplates); and avoid known wildlife migration routes. The selection of south and west facing exposures will also minimize snow accumulation.
 4. Maximize utilization of existing infrastructure network – Where feasible, closed loop routes were chosen to connect with existing surface transportation infrastructure at each end and to provide access through areas with high identified resource potential. No new routes were identified as “one-project” routes.
 5. Minimize environmental impact – Reduce stream crossings to the least possible to minimize disruption of fish habitat; avoid permafrost zones to reduce thermal impact/permafrost degradation; and avoid areas of known wildlife migration routes to reduce vehicle mortality, hunting pressure and habitat disruption.

In consideration of mineral and coal potential, corridor routing was based on the identification of generalized access through regions of highest identified mineral potential, rather than routes to known deposits or occurrences (i.e., routes to mineral camps or belts rather than into individual mining properties). The study also recognized that an increase in mineral exploration could lead to the expansion of the existing road network, but an increase in road access could lead to increased mineral development. The current economic input and future potential of the tourism industry was recognized as a significant strength in Yukon, but tourism-related criteria were considered beyond the scope of the study and were not applied to the analysis (Access Consulting Group 2003).

The study identified 32 potential resource infrastructure access corridors, including the following within the planning region (Access Consulting Group 2003):

Corridor 11 – West Yukon Resource Corridor (Map sheets 115J/K and 115N/O)

Roughly paralleling the 141st Meridian that forms the border between the Yukon and Alaska, the West Yukon Resource Corridor would provide access to both hard rock mineral potential, active placer resources and potential, and limited forestry potential. The north end of this route connects with the Top of The World Highway west of Dawson City, and the south end connects with the Alaska Highway near the Alaska border north of Beaver Creek. The route traverses through moderate mountainous terrain with deeply incised drainages. Corridor 19, the U.S. Army Corps of Engineers Corridor, intersects this corridor at roughly the midpoint, giving rise to the potential for development of an intermodal transportation system. Engineering constraints are expected to be relatively minimal on this route except for some stretches of deep permafrost. There is only one relatively minor crossing of the Ladue River on this route.

Corridor 14 – White River Resource Corridor (Map sheet 115J/K)

Commencing from the terminus of an existing road (providing access to Snag from the Alaska Highway), the White River Resource Corridor crosses the Dawson Range to connect with an existing tote trail along the left bank of the Yukon River. It terminates at this trail at the Yukon River north of Mt. Cockfield. The route passes through high mineral potential and some identified merchantable

timber, as well as a minor placer resource. The most significant engineering and construction challenge that would be presented by construction of this potential corridor would be the crossing of the White River, a multi-channel braided river lying within a broad permafrost rich valley.

Corridor 15 – Casino Trail Resource Corridor (Map sheets 115I and 115J/K)

The southern portion of this trail currently exists as a seasonal road (the Casino Trail from the west end of the Free Gold Road to the Big Creek/Hayes River Pass near Prospector Mountain). This corridor extends the constructed road to the headwaters of Britannia Creek, near the terminus of the White River Resource Access Corridor (Corridor 14). The corridor passes along the Dawson Range across the headwaters of Big Creek, a demonstrated high mineral potential belt that has significant active placer mining operations in this unglaciated region of the Yukon. Engineering and construction considerations are expected to be favourable for development. Routing down the Hayes River Valley will likely involve significant side-hill rock cuts. One crossing of the Selwyn River is also required.

Corridor 19 and 19A – U.S. Army Corps of Engineers Resource Corridor (Map sheets 105A, H, G, F, K, L, 115I, J/K and N/O)

This corridor follows the route surveyed by the U.S. Army Corps of Engineers in 1942 for a potential railway link to Alaska. Running for the most part through the Tintina Trench, the route was chosen to provide a one per cent grade overall along the entire length of the route, which is considered optimal for rail. 19A is an alternate alignment that passes next to the coal deposits near Carmacks. Next to the Alaska Highway and Dempster Lateral Pipeline Corridors, this corridor has the highest level of engineering review of those included in this study. Recent U.S. interest in the rail link to Alaska may make this corridor potentially viable.

Corridor 21 – Goldfields Resource Corridor (Map sheets 115I, N/O)

This route follows the old Dawson Overland Trail, in its post-1912 location. Some portions of the trail have been upgraded over the years as mining roads. The entire route traverses unglaciated terrain, favourable for new placer occurrences as well as favourable hard rock mineral potential. Permafrost throughout the length of the corridor presents the most significant engineering and construction challenge, plus crossing of Stewart River.

Corridor 23 – Tintina Gold Belt Connector Resource Corridor (Map sheet 115P)

Connecting the North Klondike Highway through a very high mineral potential region to the existing McQuesten River Road, this short connector provides access to several identified mineral deposits. This corridor would take advantage of many existing placer mining access roads.

Corridor 24 and 24A – Northwest Yukon Resource Corridor (Map sheets 116B/C and 116F/G)

Traversing north and south parallel to the Alaska border through some of the less accessible high mineral and oil and gas potential regions in Yukon, this route provides access to the west of Tombstone Territorial Park, to the Fishing Branch Resource Corridor (Corridor 25). A short connector (24A) has been identified to the Dempster Highway approximately 150 km north of the southern terminus at Dawson. This connector route would only be developed if the Fishing Branch Resource Corridor has not been developed first. The northern portion of the corridor accesses the Monster Oil and Gas Basin, and the southern portion of the Kandik Basin and the Wernecke Breccia mineral belt. The southern portion of the corridor accesses high mineral potential west of Tombstone Territorial Park. Engineering and construction problems would be related to extensive permafrost areas at the northern end of the route.

Corridor 25 – Kandik Resource Corridor (Map sheets 116I, J/K and 116F/G)

The Government of Yukon, Department of Infrastructure identified this route as an alternate access route to the southern portion of the Kandik oil and gas basin and the Rusty Springs mineral deposit, to avoid the Fishing Branch Protected Area (including the Fishing Branch Wilderness Preserve and Habitat Protection Area). The entire route has been flown and documented for preliminary engineering assessment. The western extremity of the corridor splits into two routes – one heads north to the Rusty Springs deposit, and one heads west into Alaska. The western portion of the route also connects with the Northwest Yukon Resource Corridor (Corridor 24). Engineering and construction challenges include extensive permafrost and significant crossings of the Miner and Whitestone Rivers.

Corridor 31 – Dempster Lateral Resource Corridor (Map sheets 116P, 116I, H, F/G, B/C, 115N/O, P, I, H, 105E and 105D)

Originally identified in the late 1970s in conjunction with the Alaska Highway Natural Gas Transportation project by Foothills Pipelines Ltd., the Dempster Lateral line was identified as a potential route for the shipment of Mackenzie Delta gas, down beside the Dempster to the North Klondike Highway to Whitehorse. Tombstone Territorial Park encompasses the Tombstone Resource Corridor, which was incorporated into the park planning process to provide for possible future development of infrastructure, including the potential construction of the Dempster Lateral Pipeline. Alternatively, oil and gas resources from the Eagle Plains Basin could be piped through the Dempster Lateral line north to the Mackenzie Valley pipeline.

Engineering considerations would include soil conditions, amount of potential rock cuts, water crossing suitability for bridge construction, permafrost conditions, terrain stability/suitability, granular source identification, vertical and horizontal alignment, mass haul considerations, and potential maintenance issues such as anticipated snow drifting. Environmental considerations would also need to be identified, including potential impacts on water quality, river navigability concerns, migratory birds, critical fish and wildlife habitat, vegetation, soil erosion/terrain stability, and cumulative environmental impacts. Other factors to be considered in future detailed planning include public sentiment regarding the development of ground transportation into certain areas valued for their pristine nature, and potential temporal constraints that may be applied, in other words, how long these corridors would persist on the landscape, which could vary between regions and projects (Access Consulting Group 2003).

No further planning for transportation infrastructure corridors has been conducted within the region since this study. Policy frameworks for public investment in resource access roads are outlined in Section 17.4.2.

17.2.3 Water Access

The Yukon River is the major navigable waterway in the planning region and an important access corridor. Barge transportation of fuel and supplies provides an economical option for seasonal resource industry activity. The George Black Ferry on the Yukon River, operated by the Government of Yukon, links Dawson to the Top of the World Highway and on to Alaska. It operates from mid-May after spring break-up until mid-October or before ice begins to accumulate in the river. The potential for replacement of ferry service at Dawson City with a permanent bridge has been discussed in the past, but no definitive information has been provided to the Commission.

The definition of “Navigable Water” in Chapter 1 of the Tr’ondëk Hwëch’in Final Agreement (TH – DIAND 1998) is:

A stream, river, lake, sea or other body of water, used or capable of being used by the public for navigation by boats, kayaks, canoes, rafts or other small craft, or log booms on a continuous or seasonal basis, and includes any parts thereof interrupted by occasional natural obstructions or bypassed by portages.

Travel routes provided by navigable rivers and lakes increased people's ability to carry heavy loads and move more quickly and effortlessly. They were linked with trails on land to create an interconnected transportation system. Types of watercraft included birch bark canoes, dugout canoes, moose skin boats and rafts. The degree in which water transportation was utilized varied among different Aboriginal groups (Tr'ondëk Hwëch'in 2012).

To the Tr'ondëk Hwëch'in today, the Yukon River corridor is one of the most valuable resources of the planning region. It is not only a key transportation corridor, but also used for many other activities including hunting, fishing and berry picking (Tr'ondëk Hwëch'in 2013a). The rivers of the region are also important access corridors for many other people for subsistence harvesting and recreational opportunities, as well as tourism activities, using motorized and non-motorized watercraft. Various landing sites and docks are also associated with water access.

Waterways have historically been significant in the Yukon, particularly prior to the development of a ground transportation system. During the Klondike Gold Rush, White Pass and Yukon Route and other companies used over two hundred wood-fired, steam-powered sternwheelers to supply a critical transportation link between ocean shipping, rail transport, and interior horse-drawn ground transportation. This system was used for decades after the peak of the Klondike Gold Rush to supply goods to communities, until it was eventually replaced by road transportation. Ice roads along rivers in the winter have also been important factors in transportation to and from resource developments. Today there is relatively minor use of river transportation by placer mines that depend on Yukon River barging for the economical transportation of bulk fuel and heavy machinery. The potential for future development of an industrial waterway system is limited to the short open-water season and to the major deeper rivers with less navigational hazards (Access Consulting Group 2003).

17.2.4 Air Access

The Dawson community airport has scheduled Air North daily passenger service to and from Whitehorse, Inuvik and Old Crow. YG-HPW manages this airport as well as the airstrips at Chapman Lake and McQuesten Field. An water aerodrome is located at Dawson City. See **Section 3 – Resource Summary Maps – Infrastructure, Access and Land Status**.

Air transportation via fixed wing planes, float planes and helicopters is vital for the movement of people, fuel, goods and supplies for the mineral and oil and gas resource sectors as well as the wilderness tourism and big game outfitting industries. Associated infrastructure includes remote airstrips, float plane landing sites and helicopter pads.

While industrial development in the north regularly depends on air service, both for exploration and development scale activities as well as personnel transport and emergency medical service, whether or not there is already an airstrip in the area generally does not play a significant role in targeting areas for exploration. In most cases, Yukon's airstrips have been constructed adjacent to areas of previous resource interest and new airstrips would be constructed on an as-needed basis to service individual projects (Access Consulting Group 2003).

There is potential for future forms of air transportation such as dirigibles and hybrid air vehicles, although the timeline for development of proven technology, and the global availability of helium on an ongoing basis, is unclear.

17.2.5 Aggregates

Aggregate reserves and deposits (i.e., sand, gravel, crushed rock and topsoil) are a critical resource needed to support the development of transportation, municipal and industrial infrastructure. Quarrying generally refers to the extraction and removal of aggregate materials from a pit or site. These valuable natural resources are used for building construction (e.g., foundations), building and maintenance of roads and airstrips, asphalt and concrete production, and landscaping and gardening

(Government of Yukon 2011*a*). Sand and gravel are also key materials in industrial infrastructure such as access roads, well pads, pipeline corridors, and drainage structures such as culverts and dykes.

In the planning region, aggregate resources are used primarily for road construction and maintenance. As shown in Table 6-4, the planning region currently has 40 gravel pit reservations with a total area of 1,174.55 ha, the most numerous and extensive third-party interest in the planning region. Three quarry leases are also registered, covering an area of 15.2 ha. These land dispositions are all located along the three major highways (Klondike, Dempster and Top of the World) and are shown in **Section 3 – Resource Summary Maps – Infrastructure, Access and Land Status**. Other related infrastructure includes storage areas for granular stockpiles and equipment.

Gravel in Government of Yukon pits is not processed or sorted, so materials range from fine silt and sand to large boulders. Permit holders are responsible for their own loading and transportation of materials. The general public can also purchase sand, gravel, rock and topsoil directly from private suppliers for landscaping and gardening purposes. These contractors sell all types of materials including pit run (unprocessed gravel), screened or crushed gravel, drain and septic rock, sand and topsoil. They also offer loading, hauling, excavation, grading and other services (Government of Yukon 2011*a*).

Potential aggregate locations can be determined relative to landscape types. Typically, granular aggregate is mined from glacial deposits such as eskers, kames and meltwater channels. Large deposits can also be found in modern or paleo-river deposits such as dry creek beds or raised terraces. Since a large portion of the planning region was unglaciated during the last ice age, accessible aggregate deposits are primarily restricted to river valleys and active floodplains. A larger deposit called the “White Channel Gravel” was also deposited pre-glaciation (see **Section 1 – Chapter 5 – Biophysical Setting** for more information on regional geology and glacial history).

Aggregate potential is not well documented in the planning region outside of existing sources, which tend to be located where there is current demand (i.e., along major highway corridors). Aggregate resource assessments have been completed for the Dempster Highway corridor, and the high terraces along the major rivers in the corridor (primarily the Eagle, Bell, Whitestone, and Porcupine rivers) are a source of potential aggregate resources (North Yukon Planning Commission 2007). A recent study (Smith et al. 2009) also uses drillers’ logs from past seismic operations throughout northern and southeastern Yukon as a means of identifying potential surface and subsurface granular aggregate resources. During auger drilling of seismic shotholes, the earth materials passed through were documented.

The point-source data can enhance information from surficial geology mapping of glaciofluvial deposits and can assist in identifying potential deposits in areas not yet mapped.

Government gravel reserves are set aside to ensure that gravel resources are available for long-term maintenance and construction projects. Reserves are proposed based on a 50-year projected need. Suitable areas are identified through review of air photos, and additional sampling determines whether the gravel has the strength and durability to be used in transportation structures. Additional geotechnical tests are required to prove that the reserve is suitable for development, but these are generally not undertaken until there is certainty of a nearby project that needs aggregates.

Gravel pits are developed as needed. Establishing a gravel reserve does not grant approval to develop a pit (this is done through the quarry permit application and review process), nor does it assume the reserve will be developed as a pit immediately or at all. Reserves can also be modified to accommodate environmentally sensitive areas and other land use interests, may be developed in only a portion of the total area, and may not be used continuously throughout their development (Government of Yukon 2011*b*). Pits are also used as camp locations, maintenance and fuel storage, granular stockpiles and equipment storage areas.

Project applications submitted to YESAB detail the types of activities associated with development of new gravel pits as well as uses of existing active gravel pits. Development of a new pit typically consists of clearing an area for the pile site (usually a pad with a drainage ditch around the perimeter), construction of an access road, geotechnical testing, and maintenance and fuel storage. Annual use of existing gravel pits typically involves stripping of overburden (usually stockpiled for reclamation purposes), extraction of gravel, transportation of extracted material to pits or crushing sites (generally in close proximity to the project, i.e., 3-6 km), maintenance and fuel storage, contractor camps, and burning of brush and trees. These tend to be short-term projects of a few days to a few weeks, conducted in summer during low water season when streambeds and floodplains are dry (YESAB 2013).

17.3 Resource Values

Many of the impacts that result from industrial land uses, particularly to ecological integrity and fish and wildlife populations (and by extension traditional economic activities), are a result of the direct and indirect effects of roads and other forms of access and people's use of them. Access is a common theme to all resource and land uses described in this report. This section describes potential impacts of access on various other values in the planning region, both positive and negative. It is recognized that these impacts are potential only (i.e., may not occur at all) and may also be project-specific, species-specific, and/or time-specific (e.g., some impacts may be only temporary, such as during the construction phase of a project). It is also recognized that not all access is the same (e.g., a trail versus a major highway), and numerous options exist to mitigate many of these impacts. Some mitigation measures are discussed in the Resource Management section below, in terms of regulatory regimes and best management practices. Specific access management strategies for the planning region will be detailed in the Final Recommended Plan.

17.3.1 Natural Value

17.3.1.1 Potential Impacts of Access on Ecological Integrity

Access can have a number of potential impacts on ecological integrity, including the following (Carmanah Research Ltd. 1995, Hamilton and Wilson 2001, Craighead 2002, Forest Practices Board 2005, Eos Research & Consulting Ltd. 2009, Daigle 2010, Union of BC Municipalities and Government of British Columbia 2010, and others specifically noted in the text):

- Roads can encourage the dispersal of new plant species that can outcompete native plants and change the nature of the ecosystem.
- Vehicles, heavy equipment and machinery can result in increased levels of contaminants and air emissions.
- Displaced and compacted soils and increased dust levels from vehicle traffic can cause changes to soil temperature and pH, water retention and light levels. This leads to changes in biomass and plant growth, loss of productivity, and impacts on larger ecosystem processes.
- Compaction of snow from snowmobiles lowers the temperature beneath the snow and reduces over-winter survival of plants, soil microbes and small mammals, changing the species composition of a landscape (YFWMB 2003).
- Reconfigured landforms can cause changes to the water table, timing of runoff, wetlands and streambed materials. Other changes to the hydrologic system include interruption or diversion of groundwater flow and alteration of streamflow (timing and intensity of high and low flows).

- Hydrology changes (slopes, surface disturbance leading to permafrost degradation, disruptions to stream flows and drainage patterns) can result in higher levels of erosion and an increased number and extent of landslides or other debris flows.
- Increased risk of forest fire due to human activity (e.g., out of control campfires) or increased need for fire suppression around areas of human activity can alter natural fire cycles.
- Potential impacts to rare and unique species are unclear. Invertebrates such as moths, butterflies and spiders are not well known in the planning region and many of those that are known are endemic and/or globally rare. The Ogilvie Mountain collared lemming and the woodchuck are two mammal species rare in Yukon. The lemmings are only known in the Tombstone area and may also occupy the road corridor, and the woodchuck is only known from the Indian River area but may inhabit other grassy areas beside roads (Jung personal communication as cited in Government of Yukon 2011c).
- Some ecosystems are particularly fragile and sensitive to damage (e.g., alpine plateaus or areas containing rare plants).
- Large, intact ecosystems are better able to adapt to change, including climate change (e.g., changing fire frequency or temperatures), than fragmented ecosystems.
- Obtaining the required volumes of aggregates to support major transportation infrastructure may disturb large areas of land. Some potential sources of new aggregate materials (e.g., river valleys) are also areas of high ecological and cultural value.

17.3.1.2 Potential Impacts of Access on Wildlife

Access can have a number of potential impacts on wildlife species and habitat, including the following (Carmanah Research Ltd. 1995, Hamilton and Wilson 2001, Craighead 2002, Forest Practices Board 2005, Eos Research & Consulting Ltd. 2009, Daigle 2010, Union of BC Municipalities and Government of British Columbia 2010, and others specifically noted in the text):

Habitat damage, loss and modification

The easiest and cheapest places to build roads (e.g., valley floors, floodplains and south-facing slopes) are also typically high-value seasonal habitat for wildlife species such as moose, caribou and sheep. Clearing of vegetation and forest cover removes both active and potential wildlife habitat and creates opportunities for changes in species composition (e.g., invasive plants). Maintenance activities in road rights-of-ways can reduce habitat quality for birds and destroy nests. Human activity and the use of vehicles and machinery in an area creates potential for contaminated soil and plants.

Habitat fragmentation and movement barriers

Access roads and trails across habitat prevents wildlife from fully using preferred areas or migration routes, especially where they are required to cross long, wide stretches (wildlife are more likely to use larger, less interrupted areas). Roads, fences, buildings and other infrastructure create physical barriers to movement. Several forest-dwelling bird species exhibit reluctance to cross gaps in forest cover, and while other species do not appear to perceive roads as barriers to movement, their willingness to fly over puts them at risk for collisions (Kociolek et al. 2011).

Direct and indirect mortalities and injuries

Each year many animals are killed or injured by vehicles on roads. Moose are killed most frequently in winter when deep snow limits their movements outside of plowed rights-of-way (YFWMB 2003). Birds are more likely to collide with vehicles if they forage, roost or nest near roads, or are attracted to road salt. Collisions with linear features such as power lines account for a major source of bird mortality, and photo documentation exists for raptors that have died by getting their talons stuck on

sign posts (Kociolek and Clevenger 2011). Road mortality is an issue especially for populations or species that are already small, isolated, declining, threatened or endangered.

Roads and trails also make areas more easily accessible for hunting, which can be seen as a benefit for humans but can also lead to depletion of local wildlife populations. Increased human activity in the backcountry (e.g., mineral exploration and development, wilderness tourism, outfitted hunts and recreational users) also increases the likelihood of negative human-wildlife encounters, particularly bears and other “problem wildlife,” which often need to be relocated or destroyed. A study in British Columbia’s Rocky Mountains found that from 1971 to 1998 all the grizzly bears killed by humans (96 bears) were killed within 500 m of a road or trail (YFWMB 2003).

Animals may be poisoned by ingesting contaminants such as de-icing agents, petroleum-based compounds, chemicals and other substances that spill or accumulate on paved roads during construction, maintenance and use. Dust on unpaved roads can change the composition of vegetation, and gravel roads are sometimes treated with dust suppressants, the environmental and toxicological effects of which are not well understood (Kociolek et al. 2011).

Many sectors of the economy rely on helicopters and fixed wing aircraft to transfer equipment, collect samples, deliver workers and provide services to remote regions of the Yukon. Mineral exploration often occurs in mountainous areas that can only be accessed by aircraft; outfitting and ecotourism businesses operate in many remote areas; and aircraft-based tourism such as flightseeing, heli-hiking and heli-skiing has also increased steadily over the years. Many of these places are also home to caribou, sheep, and other alpine species like marmots and pikas. Caribou and sheep are susceptible to aircraft disturbance, especially at periods in their annual cycle that are most important for long term survival of the herd. Animals may exhibit a “startle reflex” response where they start running, which may result in injury or death if they are in steep or uneven terrain (EDI Environmental Dynamics Inc. 2008, Laberge Environmental Services 2006).

Modified behaviour patterns and predator-prey relationships

Many wildlife species will avoid roads and other infrastructure because of heavy traffic, noise, lights, smells and other signs of human activity, over the long term causing a shift in home range and migration routes.

Some wildlife species are more adaptable than others to human activity associated with roads (e.g., grizzly bears and wolverines tend to be more sensitive to disturbance), and some individual animals may have more or less experience with similar disturbances. The type of disturbance can influence reaction (number and type of people and machines, time of year and location within overall habitat). Public access to the backcountry in off-road vehicles is now common with powerful new technology and increasing numbers of ATV and snowmobile owners. In a study conducted near Revelstoke, British Columbia the aspects of snowmobiling most disturbing to caribou were human scent and large groups of machines moving rapidly around an area. Caribou were able to tolerate low levels of snowmobile use and, if not harassed, their tolerance would increase. Bears are more likely to be impacted by disturbance in the spring when they emerge from their dens and are physically stressed. Studies in the Talkeetna Mountains near Denali, Alaska show increasing recreational snowmobile use is beginning to change moose use of preferred treeline willow habitats. Moose are especially dependent on these habitats in the winter (YFWMB 2003).

Caribou and sheep responses to aircraft disturbance vary by: season or life stage; group size; group composition; frequency of disturbance; previous experience with disturbance - in contrast to the “habituation” response of some other mammals, caribou and sheep are more likely to respond if they have been previously exposed); type of aircraft - helicopters disturb more than fixed-wing because of greater noise, maneuverability and nature of work; flight elevation; and flight pattern (EDI Environmental Dynamics Inc. 2008, Laberge Environmental Services 2006).

Animals can also be disturbed by non-motorized traffic such as boaters and hikers. One study conducted in the Tombstone area found that following a disturbance by a hiker, hoary marmots became more vigilant and spent less time foraging. The paper recommends that managers set trails more than 200 m away from foraging areas to minimize disturbance (Cadsend and Jung, manuscript in preparation, as cited in Government of Yukon 2011).

Some animals are attracted to roads for ease of travel (especially in winter), available forage or road salt. Birds often rest on road surfaces because they retain heat, and associated road infrastructure like poles and bridges can create nesting sites. However, frequenting areas close to roads makes them more vulnerable to vehicle collisions and hunting pressure. Predators like wolves are also known to use roads for easier hunting, and scavengers like foxes and ravens will look to roads as a food source (roadkill). Some animals like bears or foxes may become habituated to human presence, and this usually results in the animal being destroyed.

Impacts on health, survival and reproductive success

Access and disturbance from human activities may cause wildlife to have higher stress levels, increased exertion and use of energy reserves by running away or moving more than usual. This is especially detrimental at critical times of the year (for caribou and moose these are the fly season, very cold weather in winter, late pregnancy and calving time). Animals displaced from their preferred or ideal habitat to avoid disturbance lose nutritional value and/or safety from predators.

Female caribou may abort embryos while running, or fetuses can be displaced leading to calving difficulties. Disturbance during calving season can affect calf survival if newborn calves are deserted, trampled or left unprotected from predators, or if nursing behaviour is interrupted. Caribou that spend more time running, walking and being alert sacrifice time that could be spent eating and digesting food. These costly behaviours may increase an animal's metabolism by 25 per cent. Prolonged or cumulative exposure to disturbance may result in loss of body weight, weakening and increased susceptibility to diseases and predation (EDI Environmental Dynamics Inc. 2008).

When disturbed, a sheep will become vigilant, stop eating, un-bed (get up from a lying position where they are ruminating), and/or flee. Each of these reactions costs the animal energy. If sheep stand up while they are ruminating, the digestion process stops, limiting the amount of energy and nutrition they absorb. Disturbance may also cause sheep to move to areas of poorer quality food. Frequent disturbances could eventually affect body weight and reproductive success. Research found that sheep tended to remain vigilant for up to 45 minutes after a disturbance had passed. If the disturbance happened while they were bedded, it took up to three times longer to re-bed or begin eating than if they were already standing or eating. In large groups, one sheep reacting to a disturbance caused the rest of the group to react, even if they weren't aware of the actual disturbance. There was no evidence to suggest that sheep become habituated to helicopter overflights. The first flight of each day seemed to create as great a disturbance as the first flight of other days (Lalberge Environmental Services 2006).

Traffic noise appears to have the most widespread and greatest indirect effect on birds since they rely extensively on acoustic communication. Anthropogenic noise masks the frequencies of calls used to attract mates, communicate with flock members or offspring, defend territories and detect predators. It causes shifts in territory and nesting site locations, redirection of flight paths and increased vigilance (with subsequently less foraging and/or feeding offspring). Impaired communication affects individual fitness, survival rates, reproductive success and even viability of a population. Many birds will abandon their nests if disturbed. Chronic industrial noise can reduce species richness, alter population age structure and change avian predator-prey dynamics. Reproductive success rates of ground-nesting birds are also often lower in roaded or linear habitats because of increased "edge effect" and nest predation by mammals such as foxes (Kocielek and Clevenger 2011).

17.3.1.3 Potential Impacts of Access on Fish and Aquatic Systems

Access can have a number of potential impacts on fish species and habitat, as well as on other aquatic species such as waterfowl, including the following (Carmanah Research Ltd. 1995, Hamilton and Wilson 2001, Craighead 2002, YFWMB 2003, Forest Practices Board 2005, Eos Research & Consulting Ltd. 2009, Daigle 2010, Union of BC Municipalities and Government of British Columbia 2010, and others specifically noted in the text):

Habitat damage, loss and modification

If roads are not carefully built and maintained, they can be damaging to fish habitat. The removal of vegetation near streams during construction can cause an increase in stream sediment and temperature, as well as removing several key features of riparian vegetation (shades streams and keeps them cool, provides a food source for fish, and provides debris for shelter). Human activity and the use of vehicles and machinery in proximity to streams can cause sedimentation and there is the potential for spills and contamination to affect water quality.

Habitat fragmentation and movement barriers

The construction, use and maintenance of access roads can involve draining natural wetlands, reducing the number and size of stream pools due to erosion and high sediment levels, altering streamflow patterns, interrupting or diverting groundwater flow, restricting or altering channels and streambed materials, restricting fish passage, blocking upstream migration, and eliminating or reducing access to spawning sites.

An improperly built culvert will stop fish from migrating upstream (e.g., too high means fish will not be able to pass, too steep means the water inside them will move too quickly for fish to swim against it). This may force fish to spawn in unsuitable sites or not at all. Even when roads do not cross streams, they can still affect them (e.g., an eroding road can affect water quality in nearby streams).

Direct mortalities and injuries

Where roads bisect wetlands, ducks can collide with vehicles while crossing the road. Fish can become caught in machinery or equipment, and fish fry can be smothered by sediments.

Impacts on health, survival and reproductive success

Increased sedimentation in streams can affect the development of fish eggs and fry and be harmful to invertebrates that fish feed on. Increased water temperature can cause migratory disruption, a decrease in reproductive success, and an increased vulnerability to disease. Removal of vegetation can increase vulnerability to predators and disease, and barriers to migration can affect population levels. Chemicals and contaminants such as road salt, oil and chemicals can pollute water. All of these impacts can cause reduced body mass, reproductive success, and survival of individuals and local populations.

17.3.2 Traditional Value

Tr'ondëk Hwëch'in citizen comments (Tr'ondëk Hwëch'in 2012):

We need to protect our land so that we can enjoy it. How can you enjoy the land when it is being torn apart?

We need to limit what we do on the land in order to protect the water.

Roads can be beneficial for berries.

Roads can be good for moose because willow grows.

We need to respect the land and not strip it all up.

Reclamation is good but won't replace what is lost.

Roads and vehicles chase the animals away and spoil the land.

Traditional access routes consisted of trail networks on land connected with water routes (rivers and lakes). This access network enabled people to move efficiently across the landscape to take advantage of resource harvesting opportunities at various locations and during different seasons. They joined camping locations, harvesting locations, important landscape features, and other significant gathering places. They also helped to maintain cultural traditions, a shared knowledge of place names and stories, development of trade relationships with neighboring peoples, transfer of technology and ideas, and resolution of disputes (Tr'ondëk Hwëch'in 2012).

These trails, routes and waterways remain important today for heritage resource values as well as contemporary activities such as subsistence harvesting, trapping, wood cutting, camping and other ways of connecting with the land for spiritual, cultural or personal well-being.

Access can have a number of potential impacts on traditional values, including heritage resources and traditional economic activities:

- New and/or easier access to areas previously inaccessible (and more ground disturbance from human activity) increases the potential for more discoveries of heritage resources as well as damage and looting. Many archaeological sites and heritage features are unknown and/or undocumented, and many types of heritage resources would not be recognizable to an untrained eye. Human activity, clearing of forested areas, the use of heavy equipment and machinery, and vehicle traffic all cause ground disturbances that could impact these resources. However, the increased potential for finding heritage resources could be viewed as positive by contributing to greater knowledge and promoting the planning region's history (e.g., placer miners finding mammoth bones has made the Dawson area a hotspot for palaeontological research).
- The Tr'ondëk Hwëch'in definition of heritage resources also includes traditional economic activities such as hunting, fishing, trapping, berry picking and harvesting medicinal plants. Therefore, any impacts to the land, water, fish and wildlife will by extension impact the traditional economy (subsistence harvesting activities, movement on the landscape and social and cultural connections). Increased levels of access could impact these culturally significant areas positively (making it easier to get to areas of importance) or negatively (also opens these areas to other land uses and users).
- Increased access could create more opportunities and easier travel for subsistence hunting and trapping. On the other hand, shifting home ranges and migration routes due to avoidance of disturbance could make it more difficult to locate wildlife. Changes in population numbers, body condition and health would also influence hunting and trapping success.
- Increased access could create more opportunities and easier travel for subsistence fishing activities. On the other hand, impacts to water quality, fish health and populations, and migration timing due to disturbances could make it more difficult.

17.3.3 Socio-Cultural Value

Traditional trail networks and access routes facilitated movement of people across the landscape, enabling them to share resources and knowledge. Continued use of these access networks today enables people to be out on the land and water, teaching cultural traditions and maintaining important social connections. Trading networks (facilitated by trails and water access routes) also functioned as a means to provide environmental information about distant locations, situations, events and changes. Trade and exchange of resources provided people with goods not readily available in their area, helped ensure peace among groups, facilitated transfer of new knowledge and technologies, and enriched Aboriginal culture through customs such as ceremonial rituals, dance and trading protocol (Tr'ondëk Hwëch'in 2012).

Many trails and other access routes (on land and water) have multiple users – snowmobilers, dog mushers, skiers, ATV riders, hikers, bikers, horseback riders, walkers, runners, trappers, hunters, fishers, berry pickers, boaters, canoeists, kayakers and more. For example, old mining trails in the Dawson area that were becoming overgrown are being actively cleared for other activities. A member of the local snowmobile association, the Dawson Sled Dawgs, noted that “the trails are there so you might as well use them” and “opening up new trails will give locals more recreational options because they could also be used in the summer by hikers, horseback riders and ATVerS” (Yukon News 2007).

Access can have a number of potential impacts on socio-cultural values, including traditional economic activities, tourism and recreation:

- Potential impacts of access and industrial development on land, water, fish or wildlife also affects traditional economic activities, which in turn impacts self-identity, fundamental cultural values obtained through connections to the land, and social and community well-being.
- Increased roads and trails can facilitate increased use of otherwise remote areas, resulting in more opportunities for hunting, fishing and recreational activities (e.g., ATV/snowmobile use, dog sledding, camping and hiking).
- Loss of visual aesthetics in particular areas would impact businesses that rely on wilderness experiences and scenic viewscapes (e.g., wilderness tourism or outfitting).
- Expanded opportunities for off-road vehicle use (e.g., ATVs, snowmobiles and dirt bikes) on new access routes could create more opportunities for the tourism industry. However, unmanaged off-road vehicle use can degrade soils, riparian and wetland areas and disturb wildlife.
- Increased activity levels (e.g., large-scale random camping) and use of popular routes and destinations can result in areas being “loved to death” (impacting environmental values), or becoming non-desirable (too crowded) for those seeking more wilderness experiences.
- New access could create new opportunities for guided trips or recreational activities. Roads constructed for mining or forestry could provide access for a new tourism destination or one only accessible by air before (this would mean increased options for operators and more economically viable for larger numbers of people).

Land use and resource conflicts may arise where access constructed for the purposes of mineral exploration facilitates other activities such as forestry, hunting, recreational use, or even other mineral exploration and development. Increased resident and visitor use of popular routes and destinations may impact cultural values and conflict with traditional economic activities. Roads or trails currently used on a seasonal or temporary basis may have multiple users, but if the road became all-season or permanent these uses could overlap and conflict. For example, the Dawson Trail may have potential for all-season access to the White Gold region, which could result in conflicts between other users of the trail such as tourism, dog-mushing, mining, hunting and recreation (Government of Yukon 2011*d*). However, various industries are finding ways to work together to resolve some of these issues (e.g., the Memorandum of Understanding between Yukon Chamber of Mines, Klondike Placer Miners Association, and Tourism Industry Association of Yukon – discussed in section 17.4 on Resource Management).

17.3.4 Economic Value

According to Government of Yukon (2011*d*), maximizing the available land base in the planning region is necessary for ongoing economic development. Access fragmentation and access restriction to areas of mineral potential affects the ability to identify and achieve an economic and sustainable land base for further mineral resource exploration and development. Economic viability for large-scale development will partially depend on access roads to the resources, as well as improvements

required to existing transportation infrastructure. Placer mining requires access to, and the ability to modify, rivers and streams, and future exploration and development of placer resources depends on continued access to valley bottom and riparian zone land in the planning region. The placer industry also requires roads for transporting heavy equipment and an industrial land base for mining operations adjacent to the resource. Development of oil and gas resources in and north of the planning region is dependent on access to potential industrial customers in the south, such as the mining belt in the southern portion of the planning region. Viability of forest harvesting in the planning region generally requires access with limited road building requirements (three to five kilometers off existing all-season roads and within 1.5 hours drive from Dawson City). Access is needed for potential future renewable energy producers in the planning region to be able to connect to Yukon's electrical energy grid. Surficial materials (i.e., aggregates like sand and gravel) are key resources required to build roads and pipeline corridors. Adequate gravel resources are also required to maintain and upgrade any new roads or existing roads with increased traffic.

New all-season access roads and infrastructure will likely be a response to demand from industry (i.e., they would not be constructed if there was no significant increase in land use activities or a major resource discovery). Most new discoveries are located far from current roads, and almost all materials are transported in and out by air and/or barge during the exploration phase. Helicopters are able to fly and land almost anywhere and are used mostly in claim staking and exploration activities. Remote airstrips are required for fixed-wing aircraft at established exploration projects, and advanced development projects will require all-season roads.

The Government of Yukon provides financial and material support to industry to develop resource access roads in Yukon through the Resource Access Roads Program (described in detail in the Section 17.4 Resource Management, along with the guiding Resource Access Roads Framework). The primary focus of this program is to assist resource-based companies upgrade existing roads, including adding granular material and installing culverts and bridges. Under certain conditions, assistance may also be available for development of new roads, airstrips and docks. Total funding for 2009 to 2010 was \$1 million including \$220,000 for the Dawson Gold Field Road (Government of Yukon 2012*a*).

The Government of Yukon collects a royalty fee for aggregates (i.e., sand, gravel, rock and topsoil) that is paid at the time a quarry permit is applied for. There is no charge for a permit to remove less than 10 m³ of topsoil and 35 m³ of other materials per year for personal use (Government of Yukon 2011*a*).

A large portion of the economic cost of aggregate resources is its transportation to where it is being used. Transportation costs can quickly exceed extraction costs and royalty charges. Therefore, the most valuable sources are in close proximity to the point of consumption and are ideally located within 15 km of projects to keep hauling costs reasonable (Government of Yukon 2011*b*). The location of accessible aggregate deposits could influence the location of future transportation infrastructure and industrial development.

Construction, maintenance and life span considerations for roads are an important economic consideration related to aggregate resources in the planning region. Most major roads in the Yukon use, or are being upgraded to, Bituminous Surface Treatment (BST). BST has been used on Yukon highways since the 1970s, initially for dust control on gravel roads as an alternative to calcium chloride. It has since been developed as an inexpensive paved surface on low volume roads and as a stage replacement for asphaltic concrete on fully designed pavement structures. In order to maintain an acceptable level of service, significant expenditures on maintenance are required. The cost of applying BST varies depending on the geographical area and the proximity of that area to emulsion supply and gravel resources. Generally speaking, in the western/northern Yukon BST costs approximately \$1.80/m² or \$18,900 per km (assuming a 10.5 m wide surface), and an additional

\$0.20-\$0.25/m² is added for the cost of aggregates. Approximately 200,000 m³ of aggregate is crushed annually in the Yukon for maintenance purposes. Of this, approximately 73,000 m³ is produced and used as BST aggregate. The remainder is sanding aggregate, resurfacing aggregate or base aggregate (Government of Yukon 2012a).

Secondary gravel roads maintained by government, as well as unmaintained bush roads, trails and winter access routes are also important infrastructure assets that allow access for economic activities. These types of access features are of only limited use to large-scale industries such as hard rock mining because they cannot handle intensive use and heavy loads. However, they are considered extremely valuable to the mineral exploration, placer mining, forestry and tourism industries, as well as to the traditional economy. For example, in mineral exploration an existing road or trail is a key factor in a prospector's ability to sell or option claims as few companies are willing to acquire remote prospects. Even a rough road can substantially reduce exploration costs by eliminating the need for helicopter support, especially for mobilizing equipment that is too heavy to move by normal helicopter. In many cases, relatively little work is required to make the road passable. As well, given the cyclical nature of metal pricing, activity on claims may be suspended for a period of time. Access roads that are not required to be decommissioned at the end of each season are essential for rapid advancement from staking to large drill programs when mineral prices are high. These non-government maintained access features are also used by tourists and others looking for outdoor recreation opportunities, as well as by First Nations for hunting, fishing, trapping and other subsistence harvesting activities (Archer, Cathro & Associates (1981) Limited 2012).

Many economic development opportunities in the planning region are limited because of inaccessibility and lack of infrastructure, and new roads constructed for one resource sector could make other sectors economically viable (e.g., a new mining road could provide access for a forestry operation or tourism destination). However, roadless areas have high ecological integrity, and businesses such as ecotourism or guided outfitting that rely on visual aesthetics and a "wilderness" experience could be negatively impacted by the loss of those qualities through clearing of vegetation, traffic, noise, or changing wildlife population numbers and locations. There is the potential to utilize traditional trail networks or marine routes instead of roads to create options for development in locations that would otherwise be inaccessible, without extensive infrastructure investments or high maintenance costs and with fewer environmental liabilities (Tr'ondëk Hwëch'in 2012).

17.4 Resource Management

17.4.1 Regulatory Framework

17.4.1.1 First Nation Final Agreements

Chapter 6 of Yukon First Nation Final Agreements specifically deals with access to Crown land within that particular Traditional Territory as well as conditions of access on Settlement Land, and there are various other provisions related to access and transportation in other chapters. Access provisions in the Tr'ondëk Hwëch'in Final Agreement (TH – DIAND 1998) include but are not limited to the following:

- A Waterfront Right-of-Way exists from the high water mark to a distance of 30 metres inland, for all navigable waters which border on or are within Settlement Land (5.15.1). Any Person has a right of access, without the consent of the First Nation, to use that Right-of-Way for travel and non-commercial recreation including camping and sport fishing (5.15.3). Consent or an order of the Surface Rights Board is required for access for commercial recreation purposes and if a permanent camp or structure is built (5.15.5, 5.15.6).

- A Person has a right of access, without the consent of the First Nation, to enter, cross and make necessary stops on Undeveloped Settlement Land to reach adjacent non-Settlement Land for commercial and non-commercial purposes (6.3.1). This is conditional on the access being of a casual and insignificant nature; the route used is generally recognized or was used in the past on a regular basis; and no significant alterations are made of the route.
- A Person has a right of access, without the consent of the First Nation, to enter, cross and stay on Undeveloped Settlement Land for a reasonable period of time for all non-commercial recreational purposes (6.3.2).
- The rights of access provided by all these clauses are subject to the conditions that there shall be no significant damage to Settlement Land or improvements on Settlement Land, no mischief committed, and no significant interference with the use and peaceful enjoyment of Settlement Land by First Nations (6.1.6).
- A Yukon Indian Person has a right of access, without the consent of Government, to enter, cross and stay on Crown Land and to use Crown Land incidental to such access for a reasonable period of time for non-commercial purposes (6.2.0), if it is of a casual and insignificant nature or if it is for the purpose of harvesting fish and wildlife.
- Other access to Settlement Land may be granted with the consent of the First Nation or, failing consent, with an order of the Surface Rights Board setting out the terms and conditions of the access. Such an order would normally not be granted unless the Person seeking access satisfies the Board that such access is reasonably required, and is not also practicable and reasonable across Crown Land (5.15.6 and elsewhere in Chapter 6).
- Terms and conditions of this other access may include seasons, times, locations, method or manner of access (6.6.2). This would only be done to protect the environment; protect Fish and Wildlife or their habitat; reduce conflicts with traditional and cultural uses of Settlement Land by the First Nation; or protect the use and peaceful enjoyment of land used for communities and residences (6.6.3).
- Government will endeavor to locate any new quarries on non-Settlement Land and eliminate the use of existing quarry sites on Settlement Land by finding alternative sites. Some Settlement Land parcels are subject to further identification of quarries (18.2.5.2).
- Access to Settlement Land for an existing mineral right (18.3.0) is subject to similar clauses as in 6.3.1.
- Access to Settlement Land for a new mineral right (18.4.0) is subject to similar clauses as in 6.3.1 for Category B and Fee Simple lands. However, there is a right of access without the consent of the First Nation if “the exercise of the right of access does not require the use of heavy equipment or methods more disruptive or damaging to the land than hand labour methods” (18.4.2).

17.4.1.2 *Tr’ondëk Hwëch’in Land and Resources Act*

The *Tr’ondëk Hwëch’in Land and Resources Act* (2004) provides greater detail on the rights of access granted in the Final Agreement and states minimum terms and conditions for exercising that access. In particular, unless otherwise authorized by a Tr’ondëk Hwëch’in law, no person shall (Section 9):

- (a) cause significant damage to the land or to improvements on the land;
- (b) cause or commit mischief on the land;
- (c) cause significant interference with the use and peaceful enjoyment of the land by others;
- (d) disturb a burial site, a site of paleontological or archaeological interest, a historic site or a heritage site which may be found within the land;
- (e) allow any petroleum product, chemical or any other substance hazardous to the environment, people or wildlife to be stored or transferred in such a manner as to allow spillage into a body of water or the land; or

- (f) abandon or discard on the land rubbish, refuse, garbage, packaging, containers, glass, paper, metal, soil, manure, sewage, the whole or part of a vehicle or machinery, or any material used in construction or resulting from demolition.

Section 7 defines “traditional activities” as those undertaken by a Tr’ondëk Hwëch’in citizen on a non-commercial basis for the purpose of obtaining food or providing for subsistence, or for a ceremonial, spiritual or cultural purpose, and any activity incidental thereto, and includes trapping. A beneficiary of the Final Agreement has the right to use and occupy the land for the purpose of carrying on a traditional activity, including but not limited to:

- (a) exercising rights under Chapters 16 and 17 of the Final Agreement [Fish and Wildlife and Forest Resources];
- (b) gathering flora and fungi for food or medicine;
- (c) harvesting dead timber for personal use as firewood; or
- (d) spiritual or ceremonial activities.

The act also provides authority for Tr’ondëk Hwëch’in Government to: designate areas for specific land or resource management purposes; issue permits with terms and conditions for the exercise of access or the use of land and resources (e.g., leases, quarry concessions, easements, access permits or grazing permits); charge fees, rents, or royalties and/or require financial security; designate stewards with monitoring, inspection and enforcement capacities.

Various regulations (2004) have been established under Section 120 of the act, including:

- Permit Regulations
- Lease Regulations
- Disposition Regulations
- Central Tr’ondëk Land Management Area Regulations
- Quarry Regulations

These regulations, as well as terms and conditions in permits or leases, may have additional requirements regarding access, including controls on use where significant traffic or significant impact on wildlife or harvesting is a concern.

17.4.1.3 *Lands Act and Territorial Lands (Yukon) Act*

The Government of Yukon’s Department of Energy, Mines and Resources, Lands Management Branch manages the majority of public land in the territory under the *Lands Act* (RSY 2002, c 132) and the *Territorial Lands (Yukon) Act* (SY 2003, c 17). Pursuant to this legislation, the branch regulates the disposition of land including sales, leases and grants of rights-of-way or easements, as well as temporary use or work on public lands. A land use permit is required for activities such as: site clearing or earth work; constructing a new road, trail or access; clearing or installing a utility right-of-way; establishing quarries; and conducting geotechnical or hydrological studies. The legislation also applies to land-based activities that occur directly adjacent to water (Government of Yukon 2011f).

17.4.1.4 *Highways Act*

The *Highways Act* (RSY 2002, c 108) regulates public roads. Under the act, a highway includes land used as a highway, land surveyed for use as a highway, and land designated by the Commissioner in Executive Council as a road allowance. Bridges or other public improvements to a highway and ice roads are also included within the definition (Government of Yukon 2011f).

Section 14 of the act permits the Minister to close a highway or a portion of a highway to traffic for highway construction or maintenance, protection of the highway, protection of the public, or protection of the environment. Section 24 allows the Commissioner in Executive Council to make regulations regarding the use of highways, including restrictions on classes or weights of vehicles that

may be operated. Part 5 of the act is titled Access Control, and allows the Commissioner in Executive Council to establish controlled highways and control access to/from those roads. Section 44 (1) states that the Commissioner in Executive Council may make regulations regarding: the designation of maintained highways; standards and conditions for the use of highways; the design, location and construction of any means of access to or from a controlled highway; and the operation of ferries.

The *Highways Regulation* (OIC 2002/174), Schedule 1 provides a list of all maintained highways in Yukon, and other sections discuss required permits (i.e., Highway Access Permit) and terms and conditions of access from any of these listed highways. For example, requirements for a Highway Access Permit could restrict access to an oil and gas site for safety reasons. Various other regulations have also been established for closures of roads or portions of roads.

17.4.1.5 *Area Development Act*

The *Area Development Act* (RSY 2002, c 10) permits the Commissioner in Executive Council to designate as a development area any area in Yukon where it is considered necessary in the public interest to regulate its orderly development.

A portion of the Dempster Highway was designated as such under the *Dempster Highway Development Area Regulations* (CO 1979/064), specifically the area from Km 68 to the Yukon-Northwest Territories border, for eight kilometres each side of the centre line. Section 7(1) of the regulations states that except with the permission of the Development Area Administrator, no person shall:

- (a) undertake or cause any development in the Dempster Highway Development Area;
- (b) use or operate a vehicle, other than a snowmobile, in any part of the Dempster Highway Development Area other than the Dempster Highway and designated access and egress points such as campgrounds, highway maintenance camps and commercial travel facilities;
- (c) subject to subsection (2), allow a domestic animal to roam uncontrolled [Subsection 2 refers to horses owned by licensed outfitters]; or
- (d) use a vehicle on the Dempster Highway from kilometre 68 to the Northwest Territories border when the Highway has been closed by order of the Commissioner.

Section 7(5) adds that no person shall operate a snowmobile in any part of the Development Area other than those listed in 7(1)(b) during a closure period established by the Administrator for purposes of habitat protection.

Section 9(6) also applies to the Dempster Highway Development Area and specifically refers to the use of vehicles for hunting purposes:

9(6) No person shall use a vehicle, including a snowmobile, for the purpose of hunting, transporting hunters, or transporting big game animals in any part of the Dempster Highway Development Area during a closure period established by the Dempster Highway Development Area Administrator from time to time for purposes of habitat protection, other than the Dempster Highway and designated access and egress points to developed areas used for such purposes as campgrounds, highway maintenance camps, commercial travel facilities, telecommunication towers, and other similar infrastructure or facilities.

The *Tombstone Territorial Park Management Plan*, Section 3.0, identifies the Tombstone Corridor as excluded from the Park to “provide for continued highway maintenance activities, a possible future pipeline, transmission line or other public visitor infrastructure that may be required along the Dempster Highway.” The Tombstone Corridor is to be managed under the *Area Development Act* and is not subject to the provisions of Chapter 10, Schedule A of the Tr’ondëk Hwëch’in Final Agreement [matters related to the establishment of the park]. The Government of Yukon has

committed to manage the Tombstone Corridor in a manner that respects park values and, subject to the Tombstone Corridor objectives, is consistent with this management plan.

17.4.1.6 *Placer Mining Act and Placer Mining Land Use Regulation*

Section 1 of the *Placer Mining Land Use Regulation* (OIC 2003/59) under the *Placer Mining Act* (SY 2003, c 13) provides the following definitions related to access features and use:

- “access road” means a road that provides access to a public highway or to a private road
- “corridor” means a path from which trees and brush have been cut to accommodate a trail, water line, fuel line or power line
- “isolated road” means a road that does not provide access to a public highway directly or through a private road
- “road” means a pathway for vehicular traffic the construction of which requires the movement of rock or earth
- “trail” means an access to a site within a claim or lease that is constructed with little or no movement of rock or earth
- “upgrading,” in relation to a road, means re-establishing a road that has not been useable for more than five years by vehicles of a type the road was originally designed to serve; modifying a road to provide usability for vehicles that are of a different type than those for which the road was originally designed to serve; and any other upgrading or modifying of a road, other than for maintenance or erosion control

Schedule 1, Part L of the regulation provides further details on the use of roads and trails:

- All vehicles must be operated to avoid rutting and gouging of roads and trails.
- Off road and trail routes must be reconnoitered and must be used in a way that minimizes ground disturbances, including damage to permafrost and sensitive wildlife habitat.
- If rutting, gouging, ponding, or permafrost degradation occurs off road or trail, vehicle use must be suspended or relocated to ground that is capable of bearing the weight of the vehicle without causing such damage.
- Use of skids on permafrost or wet ground is only permitted outside of winter where it is not reasonable to use any other means of transporting equipment.
- Routes for trails must be reconnoitered and flagged.

A number of criteria are also used in Section 3 of the regulation to determine whether activities may proceed as Class 1 activities without further notification or approval (Table 17-1).

Table 17-1 Class 1 access criteria – placer mining operations

Activity	Class 1 Criteria
Construction of lines	Not exceeding 1.5 m in width and cut by hand or with hand held tools
Corridors-width	Not exceeding 5 m in width
Corridors-length	Total length not exceeding 0.5 km
New roads	Not authorized
Upgrading of roads	Not authorized

Activity	Class 1 Criteria
Use of roads or trails	Within the design limits or tolerances of the road or, if unknown, vehicles with a gross vehicle weight of less than 40 t for roads and less than 20 t for trails
Off-road use in summer	Low ground pressure vehicles only (35 kPa pressure or less)
Off-road use in winter	Low ground pressure vehicles or vehicles with a gross vehicle weight not exceeding 40 t used over a distance of not more than 15 km

Activities exceeding Class 1 criteria require review and approval under YESAA. Operations that exceed any of the Class 2 criteria or that involve construction of a structure with a foundation are considered Class 3, and any operation that requires a water licence under the *Waters Act* is considered Class 4.

17.4.1.7 *Quartz Mining Act and Quartz Mining Land Use Regulation*

Section 1 of the *Quartz Mining Land Use Regulation* (OIC 2003/64) under the *Quartz Mining Act* (SY 2003, c 14) utilizes the same definitions for access features as the *Placer Mining Land Use Regulation* above. Schedule 1, Part L, Items 33 to 37 also uses the same wording for activities related to the use of roads and trails as above, but also adds one additional (38):

In addition to any remedial action required in relation to Item 2 of this Schedule [re-establishment of vegetative mat], temporary trails must be blocked to prevent further vehicular access.

A number of criteria are also used in Section 3 of the regulation to determine whether activities are considered Class 1 or Class 2, including the following related to access and linear features (Table 17-2).

Table 17-2 Class 1 access criteria – quartz mining operations

Activity	Class 1 Criteria
Construction of lines	Not exceeding 1.5 m in width and cut by hand or with hand held tools
Corridors-width	Not exceeding 5 m in width
Corridors-length	Total length not exceeding 0.5 km
New roads	Not authorized
Upgrading of roads	Not authorized
Establishment of trails,	Not authorized
Establishing or using temporary trails	Not authorized on Settlement Land; otherwise only if width max. 7 m (or 1 m more than width of equipment to be moved), total length max. 3 km, and trail used only for moving sampling equipment between test sites
Use of existing roads or trails	Within the design limits or tolerances of the road or, if unknown, vehicles with a gross vehicle weight of less than 40 t for roads and less than 20 t for trails
Off-road use in summer	Low ground pressure vehicles only (35 kPa pressure or less)
Off-road use in winter	Low ground pressure vehicles or vehicles with a gross vehicle weight not exceeding 40 t used over a distance of not more than 15 km

The criteria also refer to helicopter pads as a type of surface clearing, with restrictions on the number and area of clearings permitted per claim. Operations that exceed any of the Class 3 criteria are considered Class 4. Mining Land Use Authorizations and Quartz Mining Licences are issued pursuant to these regulations. Land Use Permits may also be required. Planning and approval of major mine developments, including road construction and decommissioning, would be guided by the Mine Site Reclamation and Closure Policy and Security regulations.

17.4.1.8 *Forest Resources Act and Forest Resources Regulation*

Part 4, Section 32 of the *Forest Resources Act* (SY 2008, c 15) contains the following provisions regarding establishment of roads for the purposes of forest resource harvesting:

- 32 (1) Despite anything in any other enactment, the Director may construct or authorize the construction of roads to assist forest resource harvesting and may
- (a) maintain and administer these roads;
 - (b) limit the loads carried by vehicles using these roads;
 - (c) restrict the use of these roads to seasonal use or for reasons of public safety, environmental protection or fish and wildlife conservation;
 - (d) by order, close and decommission, in whole or in part, a road constructed under the authority of this subsection; and

(e) authorize, by order, a person to use the road to access forest resources or other renewable or non-renewable resources.

(2) No person may clear any forest resources for the purpose of constructing a road or trail to assist with forest resource harvesting except as authorized by a cutting permit.

(3) Despite anything in a cutting permit, where the Director considers it necessary for the purposes of managing or protecting forest resources, the Director may, by order, close the road or order any person responsible for the construction or maintenance of the road to close the road.

(4) A road constructed under the authority of subsection (1) is not a highway under the Highways Act.

In addition to new roads constructed for the purpose of harvesting forest resources, existing roads may also be designated as a forest resources road if the road:

- Requires modification or maintenance;
- Is not a highway under the *Highways Act*; and
- Will provide access for harvesting or forest management activities.

All forest resources roads are to be posted with appropriate signage indicating road name, restrictions on use, and phone number of the local Client Service & Inspections office (Government of Yukon 2013b).

The *Forest Resources Regulation* (OIC 2010/171), Part 7 states that no person may construct, modify, maintain or decommission a forest resources road or use a motor vehicle on a forest resources road without authorization (obtained through a harvesting licence, forest resources permit, cutting permit, or forest resources road permit). Upon completion of forest resource activities, the road is to be decommissioned according to terms within planning documents and the current standards. A security deposit may also be required from the holder of a forest resources road permit. Section 62(2) notes that in fixing the amount of security, the Director must consider the cost to restore the area that may be affected by the use of the road and to remedy or reduce any environmental impacts associated with the use of the road.

Section 64 permits the Director to suspend or cancel a forest resource road permit if the permit holder is not in compliance with the terms and conditions, or if use would create a safety hazard or unjustifiable damage to the environment.

Other sections permit the Director to close the road to use by any persons other than the permit or licence holder; to establish guidelines or standards for the construction, maintenance, modification and decommissioning of the road; and to limit the type of motor vehicles using the road.

Regardless of who constructs, modifies or maintains a forest resources road, ownership of the road remains with government (Section 68).

17.4.1.9 *Navigable Waters Protection Act*

The federal *Navigable Waters Protection Act* (1985) regulates and protects the public's right to marine navigation on all navigable waterways in Canada.

Recent federal legislative changes (Bill C-45) include renaming the act to the *Navigation Protection Act* and restricting its application. In the Yukon, only the Yukon River and the Arctic Ocean will remain covered under the new act, with Transport Canada as the decision body for projects. According to YESAB staff, this will not be a major change since it is rare that developments on waterways (e.g., bridges or roads) are proposed in isolation. They are usually included in larger development proposals such as a mine, oil and gas development, or transmission line and are assessed accordingly. However, the Yukon Conservation Society has expressed concern that in the Yukon, waterway

navigation is not confined to proposed development projects. It also means recreation, tourism operations and subsistence fisheries and impacts to those activities are no longer protected under the new act (Winter 2013).

17.4.1.10 *Waters Act*

The *Waters Act* (2003) regulates the use, diversion and discharge of water (both surface and ground water) from waterbodies in the Yukon, as well as the deposit of waste into waterbodies.

Many development activities that impact a water body will require a water licence (e.g., stream crossings, pipelines, erosion control measures, construction of bridges and docks, and installation of culverts). Schedules 5 through 10 of the *Waters Regulation* define the activities and uses that trigger the need to obtain a water licence, including: direct water use; watercourse crossings including pipelines, bridges and roads; altering the flow or direction of a watercourse; depositing waste into waterbodies; constructing flood control structures; any other use that would have significant environmental effects; and any use that would interfere with the rights of other licensed water users.

Water licences are issued by the Yukon Water Board with specific terms and conditions and a list of monitoring requirements (see **Section 2 – Chapter 9 – Water** for more information).

17.4.1.11 *Wilderness Tourism Licensing Act*

The *Wilderness Tourism Licensing Act* (RSY 2002, c 228), Section 14(1) permits the Commissioner in Executive Council to make regulations including the following, which could pertain to access management:

- (c) limiting the type, use, volume, location, and duration of wilderness tourism activities for conservation purposes or sustainability of the wilderness resource; and
- (p) establishing standards for vehicles and equipment to be used in a wilderness tourism activity.

The current *Wilderness Tourism Licensing Regulation* (OIC 1999/69) does not contain any regulations related to these specific matters.

17.4.2 Policy Direction

17.4.2.1 Transportation infrastructure maintenance

In terms of the *Highways Act*, roads built by developers for their own purposes typically remain private. Otherwise, they are designated as public roads unless access is specifically limited by the Minister under the act. Private resource roads where access may be restricted are generally of a limited life span, and the Government of Yukon’s Department of Highways and Public Works (YG-HPW) generally requires that the road be gated or signed indicating it is not a public road. The general meaning of “access” to YG-HPW is the point where the new road intersects the main highway or secondary road within the highway right of way. It would be highly unlikely YG-HPW would ever deny a resource-type access. However, they do insist that the point of access to the main highway meets all safety standards, and request that the Department of Energy, Mines and Resources include road reclamation requirements in the land use permit (Government of Yukon 2012*b*).

YG-HPW, Transportation Engineering Branch manages planning and budgeting, monitors condition of infrastructure, and maintains information on land and granular resources associated with highway infrastructure.

Quarrying activities administered by the Government of Yukon include (Government of Yukon 2011*a*):

- Quarry leases – sites in planned quarry projects on Yukon land are leased to individual

- contractors or operators, or individuals may apply to lease stand-alone parcels.
- Designated public/community pits – provide small quantities of granular material for the general public and small contractors.
 - Highway pits – With the consent of YG-HPW Transportation Maintenance Branch, users may remove raw gravel (pit run) from government pits. However, all stockpiles of crushed gravel are for government use only.

A quarry permit is required for all of these activities and is issued by the Department of Energy, Mines and Resources, Land Management Branch. Quarry permits specify how much and what type of material to be taken, start and finish date, and other conditions that may deal with pit reclamation. Some quarry activities, such as new pit development, may be subject to review under YESAA.

Closure and reclamation of gravel pits is undertaken on both a temporary and permanent basis. Operations will cease at a gravel pit when all the material needed has been extracted, or if the supply has been exhausted. Operations may also cease temporarily if material is not required on a constant basis, as is the case with many highway maintenance pits. When closed temporarily, YG-HPW ensures that clean up addresses erosion, drainage or contaminated soils within the pit. Some pits may appear abandoned as they are only used every five to 10 years (Government of Yukon 2011*b*). When a pit is closed permanently, the developer must follow a reclamation plan that includes removal of all garbage and debris from the site, erosion control and treatment of any contaminated soil. Seeding, planting and fertilizing may then occur as well as reclamation of the access road and removal of access from the highway.

17.4.2.2 Resource Access Roads Framework (2013)

The Resource Access Roads Framework (RARF) was recently finalized by the Yukon government following a public consultation in the latter part of 2012. It outlines the goals and principles that guide decisions around the development and management of resource access roads and is supported by operational procedures and guidelines.

For the purposes of the framework, resource access roads are defined as “all routes needed by industry to access their properties and move their product to market” (Government of Yukon 2013*e*). They include routes maintained by YG-HPW, routes not maintained by YG-HPW but still used by the public, and resource roads used by industry. The RARF applies to quartz or hard rock mining and oil and gas sectors, as well as any placer mining operations that are large enough in scale. The policy does not apply to forestry, tourism or agriculture industries as these are governed by other policies and regulatory instruments. However, the use of resource access roads by these other industries can be accommodated within shared road use provisions.

Principles of the RARF include: managing resource access road development to minimize the potential for unsustainable maintenance costs or ongoing liability for government; consideration of potential socio-economic benefits as well as potential negative environmental and socio-economic impacts of proposed road projects; and maximizing the public good while minimizing risk.

The RARF states that it will “minimize impacts by ensuring shared access routes whenever possible,” but does not discuss planning of regional corridors or otherwise designating access routes. Instead industry is “encouraged” to work together to bring forward shared-use arrangements to government, who may then facilitate cost-sharing arrangements between the users. Agreements would also include any restrictions to use, access controls (whether physical or signage), and cost recovery mechanisms.

The RARF notes that development of new public access roads will be discouraged, and that all new roads for resource development will be decommissioned to an appropriate level upon completion of the project, unless otherwise determined by Government of Yukon. It also notes that access management will be key to controlling public use. When deciding on the closure of roads,

Government of Yukon will consider social and economic benefits as well as potential environmental risk. In some cases, the potential for future industry use may warrant minimal decommissioning, such as taking out a bridge rather than reclaiming a whole road. Other situations may warrant minimal reclamation by virtue of their remoteness, and simply use signage indicating they are private roads to mitigate liability concerns.

17.4.2.3 Resource Access Road Program (RARP)

The RARP (Government of Yukon 2009) recognizes that resource access roads are a key link in industry transportation corridors, enabling exploration and extraction activities to take place and fostering economic development. Year-round access is often essential to the viability of projects. The Government of Yukon provides financial and material support to industry to assist companies with upgrading existing roads to the point where they can be maintained for public use year-round (Government of Yukon 2012a).

17.4.2.4 Forest resource roads and forest management

The recently approved *Dawson Forest Resource Management Plan* (Dawson Forest Management Planning Team 2013) includes a number of strategic directions for access management, including but not limited to:

- Consider concentrating logging in some areas, and leaving other areas undeveloped, as well as utilize existing access in order to reduce land use conflict caused by road access and human caused disturbance (5.2.3).
- Integrate management of valued viewsapes into planning along the Dempster and North Klondike highway corridors and major recreational and historic trails and routes, including waterways. Design harvest blocks that simulate natural forest openings and blend into the landscape to reduce the visual impacts (5.6).
- Incorporate access management into development planning. The primary objective is to minimize creation of long-term access, and ensure that deactivation and decommissioning of access is addressed (5.7).
- When possible utilize existing access and integrate with other forest land users (i.e., mining sector, tourism) (5.7).
- Consider available methods of access control and management to minimize indirect negative impacts (i.e., gates, natural barriers, hunting restrictions and seasonal access) (5.7).

Section 5.7 also notes that “access can be both positive and negative depending on the user. Improperly built or poorly engineered roads can be the single largest environmental impact associated with harvesting operations, especially at water crossings. Roads built to access natural resources often persist long past their intended purpose, causing other land use issues to arise.”

Access management objectives are considered during strategic community-based forest resource management planning and at the operational timber harvest planning stages. Depending on the objectives, the public and other potential users may or may not be permitted to use the road. Road construction, modification and/or decommissioning activities may be negotiated as part of the harvesting licence. Opportunities for input are provided through the YESAB review required for all new roads (Government of Yukon 2013b and 2013d).

Under Section 23 of the *Forest Resources Regulation*, Government of Yukon’s Forest Management Branch has established a number of standards and management guidelines. These identify operating procedures for forest resource harvesting and related activities as described in timber harvest plans, woodlot plans or site plans. Their purpose is to ensure that the management of forest resources occurs in a sustainable manner and with consideration to other values on the land base.

[The following are available online at <http://www.emr.gov.yk.ca/forestry/442.html>]

Incorporating Land User Interests Standards and Guidelines (October 11, 2011)

The management objective is to ensure land user interests are maintained during harvesting operations. Locations of recreation trails, recreation properties, or cabins that are not heritage or archaeological sites should be identified and avoided or buffered. In relation to access, forest harvesters shall:

- Ensure road maintenance does not limit access roads where recreation trails intersect.
- Restore any recreation trails if they have been damaged as a result of harvesting activities (including the building of roads).
- Consider other options, including building alternative routes for roads, to maintain land user opportunities.

Riparian Management on Streams and Lakes Standards and Guidelines (October 11, 2011)

The management objective is to conserve the integrity of water quality for fisheries, riparian wildlife values and hydrology through the implementation of riparian management areas for streams and lakes. Specific guidelines regarding access include:

- Roads should be located to avoid Riparian Management Areas (RMAs) except when required for stream crossings.
- Crossings should be located perpendicular to the RMA and must adhere to all road construction standards.
- Other guidelines on “Machine Free Zones” (harvestable zones in which motorized equipment cannot be used), zone widths and limited skid crossings.

Wetlands Riparian Management Standards and Guidelines (October 11, 2011)

The management objective is to conserve the integrity of wetlands, water quality and quantity, hydrology and associated fish, wildlife and wetland habitat. Specific guidelines regarding access include:

- Roads should be located to avoid riparian management areas zoned as Shallow Open Water and Marsh Wetland, except when no reasonable alternative exists.
- When possible wetlands should include a 3 m high visual buffer along the perimeter of the wetland.

Wildlife Features Standards and Guidelines (October 11, 2011)

The management objective is to ensure that important wildlife and ecological features are given adequate protection during forestry operations. Wildlife features include: mineral licks, bear and wolverine dens, nest sites, beaver dams, cavity nesting and wildlife trees, game trails, cliff faces, and fish over-wintering or spawning areas. Specific guidelines regarding access include:

- Locations of known wildlife features shall be identified and avoided or buffered from disturbance.
- Maintain local migration corridors for wildlife by avoiding documented game trails. Where roads bisect a game trail, minimize activity within 100 m. Other options may include notching windthrow and sightlines.
- Preserve wildlife licks and prevent easy access to the lick by hunters by maintaining cover around the licks and the trails to them.
- Roads and stream crossings should avoid known fish over-wintering and spawning habitat. Ensure that fish can pass through all manmade structures.

- Seasonal operating windows to avoid impacts may be considered.

Soil Conservation Standards and Guidelines (July 3, 2012)

The management objective is to ensure there are protective measures used in relation to timber harvesting and road construction to conserve soil productivity and the hydrological function of soils. Specific guidelines regarding access include:

- The Site Plan must set out the maximum percentage of the area in permanent access structures (i.e., roads and landings), which should not exceed five per cent of the gross block area.
- The Site Plan must set out the maximum percentage of soil disturbance (including temporary access structures), which must not exceed five per cent of the net area to be reforested unless other rationale for soil conservation measures is provided.
- Soils with a high hazard rating will be scheduled for winter/frozen harvest to avoid rutting, compacting or gouging of the surface unless the Site Plan clearly states mitigation factors. Soils with a very high hazard rating must be scheduled for winter/frozen harvesting only.
- Permanent access structures should be kept to a minimum, as should the area of temporary and permanent roads and landings.
- Avoid permafrost areas whenever possible.
- Avoid operating on slopes greater than 30 per cent with ground based systems.

“Permanent Access Structures” include main haul roads, spur roads, landings, gravel pits and permanent logging trails which are planned to be used for a long enough period that, if they were rehabilitated, a commercial crop of trees could not be established within the same time frame as the remainder of the unit.

“Temporary Access Structures” includes roads, landings, and skid trails that are identified as temporary in the site plan and which meet the criteria of soil disturbance.

17.4.3 Boards and Councils

17.4.3.1 Yukon Surface Rights Board

The Yukon Surface Rights Board was established under the federal *Surface Rights Board Act* (SC 1994, c 43) with the primary role being to resolve access disputes between those owning or having an interest in the surface of the land and others with access rights to the land. These disputes are primarily related to accessing or using Yukon First Nation Settlement Land and, in certain circumstances, disputes involving access to or use of non-Settlement Land. For example, the board’s responsibilities under the *Quartz Mining Act* and *Placer Mining Act* are to hear and determine disputes about compensation to be paid under those acts for loss or damages, or about the adequacy of security required by the mining recorder (Yukon Surface Rights Board 2013).

17.4.3.2 Yukon Fish and Wildlife Management Board

The YFWMB has researched and participated in a number of initiatives related to access management as it pertains to fish and wildlife species. For example, in 2003 the board established a working group to explore the issues surrounding the use of off-road vehicles in the Yukon and produced a report entitled *Down the Road: The Effects of Roads and Trails on Wildlife* (YFWMB 2003). The board has also produced a number of documents related to the potential impacts of oil and gas development, and participated in development of the *Northern Mountain Caribou Management Plan* and the *Forty Mile Caribou Herd Working Group Habitat Protection Recommendations* (YFWMB 2013).

17.4.3.3 Dawson District Renewable Resources Council (RRC)

The Dawson District RRC participates in a number of management planning initiatives related to fish and wildlife habitat, including access management issues and recommendations (e.g., *Tombstone Territorial Park Management Plan*, *Porcupine Caribou Management Plan*, and *Dawson Forest Resources Management Plan*).

17.4.4 Best Management Practices

A large number of industry-specific best management practices have been developed by the Government of Yukon in consultation with industry representatives and other stakeholders, all of which address some mitigation measures for access construction and use. These are listed in **Section 1 – Chapter 3, subsection 3.4** of this report.

Guidelines have also been developed in the Yukon for minimizing aircraft disturbance to animals when flying in sheep and caribou country. These recommended best practices include planning routes to avoid sensitive areas and critical times of year, flying a minimum distance away from known ranges and at a minimum altitude, concentrating flights into single sessions instead of over multiple days, and utilizing fixed-wing aircraft rather than helicopters wherever possible (EDI Environmental Dynamics Inc. 2008, Laberge Environmental Services 2006).

Road access around waterways, particularly those that involve stream crossings (with or without bridges), can potentially affect water quality, fish and other aquatic life. Some possible effects include increased runoff, sedimentation, influxes of nutrients and contaminants, and alterations in temperature and flow. Best management practices for works affecting water have been developed that discuss: materials and methods, including erosion and sediment control such as vegetation management and revegetation; contaminant control such as proper fueling practices; and fish specific guidelines for activities such as the use of fish screens and water pumping. They also detail best practices for working in and around water bodies such as installing culverts, diverting streams, fording streams, setting up docks and barge landings, and minimizing site footprint (Government of Yukon 2011c).

The report entitled *Down the Road: The Effects of Roads and Trails on Wildlife* produced by the Yukon Fish and Wildlife Management Board (2003) contains extensive recommendations on ways to reduce potential impacts of access on wildlife and wildlife habitat, including road design and construction, seasonal timing of access, decommissioning and reclamation, and access management strategies specifically for controlling or reducing the human use of development corridors.

The *Memorandum of Understanding* between the Yukon Chamber of Mines, Klondike Placer Miners' Association, and the Tourism Industry Association of the Yukon (2008) is an example of industries in the planning region acknowledging shared use of the land and resources, agreeing to share information on areas of importance, and making an effort to enhance communication and avoid conflict. A mechanism for conflict resolution is laid out in the MOU.

17.5 Risks and Uncertainty

17.5.1 Access and Climate Change

The Yukon's geology and climate present some unique challenges for road construction and maintenance. How a road performs under vehicle traffic is a function of the way that the road was built and the materials used. Today, major Yukon highways are built by preparing and shaping a subgrade from the locally available soil and adding high-strength granular material such as sand or gravel to base layers. These roads have a greater ability to support the wheel loads imposed by heavy traffic.

Roads constructed using local soils containing high amounts of silt and little or no granular base material, such as many of Yukon's older roads, are much weaker and more susceptible to damage. Under freezing conditions, silty soils attract water through negative pressure drawing water up from below. When it thaws in the spring, the frost line moves downwards but the moisture is left behind and trapped directly below the road surface. This high moisture content can cause the road to lose 50 to 70 per cent of its strength. The relatively rigid road surface on top of soil containing trapped moisture has been compared to a sheet of glass on a waterbed, due to the high potential for damage from heavy traffic loads. In fact, it has been observed that under certain conditions, a single truck can completely destroy a portion of road surface (Government of Yukon 2012a). Spring weight restrictions such as reduced axle weights are utilized in Yukon to minimize damage to road surfaces and vehicle wear and tear. As the frost line moves further downward in late spring and summer, the trapped water is finally able to escape. The microscopic structure of the soil reverts to its original state and the soil strength increases.

Achieving and maintaining stable roads over permafrost soil is another major challenge. Anything that causes the permafrost to melt (including soil disturbance during construction, soil contact with ground water, or warming climate) will cause the ice-rich soil to liquefy. Liquid soil has little strength and will settle or subside. When it freezes, it will expand or heave. This process causes large amounts of damage on road surfaces, such as undulations and cracking (Government of Yukon 2012a).

YG-HPW quarries large amounts of rock and gravel to provide suitable construction materials for road embankments and alignment needs. Granular "blankets" have been used on ice-rich slopes for stabilization and allowance of melting and settling without major slope failure. Culverts are installed in thawed streambeds, or they are insulated with styrofoam and granular bedding material.

17.5.2 Other Risks and Uncertainties

Aggregate resources in the Dawson planning region can be considered a non-renewable resource in limited supply. New sources of granular materials will need to be identified as existing sites are exhausted, particularly in the Dawson City area as well as along the major highways in the planning region (North Klondike, Dempster and Top of the World). Long-term planning must consider current and future highway reconstruction and maintenance operations, community infrastructure needs, and current and potential future resource development projects. Aggregate requirements for new projects, in particular a full-scale operating mine, would be substantial. Other changes in land use and development patterns may affect aggregate demand and utilization patterns.

It is generally cost prohibitive to transport large volumes of aggregate over long distances, so sources are typically developed close to where they are required. Therefore, the location of accessible aggregate deposits could influence the location of future transportation infrastructure and industrial development. However, most potential gravel sources in the planning region are located within river valleys and active floodplains. This means there is likely to be significant overlap with other resource values such as fish and wildlife habitat, subsistence harvesting activities, culturally important areas, and recreational opportunities such as river-based wilderness tourism.

New technological developments such as the use of dirigibles, hybrid air vehicles, and drones may help to reduce the amount of surface access features required for some industries. As well, new road and trail building techniques and/or the increased use of water transportation corridors could also lessen cumulative impacts on the ground.

It is difficult to monitor and manage cumulative effects when many land use activities utilizing access routes are not reported or recorded. The Government of Yukon has recently implemented a voluntary Class 1 mining activity notification system.

For example, staking activities (while relatively low impact in and of themselves) when conducted en masse over large areas may lead to wildlife disturbance from helicopter traffic, increased use of airstrips and seasonal camp sites, and higher incidence of overlap with other resource users.

Disturbance of wildlife from many sources can have a cumulative effect (e.g., aircraft overhead flights, ATVs, snowmachines, predators, hikers, insects and hunters). Direct and indirect effects may act synergistically to cause decreases in population density and species richness. Increasing habitat loss and fragmentation, altered physical health due to disturbances and displacement from ideal habitat, increased hunting pressure, and projected impacts of climate change could combine to compound the overall effects of increasing access (EDI Environmental Dynamics Inc. 2008, Laberge Environmental Services 2006).

17.6 Chapter References

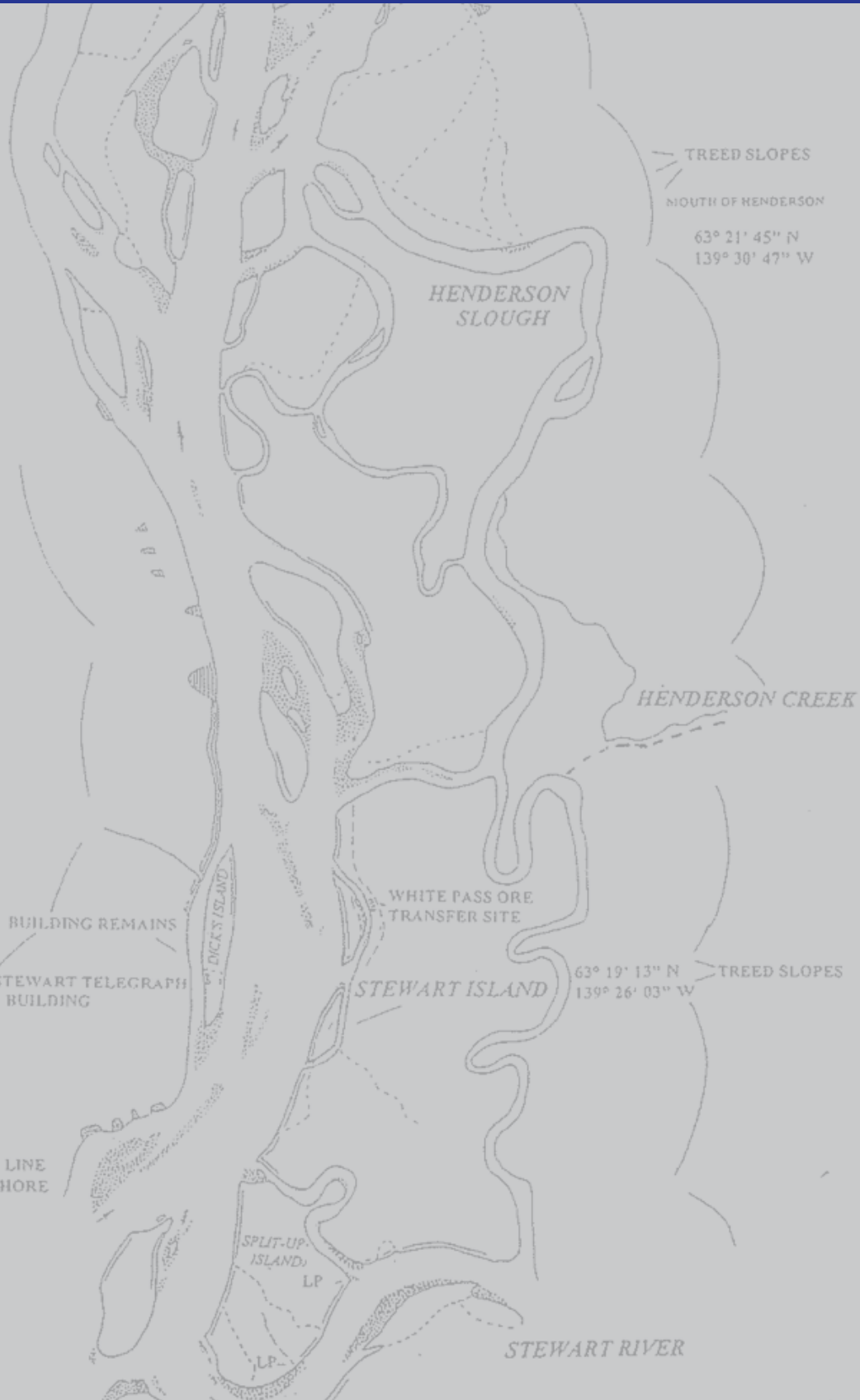
- Access Consulting Group. 2003. *Conceptual study report to identify potential natural resource infrastructure access corridors, Yukon, 2002-2003*. Volume I: Report. Prepared for Government of Yukon, Department of Energy Mines and Resources.
- Archer, Cathro & Associates (1981) Limited. 2012. *Comments on draft Government of Yukon Resource Access Roads Framework*. Available at: http://www.hpw.gov.yk.ca/pdf/Archer_Cathro_-_RAR_Framework_feedback.pdf.
- Carmanah Research Ltd. 1995. *A Review of the Coordinated Access Management Planning (CAMP) Process in British Columbia: Applications and Lessons Learned*. Prepared for the Access Management Initiative in Northeastern BC, Victoria, BC, Canada.
- Craighead, F.L. 2002. *Wildlife-related road impacts in the Yellowstone to Yukon region*. Available at: http://www.ayccc.y2y.net/data/1/rec_docs/38_Wildlife-related_Road_Impacts_Craighead_02_Report.pdf.
- Daigle, P. 2010. *A summary of the environmental impacts of roads, management responses, and research gaps: a literature review*. BC Journal of Ecosystems and Management 10(3):65-89.
- Dawson Forest Management Planning Team. 2013. *Dawson Forest Resources Management Plan*. Prepared for Government of Yukon, Department of Energy, Mines and Resources, Forest Management Branch. Whitehorse, Yukon, Canada. Available at: http://www.emr.gov.yk.ca/forestry/dawson_frm.html.
- EDI Environmental Dynamics Inc. 2008. *Flying in caribou country: how to minimize disturbance from aircraft*. Prepared for Mining and Petroleum Environmental Research Group, MPERG Report 2008-1.
- Eos Research & Consulting Ltd. 2009. *Review of Access Management Strategies and Tools*. Prepared for Foothills Landscape Management Forum.
- Forest Practices Board. 2005. *Access Management in British Columbia Issues and Opportunities*. Special Report FPB/SR/23, December 2005. Available at: http://www.fpb.gov.bc.ca/sr23_access_management_in_bc_issues_and_opportunities.pdf.
- Government of Yukon. 2009. *Resource Access Road Program Guidelines*. Department of Highways and Public Works.
- Government of Yukon. 2011a. *Info Sheet 9: Quarry Permits*. Department of Energy, Mines and Resources, Land Management Branch.

-
- Government of Yukon. 2011*b*. *Info Sheet 10: Government Gravel Reserves*. Department of Energy, Mines and Resources, Land Management Branch.
- Government of Yukon. 2011*c*. *Summary of Fish, Wildlife and Habitat Data for the Dawson Regional Land Use Planning Process*. Department of Environment.
- Government of Yukon. 2011*d*. *Dawson Planning Region Technical Report on Issues and Interests*. Compiled by the Department of Energy, Mines and Resources, Corporate Policy and Planning Branch. Whitehorse, Yukon, Canada.
- Government of Yukon. 2011*e*. *Best Management Practices for Works Affecting Water in Yukon*. Department of Environment, Water Resources Branch.
- Government of Yukon. 2011*f*. *Overview of Legislation and Policies Pertaining to Regional Land Use Plans in the Yukon*. Department of Energy, Mines and Resources, January 2011.
- Government of Yukon. 2012*a*. Department of Highways and Public Works, Transportation Branch Website. Available at: <http://www.hpw.gov.yk.ca/trans/index.html> (accessed April 10, 2012).
- Government of Yukon. 2012*b*. *Yukon Government Access Management*. Table developed by the ECO-Development Assessment Branch. Provided to the Dawson Regional Planning Commission.
- Government of Yukon. 2013*a*. *Comments and suggested revisions on draft Resource Assessment Report for Dawson Regional Planning Commission*. Submitted to the Dawson Regional Planning Commission, January 15, 2013.
- Government of Yukon. 2013*b*. *Fact Sheet 3: Using Yukon Forest Resources Roads*. Department of Energy, Mines and Resources, Forest Management Branch. Available at: http://www.emr.gov.yk.ca/forestry/pdf/fs3_forestry_roads.pdf.
- Government of Yukon. 2013*c*. *Resource Access Roads Framework*. Department of Highways and Public Works.
- Government of Yukon. 2013*d*. *Fact Sheet 4: Forest Resource Fees*. Department of Energy, Mines and Resources, Forest Management Branch. Available at http://www.emr.gov.yk.ca/forestry/pdf/fs4_fees.pdf.
- Hamilton, D. and S. Wilson. 2001. *Access Management in British Columbia: A Provincial Overview*. Prepared for Government of British Columbia, Ministry of Environment, Lands and Parks, Habitat Protection Branch. Victoria, BC, Canada.
- Kociolek, A.V. and A.P. Clevenger. 2011. *Effects of paved roads on birds: a literature review and recommendations for the Yellowstone to Yukon ecoregion*. Yellowstone to Yukon Conservation Initiative. Canmore, Alberta, Canada. Technical Report #8, March 2011.
- Kociolek, A.V., A.P. Clevenger, C.C. St. Clair and D.S. Proppe. 2011. *Effects of road networks on bird populations*. Conservation Biology 25(2):241-249.
- Laberge Environmental Services. 2006. *Flying in sheep country: how to minimize disturbance from aircraft*. Prepared for Mining Environment Research Group, MERG Report 2002-6.
- North Yukon Planning Commission. 2007. *North Yukon Planning Region Resource Assessment Report*. Whitehorse, Yukon, Canada. Available at: http://www.planyukon.ca/index.php/documents/cat_view/81-north-yukon-planning-commission-documents/99-resource-assessment-report-maps-a-posters.html.
- Smith, I.R., K. Lesk-Winfield, K.E. Kennedy, P.S. Lipovsky and J.D. Bond. 2009. *An integrated assessment of potential granular aggregate resources in northern and southeastern Yukon based on seismic*
-

- shothole drillers' logs and surficial geology maps*. Abstract available at:
http://geoscan.ess.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/geoscanfastlink_e.web&search1=R=248146.
- TH – DIAND. 1998. *The Tr'ondëk Hwëch'in Final Agreement*. Department of Indian Affairs and Northern Development. Ottawa, Ontario, Canada.
- Tr'ondëk Hwëch'in. 2012. *Tr'ondëk Hwëch'in Resource Report*. Submitted to the Dawson Regional Land Use Planning Commission, May 2012. Dawson City, Yukon, Canada.
- Tr'ondëk Hwëch'in. 2013a. *Comments on Resource Assessment Report*. Submitted to the Dawson Regional Planning Commission, June 22, 2013.
- Tr'ondëk Hwëch'in. 2013b. *Tr'ondëk Hwëch'in Heritage Department Update* newsletter, September 2013. Available at: <http://www.trondek.ca/downloads/Sept%202013%20TH%20Heritage%20e-Newsletter.pdf>
- Union of BC Municipalities and Government of BC. 2010. *Resource Roads and Communities Staff Report*. UBCM/Province Joint Committee.
- Winter, J. 2013, January 18, 2013. *Yukon waterways still protected: YESAB*. Yukon News. Available at: <http://yukon-news.com/news/yukon-waterways-still-protected-yesab/>.
- Yukon Chamber of Mines, Klondike Placer Miners Association and Tourism Industry Association of the Yukon. 2008. *Memorandum of Understanding*. Whitehorse, Yukon, Canada. Available at: <http://www.kpma.ca/assets/files/kpma-mining-tourism-mou.pdf>
- Yukon Environmental and Socio-economic Assessment Board (YESAB). 2013. Public Registry Available at: <http://www.yesab.ca/>.
- Yukon Fish and Wildlife Management Board (YFWMB). 2003. *Down the Road: The Effects of Roads and Trails on Wildlife*.
- Yukon Fish and Wildlife Management Board. 2013. YFWMB Website. Available at: www.yfwmb.ca.
- Yukon News. 2007, August 11. *Snowmobilers blazing trails on old mining roads*. Yukon News. Available at: <http://www.yukon-news.com/arts/snowmobilers-blazing-trails-on-old-mining-roads>.
- Yukon Surface Rights Board. 2013. Board Website. Available at: www.yukonsurfacerights.com.

Section 3

Resource Summary Maps



List of Resource Summary Maps

Map Theme	Data Reference	Notes regarding Data Sources
Dawson Planning Region	<p>Shaded Relief: Yukon Department of Environment, Information Management & Technology Branch. Based on 30m DEM</p> <p>Planning Boundary: Yukon Land Use Planning Council. 2008.</p> <p>Protected Areas: Yukon Corporate Spatial Warehouse 2012. (csw_admin_boundaries.park_protected_poly_250k)</p> <p>Settlement Land: Canada Land Survey Cadastral Data. 2012. Her Majesty the Queen in Right of Canada, Department of Natural Resources. All rights reserved.</p> <p>Traditional Territory: Yukon Corporate Spatial Warehouse 2012. (csw_admin_boundaries.fn_trad_ter_poly_250k_svw)</p> <p>Community Boundary: Yukon Corporate Spatial Warehouse 2012. (csw_land_tenure.lp_municipal_bdry_poly_50k)</p> <p>Local Area Plan Boundaries: Yukon Corporate Spatial Warehouse 2012. (csw_land_tenure.lp_development_area_bdry_50k)</p> <p>Hydrography; Toponymy; Transportation Features: National Topographic Database 2012. Government of Canada, Natural Resources Canada, Earth Sciences Sector, Mapping Information Branch, Centre for Topographic Information - Sherbrooke</p>	<p>Yukon Planning Regions are established by Yukon Land Use Planning Council under Yukon First Nation Final Agreements, Chapter 11. Boundaries are generalized from 1:250K Yukon First Nation Traditional Territories, and are provisional until agreed to by Yukon Government and the affected Yukon First Nations.</p> <p>Yukon parks and protected areas captured using the National Topographic Base (NTDB) 1:250,000 scale dataset. Boundaries were generalized from survey information captured by Legal Survey Division of Natural Resources Canada (NRCan).</p> <p>Traditional territories of Yukon first nations and settlement areas of Inuvialuit and Tetlit Gwich'in within the Yukon Territory. This data was built using the 1:1,000,000 Digital Chart of the World (DCW) data as the base and the 1:500,000 hardcopy traditional territory maps as signed by individual First Nation chiefs on November 8, 1988 for the line work.</p>
Physiographic Regions and Simplified Geology	<p>Yukon bedrock geology 250k, Physiographic regions and Fault Lines: Gordey, S.P. and Makepeace, A.J. (comp.) 1999: Yukon bedrock geology in Yukon digital geology, S.P. Gordey and A.J. Makepeace (comp.); Geological Survey of Canada Open File D3826 and Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, Open File 1999-1(D)</p>	<p>Obtained from: Exploration and Geological Services Division, Yukon Region, Indian and Northern Affairs Canada</p>
Glacial History	<p>Glacial Limits: Gordey, S.P. and Makepeace, A.J. (comp.) 1999: Yukon bedrock geology in Yukon digital geology, S.P. Gordey and A.J. Makepeace (comp.); Geological Survey of Canada Open File D3826 and Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, Open File 1999-1(D)</p>	<p>Obtained from: Yukon Geological Survey GLACIAL_LIMIT_POLY_1M</p>

Map Theme	Data Reference	Notes regarding Data Sources
Fire History pre-1950 to 2011	Fire History to 1946 – 2011: Wildland Fire Management, Community Services, Yukon Government	
ELC – Bioclimate	Bioclimate: Grods, J., S.R. Francis, J.C. Meikle and S. Lapointe. 2012. <i>Regional Ecosystems of West Central Yukon. Part 1: Ecosystem Descriptions</i> . Prepared for Government of Yukon, Department of Environment by Makonis Consulting Ltd. and Associates, West Kelowna, British Columbia, Canada.	
Ecodistricts	Ecoregions and Ecodistricts: Ecological Stratification Working Group, 1996. A National Ecological Framework for Canada. Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research, and Environment Canada, State of the Environment Directorate, Ecozone Analysis Branch, Ottawa/ Hull. Report and national map at 1:7 500 000 scale. (see also Soil Landscapes of Canada Working Group, 2010. Soil Landscapes of Canada version 3.2. Agriculture and Agri-Food Canada. Digital map and database at 1:1 million scale.) http://sis.agr.gc.ca/cansis/nsdb/slc/v3.2/index.html	Note: Not all ecodistricts are named in this version of the classification (1995). Two ecodistricts are referenced by number only. Summary values in the Resource Assessment Report were generated from this layer. A recent classification SLC (2010) is now available. This data was not used for analysis during production of this report.
Unique and Special Landscape Features	Rare and Ecologically Significant Ecosystems: Grods, J., S.R. Francis, J.C. Meikle and S. Lapointe. 2012. <i>Regional Ecosystems of West Central Yukon. Part 1: Ecosystem Descriptions</i> . Prepared for Government of Yukon, Department of Environment by Makonis Consulting Ltd. and Associates, West Kelowna, British Columbia, Canada. Dolomite, Limestone and Unglaciaded Areas: Gordey, S.P. and Makepeace, A.J. (comp.) 1999: Yukon bedrock geology in Yukon digital geology, S.P. Gordey and A.J. Makepeace (comp.); Geological Survey of Canada Open File D3826 and Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, Open File 1999-1(D) Tracked plants; rare plant and animal species: Yukon Conservation Data Center, 2012. Mineral Licks: Government of Yukon. 2012. <i>Yukon Wildlife Key Area Inventory</i> . Fish and Wildlife Branch, Department of Environment. Whitehorse, Yukon, Canada. Wetlands: Government of Canada. 2009. <i>CanVec</i> . Natural Resources Canada, Earth Sciences Sector, Mapping Services Branch, Centre for Topographic	Regarding information provided by Yukon Conservation Data Center, the dataset was provided in response to data request #1112-135 by Heather Clarke, Habitat Biologist, Yukon department of Environment. This data is only to be used in analyses to determine biologically diverse or otherwise important areas within the Dawson Land Use Plan. NB: Please remember the data are not a final statement on the current presence, absence, or condition of species within a given area. Much of the Yukon has not been surveyed or surveys may not have been conducted at key times of year. The data are constantly updated and added to. The data do not constitute and cannot replace on-site surveys conducted by qualified biologists at appropriate times of year to detect all species of concern actually present in an area.

Map Theme	Data Reference	Notes regarding Data Sources
	<p>Information – Sherbrooke, PQ, Canada.</p> <p>Forest Older than 140 y: Government of Yukon. 2012. <i>Yukon Forest Inventory Polygons (1:40,000)</i>. Forest Management Branch. Whitehorse, Yukon, Canada.</p> <p>Local Knowledge Environmentally Important Areas Government of Yukon. 2012. <i>Data gathered during focused local knowledge workshops in 2011-12</i>. Department of Environment. Whitehorse, Yukon, Canada.</p>	
Wildlife Key Areas	<p>Wildlife Key Areas: Government of Yukon. 2012. <i>Yukon Wildlife Key Area Inventory</i>. Fish and Wildlife Branch, Department of Environment. Whitehorse, Yukon, Canada.</p>	<p>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 sites important for wildlife for reasons outside the scope of the WKA Inventory Program. Updates to Key Areas occur only periodically.</p>
Paleontological, Archaeological and Historic Localities	<p>Paleontological, Archaeological and Historic localities: Government of Yukon. 2012. <i>Yukon Archaeological Sites Database</i>. Department of Tourism and Culture. Whitehorse, Yukon, Canada.</p> <p>Aircraft Crash Sites; Unsurveyed areas with high heritage potential: Government of Yukon. 2012. <i>Historic Resources in the Dawson Land-Use Planning Region</i>. Department of Tourism and Culture, Historic Sites Branch. Whitehorse, Yukon, Canada.</p>	<p>The Yukon Archaeological Sites Data Base contains records for “known” or recorded archaeological sites. Since archaeologists have not yet systematically investigated many areas of the Yukon, it is possible that unrecorded archaeological sites exist within your area of interest. Archaeological impact assessments are frequently necessary for development projects in areas where there is little known about heritage resources.</p>
Peregrine Falcon Habitat Suitability	<p>Peregrine Falcon Habitat Suitability Government of Yukon. 2012. <i>Peregrine Habitat Suitability Model</i>. Fish and Wildlife Branch, Department of Environment. Whitehorse, Yukon, Canada.</p>	<p>Rivers that were known to support peregrine were selected. Information used included the location of known nest sites and information collected at local knowledge workshops in Dawson City and Whitehorse. Waterbodies included: the Yukon River, a large portion of the Sixty Mile River, the White River, the Forty Mile River, the Indian River, and the portion of the Klondike River from Dawson to the Dempster cut-off. Around each of these waterbodies, a 1km buffer was delineated to indicate areas where the probability of use by peregrine is high. The majority of nests are apparently within 1km of water making this the buffer width. To take a conservative approach and include the possibility of peregrine nesting or foraging a bit further out than this</p>

Map Theme	Data Reference	Notes regarding Data Sources
		<p>1km, a 3km buffer was also established around each waterbody to delineate areas where the probability of use is moderate.</p> <p>To identify areas within these buffers where habitat suitability for nesting is particularly high, I conducted a spatial analysis to identify steep areas and cliffs (this was an evaluation of the variation in elevation over a 90m radius). Thus there is also a measure of relative nesting suitability; areas with higher suitability are more likely to be nest-sites.</p>
Caribou Range and Habitat Suitability	<p>Porcupine Caribou Concentrated Use Areas: Ryder, J. L., McNeil, P., Hamm, J., Nixon, W.A., Russell, D. & Francis, S.R. 2007 <i>An integrated Assessment of Porcupine Caribou seasonal distribution, movements, and habitat preferences for regional land use planning in northern Yukon Territory, Canada</i>, Rangifer Special Issue No. 17. 259-270</p> <p>Fortymile Caribou Habitat Suitability: Barker, O., and T. Hegel. 2011. <i>Late Winter Habitat Selection by Forty Mile Caribou in the Dawson Region</i>. Yukon Fish and Wildlife Branch Report TR-11-XX, Whitehorse, Yukon, Canada.</p>	
Moose Habitat Selection – Late Winter (Adult)(Cow & Calf)	<p>Moose Habitat Suitability Morrison, S., and M. Wong. 2012. <i>Late winter habitat selection by moose in the Dawson land use planning region</i>. Prepared by Dryas Research Ltd. and Mark Wong Consulting for Yukon Department of Environment. Yukon Fish and Wildlife Branch Report TRC-12-01, Whitehorse, Yukon, Canada.</p>	
Beaver Habitat Suitability	<p>Stream Dwelling Beavers: Flynn, N. 2008. <i>Analysis of Beaver-colony Survey: Dawson and Braeburn Regions</i>. Prepared for Department of Environment, Whitehorse, Yukon, Canada.</p> <p>Pond Dwelling Beavers: Government of Yukon 2012. <i>Local Knowledge Workshops</i>. Department of Environment, Fish and Wildlife Branch. Whitehorse, Yukon, Canada.</p>	<p>Pond Dwelling Beaver suitability was classified in a GIS by:</p> <ul style="list-style-type: none"> • Selecting waterbodies greater than 10000m² (assumed this is the minimum size at which ponds are deep enough to avoid complete freezing over winter). • Selecting suitably-sized waterbodies with both an inflow and an outflow. • Calculate the % cover of deciduous tree/shrub cover within a 100m buffer surrounding suitable waterbodies. <p>Suitable waterbodies were ranked as follows (probability of beaver occurrence): <10% cover (none), 10-30% cover (low), 30-50% cover (moderate), >50% cover (high).</p>

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Map Theme	Data Reference	Notes regarding Data Sources
Muskrat Habitat Suitability	Government of Yukon 2012. <i>Local Knowledge Workshops</i> . Department of Environment, Fish and Wildlife Branch. Whitehorse, Yukon, Canada.	<p>Muskrat suitability was classified in a GIS by:</p> <ul style="list-style-type: none"> • Selecting waterbodies greater than 10000m² (assumed this is the minimum size at which ponds are deep enough to avoid complete freezing over winter; also represents the minimum size of waterbodies selected by muskrats in previous YG muskrat habitat surveys). • Calculating the % cover of herbaceous vegetation within a 50m buffer surrounding suitably-sized waterbodies (assumed the presence of herbaceous species surrounding the waterbodies was positively related to the presence of herbaceous species within the waterbody). • Suitable waterbodies were ranked as follows (probability of muskrat occurrence): <10% cover (none), 10-30% cover (low), 30-50% cover (moderate), >50% cover (high).
Sheep Habitat Selection – Late Winter	Government of Yukon 2009. <i>Late Winter Habitat Selection by Sheep in the Dawson Region</i> . Department of Environment. Whitehorse, Yukon, Canada.	<p>Late winter habitat selection by sheep in the Dawson region using resource selection functions (RSFs) built using sheep survey data collected 12-15 March 2009. These RSFs incorporated information on habitat types available to sheep, and those habitat types that sheep were observed using, and calculated relative probabilities of use by sheep for the entire study area. Of the candidate models, the best-supported model showed that sheep selected for areas with high elevation, high convexity, high ruggedness and a southerly aspect, and selected against areas distant from escape terrain and with northerly aspects. Model validation using k-fold cross-validation showed that this RSF model accurately predicted late winter habitat selection by sheep in the Dawson region.</p>
Stream Classification for Fish Habitat Suitability	<p>Placer Stream Class: Yukon Placer Watershed Atlas. 2012 .http://mapservices.gov.yk.ca/PlacerAtlas Accessed June 22, 2012</p>	<p>This online tool provides information available in a Geographic Information System for fish and fish habitat, geology and mining, hydrology, resources, mining and land uses activities, mineral claims, First Nation Traditional Territories and Settlement Land and the results of environmental monitoring.</p>

Map Theme	Data Reference	Notes regarding Data Sources
Relative Distribution of Gold, All Deposit Types	Commodity by Tract – Gold (C4Plus) Kilby, W.E. 2013. Dawson Land Use Planning Mineral Potential Assessment. Yukon Geological Survey, Miscellaneous Report 8. Whitehorse, Yukon, Canada.	Commodity_by_Tract- A Shapefile containing the mass of each type of commodity that was estimated by the expert estimators. The mass values are in tonnes per km2. The spatial information is provided in the Yukon Albers projection on the NAD 83 Datum. Those fields labeled with a "PLUS" contain the known commodity tonnages as well as the estimated values.
Quartz Mining Activity (as at June 22, 2012)	Quartz claims \\EMR-DEPT\Dept\Mining GIS\FTPSite\quartz_claims Quartz Mining Leases: CSW_MINING.QUARTZ_LANDUSE_PERMIT_POLY_50K	The quartz mining land use threshold table is available at http://www.emr.gov.yk.ca/mining/quartz_mlu_threshold_table.html Copies of Water Licenses are available at http://www.yukonwaterboard.ca/licences.htm#quartz As of November 28, 2005, Yukon assessments are conducted by the Yukon Environmental and Socio-Economic Assessment Board (YESAB) http://www.yesab.ca/
Placer Gold Potential	Placer gold potential: Bond, J. 2013. <i>Placer Potential Map, Dawson Land Use Plan</i> . Yukon Geological Survey. Whitehorse, Yukon, Canada.	The placer potential mapping process consisted of applying a classification rating of 1 (lowest) to 5 (highest) for all the streams within the planning area (Table 1). Factors affecting a stream's potential included development history and hard rock mineral potential (gold deposit potential). These are described in the following sections. Terrain attributes such as potential overburden thickness, water flow or local topography were not factored into the rating due to the lack of knowledge for most un-mined drainages.
Placer Mining Activity (as at June 22, 2012)	Placer Land Use Permits CSW_MINING.PLACER_LANDUSE_PERMIT_POLY_50K Placer Claims: \\EMR-DEPT\Dept\Mining GIS\FTPSite\placer_claims.shp Placer Operations (Feb, 2010) Placer Streams (Feb 2010) Prospecting Lease: \\EMR-DEPT\Dept\Mining GIS\FTPSite\prospecting_lease.shp	The placer mining land use threshold table is available at http://www.emr.gov.yk.ca/mining/placer_mlu_threshold_table.html Copies of Water Licenses are available at http://www.yukonwaterboard.ca/licences.htm#placer As of November 28, 2005, Yukon assessments are conducted by the Yukon Environmental and Socio-Economic Assessment Board (YESAB) http://www.yesab.ca/

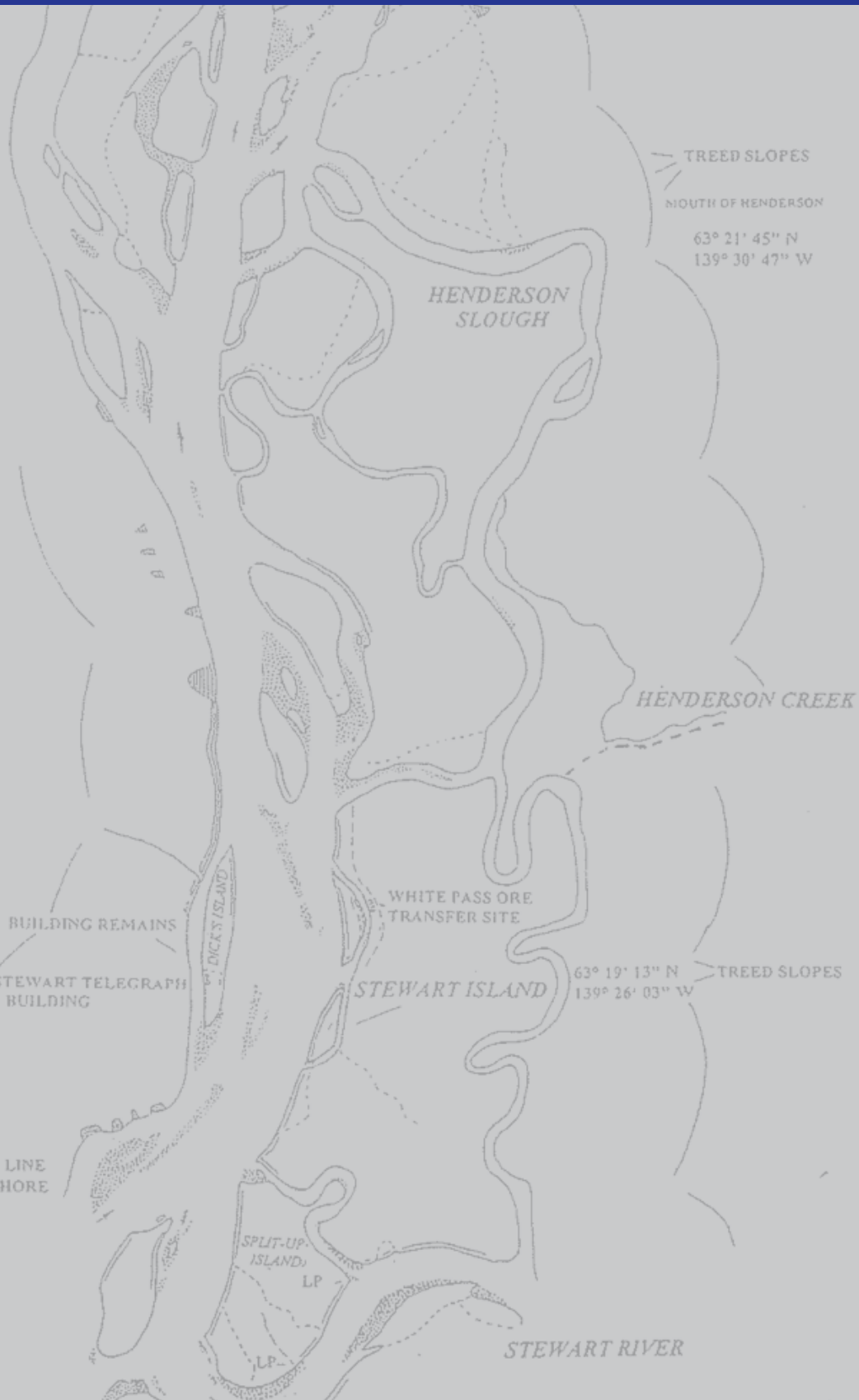
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Map Theme	Data Reference	Notes regarding Data Sources
Oil and Gas Basins	Oil & Gas Dispositions (2008-12-03) Yukon Exploration Basins(2005-02-05) Wind Energy Sites(2010-02-24)	Yukon Oil and Gas Exploration Regions. Based on the Resource Assesments completed and the 2003 Yukon Digital Bedrock Geology. Created by Oil and Gas Managemnet Branch under guidance from Yukon Geological Survey
Infrastructure, Access and Land Status	Linear and Areal disturbance: Government of Yukon. 2010. <i>Mapping of surface disturbance and linear features in the Dawson Land Use Planning Region</i> . Department of Environment. Mammoth Mapping, Dawson City Yukon January 2010.	LINEAR_FEATURES_MAMMOTH Description: Lines representing linear disturbances visible on available imagery at 1:12500. Digitized at 1:12500 using a heads-up method in ArcGIS 9.3/10. Attributes: AREAL_FEATURES_MAMMOTH Description: Polygons representing areal disturbances visible on available imagery at 1:12500. Digitized at 1:12500 using a heads-up method in ArcGIS 9.3/10. Attributes: AREAL_FEATURES_MAMMOTH by using the NRN (National Road Network) with a buffer width of 20m for highways and 15m for all other roads.
Recent YESAB Applications	Dawson Regional Planning Commission. 2012. <i>YESAB Project Tracking Spreadsheet: January 2010 – April 2012</i> . Dawson City, Yukon, Canada.	Point and Polygon Features from Project descriptions, YESAB Project Registry
Watershed Boundaries	Government of Canada. 2007. <i>National Hydro Network</i> . Natural Resources Canada, Earth Sciences Sector, Mapping Information Branch, Centre for Topographic Information - Sherbrooke	1:50,000 vector digital data from http://www.geobase.ca
Yukon Wilderness Tourism: Resources, Infrastructure and Activities	High recreation value/potential: Recreation Features Inventory, Department of Environment, YG Private infrastructure: Lands Branch, Department of Energy, Mines& Resources, YG Tourism activities, resources: Department of Tourism & Culture, YG Campgrounds, outfitting concessions, hillshading: Department of Environment, YG Protected areas: Department of Environment, YG; Atlas of Canada; NWT Protected	Produced by Mammoth Mapping 2012 for the Department of Tourism and Culture, Government of Yukon.

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Map Theme	Data Reference	Notes regarding Data Sources
	<p>Areas Strategy, GNWT; NWT Centre for Geomatics; Parks and Protected Areas Branch, BC; National Park Service (US), Alaska Regional Office</p> <p>Air Transportation: Canada Flight Supplement, Nav Canada; NTDB, NRCan</p> <p>Surface Transportation : Geobase; NTDB, NRCan; Alaska Department of Natural Resources, Land Records Information Section</p> <p>Hydrography, glaciers: Atlas of Canada; Alaska Department of Natural Resources, Land Information Section; NTDB, NRCan; GLIMS database, NSIDC</p> <p>All other data: Department of Tourism & Culture, YG</p>	

Appendices



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APPENDIX E

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APPENDIX F

Dawson Land Use Planning Mineral Potential Assessment

APPENDIX G

Placer Potential Map