



February 27, 2009

Ken McKinnon, Chair
Yukon Environmental and Socio-economic Assessment Board
3059-3rd Avenue
P.O. Box 31642
Whitehorse, YT Y1A 6L2

Dear Mr. McKinnon,

Re: Mayo Hydro Enhancement Project

Pursuant to section 50(1)(a) of the *Yukon Environmental and Socio-economic Assessment Act* (the "Act"), please find enclosed Yukon Energy's Project Proposal for the proposed Mayo Hydro Enhancement Project (the "Project", or "Mayo B"). The Project is subject to a screening level assessment by the Executive Committee of YESAB, in accordance with sections 25(a) and 26 of Schedule 3 of the *Assessable Activities, Exceptions and Executive Committee Projects Regulations*.

As required under section 50(2) of the Act, the Project Proposal takes into consideration the matters referred to in section 42(1)(b), (c) and (e) to (h) of the Act, and incorporates certain proposed mitigative measures (as outlined in Chapter 7) that may be appropriate.

As required under section 50(3) of the Act, Yukon Energy has also consulted with the First Nation of Nacho Nyak Dun ("NND"), via NND's Cooperative Engagement Process, and with the residents of Mayo, Yukon (as outlined in Chapter 4 of the Proposal). Yukon Energy will continue to consult with NND on an ongoing basis, during the course of the YESAB review and Project implementation, concerning details of permitting, design, finance and construction.

The Yukon Government has been engaged in discussions with the Government of Canada, with a view to securing current federal infrastructure funding for the Project. That funding will be critical to enable Yukon Energy to proceed expeditiously with the development of the Project.

To facilitate the Yukon Government's request for federal funding, Yukon Energy has accelerated the timing of the filing of the Project Proposal from the previously anticipated March 2009 filing. We also respectfully request that, if the Executive

Committee determines during the course of the adequacy review phase that any supplementary information might be required from Yukon Energy, Yukon Energy be notified of this on a progressive basis, and as soon as it is feasible to do so, so that we may endeavour to provide that information at the earliest opportunity (and, to the extent possible, before the end of the initial 60-day review period under section 17 of the *Screening Rules*) in order to avoid any undue delay in the commencement of the screening and recommendation phase.

Yukon Energy would also like to invite the YESAB Executive Committee and staff to attend a project familiarization tour of the Project area early in the adequacy review period. Familiarization with the existing project and setting would likely be beneficial to assist all involved to have a better understanding of the Project and its environment. Subsequent site visits can also be arranged during the snow-free period of the year, as appropriate.

Please do not hesitate to contact Mr. Hector Campbell, P.Eng., Director, Resource Planning & Regulatory Affairs at 867-393-5331, or by email at Hector.Campbell@yec.yk.ca should there be any questions, comments, or concerns regarding the Proposal. Mr. Campbell is Yukon Energy's designated contact for the YESAA assessment and subsequent licensing of the project.

Yours truly,



David Morrison
President and CEO

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1.0 PROJECT INTRODUCTION AND OVERVIEW

1.1 EXECUTIVE SUMMARY

The Mayo Hydro Enhancement Project ("Mayo B" or "the Project") involves enhancements to the existing Yukon Energy Mayo hydroelectric facilities to increase power production. It comprises the construction of a new powerhouse and related facilities, as well as adjustments to the management of water on the Mayo River system. The Project has a planned in-service date of late 2011.

The Project is located in the Yukon interior, north of the Village of Mayo. The Project will add additional infrastructure to the existing Mayo Hydro facility downstream of Wareham Lake to increase generating capacity. The immediate Project **Construction Footprint Area** south of Wareham Lake is adjacent to the Silver Trail Highway. At a larger scale, the system enhancement will alter the managed water regime, notably at Mayo Lake and flows in the Lower Mayo River, within the **Project Study Region**. The entire project lies within the Traditional Territory of the First Nation of Nacho Nyak Dun ("NND"). The precise location of the each project component of the Project will be finalized upon completion of detailed engineering design.

The existing facility was built to supply electricity to the United Keno Hill mine at Elsa in 1951, as well as serve the communities of Mayo and Keno, and includes the following components:

- **Wareham Dam** – a 32 m high earthen dam which created Wareham Lake. The dam controls the lake levels within a licensed range. From the lake, water passes through an intake structure and a tunnel to the powerhouse.
- **Powerhouse** – located on the Mayo River, the plant has two generating units of approximately 2.7 MW each, which operate with 36 metres of 'head' or vertical drop between Wareham Lake and the existing generating station.
- **Mayo Lake Water Storage** – approximately 50 km upstream of Wareham Lake, the Mayo Lake dam provides the ability to control the level of Mayo Lake within a licensed range subject to minimum flow releases. Water released from the lake flows to Wareham Lake where it is used to generate power. The Mayo Lake dam is a six meter high rock-filled wood structure, which was entirely rebuilt in 1988 and 1989.

Mayo B includes the following components:

- A new **powerhouse** with installed capacity of approximately 10 to 12 MW, approximately 3.9 km downstream of the existing powerhouse.
- A new **penstock-canal system** that will divert water from the existing intake tunnel to the new powerhouse, comprising a new tunnel extension that conveys flow to a low pressure

“upstream” penstock that extends from the existing tunnel to a new canal (approximately 460 m); a surface-run canal (approximately 2,500 m); and a pressurized “downstream” penstock from the canal to the new powerhouse (approximately 800 m).

- A new **all-weather access road** to the new powerhouse from the existing YEC access road serving the current Mayo hydro facility.
- A new **distribution line** of approximately 1,700 m operating at 12.5 kV from the new powerhouse to existing YEC 12.5 kV distribution to provide station service power and communication to the new powerhouse.
- A new **transmission line** of approximately 3,600 m operating at 69 kV from the new powerhouse to the existing Yukon Energy transmission grid substation located near the existing Mayo Hydro Plant.
- **Temporary construction-related facilities** including a work camp for a peak workforce of 50-75 workers, lay down areas, a concrete batch plant, and related facilities.

Yukon Energy Corporation (Yukon Energy) is undertaking all required planning, consultation, environmental, engineering and other related activities in order to obtain authorizations and approvals necessary to allow for a decision to commence construction of the Project in 2010. At this time, Yukon Energy has made no final decision to proceed with the Project.

Yukon government and Federal government regulatory approvals and decisions are required before any construction activities may be undertaken; however these approvals and decisions may only be made after the required screening assessment by the Executive Committee of the Yukon Environmental and Socio-economic Assessment Board (YESAB) of this Project Proposal Submission (Project Proposal). Yukon Energy submits the Project Proposal in response to YESAB guides and the requirements set out pursuant to the *Yukon Environmental and Socio-economic Assessment Act* (YESAA).

Yukon Energy undertook a public involvement program in order to incorporate community input in the Project design and environmental assessment, and to meet the regulatory requirements for public consultation in an effective and meaningful manner, and as a standing corporate principle for good planning. This included involvement with NND, the Village of Mayo, the Mayo District Renewable Resources Council, residents of Mayo and the surrounding area, various territorial and federal government departments, and other interested parties. Public involvement in Project planning occurred over an eight month period in 2008-2009. Yukon Energy shared information about the Project, the ongoing studies to assist in the assessment of effects, and sought to address the concerns and interests of individuals and organizations. Yukon Energy intends to continue its engagement with stakeholders, particularly NND and others in the Mayo area, throughout the YESAB process and during Project implementation.

The Project is proposed to occur within an existing environmental and socio-economic setting that has seen substantial development and activity over a sustained period of time. Of particular note, a dominant

feature of the existing conditions arises from the presence and influence of the existing Mayo Hydro project. The facility was constructed in 1951 by the Federal government but has been owned and operated by Yukon Energy since 1987.

Yukon Energy focused the assessment of effects of the Project from a Valued Components (VCs) perspective. VCs are elements of the Project Study Region that are valued for environmental, scientific, social, aesthetic, or cultural reasons. VCs for the Project were determined in part based on the results of consultation activities with stakeholders. Environmental VCs included both aquatic and terrestrial items, including Chinook salmon, fall spawning fish (lake trout and whitefish), wetlands, and key wildlife species. Socio-economic VCs included components related to resource use (including traditional, domestic and commercial resource use); heritage resources; local and regional economy; and the social context that are of particular concern to individuals and communities in the region and that may potentially be affected by the Project. Cumulative effects were fully considered as an integral part of the effects assessment process. The assessment process was completed based on data previously available, as well as Mayo B specific field studies, and Traditional Knowledge and local knowledge collected during the study process.

The Project, including mitigation measures set out in the Project proposal, is not expected to cause any likely significant adverse environmental or socio-economic effects. This conclusion reflects careful consideration of the Project design as well as the consideration of mitigation measures that reduce or eliminate potential adverse effects. Some residual effects (e.g., the physical presence of the facilities result in an altered landscape and other changes for as long as the facilities are in place) are anticipated, but are not expected to be significant based on criteria relevant to the YESAB assessment.

The Project will also have positive environmental and socio-economic effects in a variety of areas. Notably, the project has the potential to provide for increased renewable power being made available in Yukon and to displace diesel generation emissions. This is consistent with The *Yukon Government Climate Change Action Plan* and the *Energy Strategy for Yukon*, both of which note that development of renewable generation supports government objectives. The plan and strategy set reduction of greenhouse gas emissions as a priority. The *Yukon Government Climate Change Action Plan* identifies renewable resource development, including hydro, as a mitigation strategy to help reduce or delay global warming. Other positive effects include the potential for local jobs and business activity during the two-year construction period, and an anticipated material opportunity for NND to participate in the project financing.

1.2 PROPONENT INFORMATION

Yukon Energy is the Project Proponent.

Yukon Energy, a public utility, is owned by the Yukon Government through the Yukon Development Corporation (a Crown Corporation), and is subject to rate regulation by the Yukon Utilities Board, under the *Public Utilities Act*. Yukon Energy owns and operates the 138 kV WAF and 66/69 kV MD transmission

grids as well as over 90% of the electric generating resources on those grids; it is also the electric utility with primary responsibility for planning and development of new generation and transmission facilities in Yukon.

Yukon Energy has installed generation capacity of approximately 120 MW. Of this, 75 MW is installed capacity at three hydro facilities: Whitehorse, Aishihik, and Mayo. A further 0.8MW is installed wind generation. The remainder is installed diesel generating capacity. In addition to hydro generation, YEC owns and operates the 138kV Whitehorse Aishihik Faro grid and the 69 kV Mayo Dawson grid. Yukon Energy's wholesale customer, YECL, distributes power to 89% of Yukon retail customers, while YEC distributes power to the other 11% (about 1,900), located primarily in Dawson City, Mayo, and Faro.

Yukon Energy management reports to a Board of Directors through the President. Final approval to proceed with the Mayo Hydro Enhancement Project is subject to the approval of the Board of Directors and the territorial Minister responsible for Yukon Energy.

The designated contact for the YESAA assessment and subsequent licensing of the project is Hector Campbell, Yukon Energy's Director, Resource Planning & Regulatory Affairs.

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1.3 PROJECT BACKGROUND

The existing Mayo Hydro facility, with an installed capacity of approximately 5.4 MW, was built by the Northern Canada Power Corporation in the 1950s to supply power to Mayo and the United Keno Hill Mine. Since the closure of the Keno Hill mine in 1988/89, the plant has been operated below its full capacity. The completion of the Mayo-Dawson transmission line in 2003 resulted in a substantial increase to the load served by the existing facilities, but the facilities continue to operate below the maximum capability of the plant.

The Mayo B project concept dates back to 1968, when the facilities were still owned and operated by the Northern Canada Power Commission (NCPC). The project was investigated a number of times in the intervening years under various concepts and layouts. The current round of investigations arise from the Yukon Energy 20 Year Resource Plan, 2006-2025, and related planning activities, which identified the project as a potentially attractive enhancement to existing hydro generation.

The proposed additions to the current Mayo system include the installation of a new powerhouse approximately 3km downstream from the existing powerhouse at Wareham lake, and a water conveyance system to divert water from the existing intake to the new powerhouse, as well as other ancillary

infrastructure (such as an all-weather access road and a distribution line). The Project also includes revision to the parameters within which Yukon Energy manages water on the system. Specifically, the Project incorporates a revision to the range within which Yukon Energy is permitted to manage Mayo Lake, as well as implementation of new parameters for water management at Mayo Lake and the Lower Mayo River.

Planning activities for the Project that have been undertaken to date include a public involvement program with NND, local stakeholders, government, and broad communication with Yukoners. Details on the public involvement program are set out in Chapter 4.

1.4 PROJECT PURPOSE

By 2011 or 2012, Yukon Energy expects to need additional renewable power to help serve system-wide loads, and to ensure diesel used to generate electricity is minimized. This load growth reflects expected growth of existing non-industrial loads on each grid (residential and general service), expanded industrial loads currently forecast, and potential new mine loads. By 2012, absent new renewable power supplies, material baseload diesel generation requirements are forecast.

In 2007/08, Yukon Energy identified priority near-term renewable generation development opportunities to enhance its existing hydro capabilities.

Mayo B has been identified as the largest single near-term renewable project opportunity (approaching 40 GWh/yr of ultimate incremental hydro generation) and the least risky timeline for in-service between late 2011 and late 2012. Mayo B will develop new hydro generation without requiring a new dam and is expected to be economic relative to diesel generation alternatives. However, to keep its costs and risks to Yukon ratepayers within acceptable bounds (e.g., more in line with B.C. green market power purchase costs), government infrastructure funding was also determined to be required.

1.5 REQUIRED AUTHORIZATIONS AND REGULATORY APPROVALS

The Project is subject to a screening level assessment by the Executive Committee of YESAB, in accordance with sections 25(a) and 26 of Schedule 3 of the *Assessable Activities, Exceptions and Executive Committee Projects Regulations* as the Project will involve construction and expansion of a hydroelectric generating station with a production capacity of 5 MW or more.

Subsequent to the YESAB Executive Committee screening, review of the Project will be required by the Yukon Water Board under section 6(1) of the Yukon *Waters Act* due to the need for a new or amended Class A Water Licence for the Project.

Table 1-1 lists the regulatory permits and approvals that have been identified as being potentially required for the Project.

Table 1-1
Regulatory Authorizations Required for the Project

Activity	Authorization Required	Act or Regulation
Water use or deposit of waste in water	Water Use License	<i>Waters Act, Water Use Regulations</i>
Harmful alteration, disruption or destruction of fish habitat; destruction of fish	Fisheries Act Authorization	<i>Fisheries Act (Sections 32 and 35(2)); Fishery (General) Regulation</i>
Work, build or place in, on, over, under, through or across any navigable water	Review for possible exemption, if not exempted then file Application for an Approval of Proposed Works	<i>Navigable Water Protection Act Territorial Lands (Yukon) Act, Lands Act, Land Use Regulation</i>
Use of more than 50 kg of explosives on Commissioner's land in any 30-day period	Land Use Permit	<i>Territorial Lands (Yukon) Act, Lands Act, Land Use Regulation</i>
Temporarily using or occupying Commissioner's Land		
Construction of a trail or road		
Clearing or installing a utility right-of-way		
Permission to obtain gravel/sand from a quarry	Quarry Permit	<i>Territorial Lands (Yukon) Act, Quarry Regulations, Lands Act</i>
Burn refuse (wood)	Burning Permit	<i>Forest Protection Act, Forest Protection Regulation; Territorial Lands (Yukon) Act</i>
Tenure for land lease or agreement of sale, or other disposition	Application for Land	<i>Territorial Lands (Yukon) Act, Territorial Lands Regulation, Lands Act, Lands Regulations</i>
Construction of buildings outside a municipality	Building Permit	<i>Building Standards Act, Building Standards Regulation</i>
Gas Piping	Gas Installation Permit	<i>Gas Burning Devices Act</i>
Use of propane gas in a gas burning device		
Electrical work	Electrical Permit	<i>Electrical Protection Act; Canadian Electrical Code</i>
Plumbing	Plumbing Permit	<i>Building Standards Act, Building Standards Regulation</i>
On-site sewage disposal system	Permit to install a sewage disposal system	<i>Public Health and Safety Act, Sewage Disposal Systems Regulation</i>

Activity	Authorization Required	Act or Regulation
Operating a food premise	Permit to Operate a Food Premise	<i>Public Health and Safety Act, Eating or Drinking Places Regulation</i>
Supply of Potable water	Must meet the Health Criteria under the Guidelines for Canadian Drinking Water Quality	<i>Public Health and Safety Act, Drinking Water Regulation</i>
Operation of a solid waste incinerator	Air Emissions Permit	<i>Environment Act, Air Emissions Regulations</i>
Handling, disposal, generation or storage of special (hazardous) wastes	Special Waste Permit	<i>Environment Act, Special Waste Regulations</i>
Explosives Storage and Use	Permit of Use of Explosives; Explosives Magazine Permit; Blaster's Permit	<i>Explosives Act</i>
Oversize trucking	Over-dimensional or Over-weight Vehicle Permits (single trip or multiple trip)	<i>Highways Act, Highways Regulation</i>
Transport of dangerous goods/waste	Permit for transport of dangerous goods	<i>Dangerous Goods Transportation Act, Dangerous Goods Transportation Regulations</i>
Erect a sign within highway right of way	Sign Permit	<i>Highways Regulation</i>
Fish Research and Surveys	Fisheries Permit	<i>Fisheries Act, Fisheries (General) Regulations</i>
Collection of fish	Licence to Collect Fish for Scientific Purposes	
Search for and research at archaeological and palaeontological sites	Archaeological Sites Regulations Permit	<i>Historic Resources Act, Archaeological Sites Regulation</i>
Scientific and social scientific research in the Yukon, including studies connected with environmental assessments	Scientists and Explorers Permit required for non-resident researchers in the Yukon and optional for residents	<i>Scientists and Explorers Act</i>
Work within 4 km of aerodrome property	Transport Canada Obstacle Clearance Form	<i>Canadian Aviation Regulation TP 312 Standards and Recommended Practice</i>

1.6 ALTERNATIVES TO THE PROJECT

The proposed Project comprises a unique opportunity to enhance existing renewable generation by increasing the output available from assets already in service. In this regard, the project is consistent with other major Yukon Energy projects undertaken or underway as part of its long-term resource planning, such as the installation of a third turbine at the Aishihik facility (now underway, and targeted for in-service in 2010) and the Carmacks-Stewart Transmission Project (with Stage 1 now in-service, and Stage 2 under active planning). The Mayo B project is the largest single enhancement available (in terms of energy benefits) to Yukon Energy's existing hydro generating facilities.

Outside of enhancements to existing hydro facilities, renewable power generation for northern (i.e. has a wintertime electrical peak) climates can be pursued from only a limited number of sources. A thorough review of Power Resource Technology Options is provided in Appendix A to **Yukon Energy's 20 Year Resource Plan 2006-2025** ("20 Year Resource Plan"). A copy of the summary overview of the 20 Year Resource Plan is provided in Appendix 1A. Each of the generation technologies of notable promise (with respect to ability to effectively serve loads typical of Yukon) are under active investigation by Yukon Energy, notably geothermal, as well as further wind generation. Neither of these technologies, however, is an alternative to the Mayo B project at this time, and each can be developed in future to complement the Project. Specifically, geothermal generation is not an alternative as it remains in exploratory stages, and wind does not offer the same power characteristics as hydro enhancements (e.g., the type and degree of firmness provided by the Mayo B Project).

Outside of enhancements to existing facilities, a number of utility "greenfield" hydro sites and alternative existing hydro project enhancements have been reviewed by Yukon Energy since 1987, and by NCPC or others prior to 1987. In 2007, following the Yukon Utilities Board review of the 20 Year Resource Plan, Yukon Energy initiated an update to the studies of hydro sites and enhancements previously identified as relatively promising, in the range of 20-50 GW.h per year (subsequently expanded to 50-100 GW.h per year). The Executive Summary from this Concept Phase Study is provided in Appendix 1B, indicating estimated capabilities and costs for the various options, excluding costs of transmission (which can be material for greenfield sites). Coming out of the study, Yukon Energy proceeded with planning activities on a series of enhancements to existing hydro facilities, of which Mayo B is the largest and first to proceed. No greenfield sites were considered to be competitive on cost and timing factors to Mayo B.

1.7 SUBMISSION ORGANIZATION AND CONTENT

The project Proposal has been prepared so as to follow the *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions (v. 2005.11)* (Proponent's Guide) in structure and content in all materials respects. As the Proponent's Guide describes in general terms the form of Project Proposal submissions, it has been applied in this document so as to reflect the specific characteristics of the Project.

The following outlines the chapter organization of this Project Proposal:

- **Chapter 1:** Project Introduction and Overview
- **Chapter 2:** Project Location
- **Chapter 3:** Assessment Approach
- **Chapter 4:** First Nations and Other Public Consultations
- **Chapter 5:** Environmental and Socio-Economic Scan
- **Chapter 6:** Project Description
- **Chapter 7:** Environmental and Socio-Economic Effects Assessment
- **Chapter 8:** Monitoring and Follow-up Programs
- **Chapter 9:** Acknowledgement & Certification
- **Chapter 10:** List of Acronyms, Glossary & References

2.0 PROJECT LOCATION

Chapter 2 provides a general geographical setting for the Project Proposal in terms of its location within the Yukon. The chapter addresses the requirements stipulated in Section 3.0, Project Location, of the *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submission* (YESAB, 2005) ("Proponent's Guide") by setting out information regarding geographic location, land tenure, traditional territory of Yukon First Nations, Yukon Land Use Planning Region and consistency of the proposed Project activities with any existing land and/or resource management plans. It also outlines the broad **Project Study Region** for the Project Proposal assessment approach as more fully described in Chapter 3, as well as the more localized **Construction Footprint Area** for the key physical components of the Project, also more fully described in Chapter 3.

The Proponent cannot provide a precise legal land description of the Project components at this time. Precise final locations of Project Components will not be available until after final engineering design and construction have been completed. Many of the Project components will be situated on, or transect, the same parcels of land as the existing infrastructure (owned by YEC). In addition, land not presently owned by Yukon Energy is required for the Project.

With respect to Crown lands required for the Project, Yukon Energy has been engaged in discussions with the Department of Energy, Mines and Resources to ensure that it will be able to acquire licence(s) of occupation, lease(s), or fee simple title in respect of those lands or portion thereof, to the extent that such grant(s) of tenure may be necessary for the purpose of the construction or long-term operation of the Project. In the interim, Yukon Energy will seek Land Use Permit(s) or other rights to Crown lands as may be needed to proceed with the construction of the Project.

With respect to the privately owned parcels required for the Project, Yukon Energy will initiate specific negotiations with the landowner towards acquisition of the lands, if and to the extent necessary, in advance of construction.

2.1 GEOGRAPHIC LOCATION

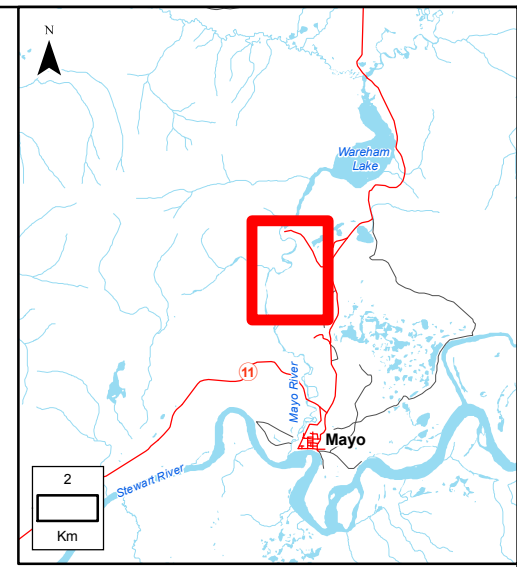
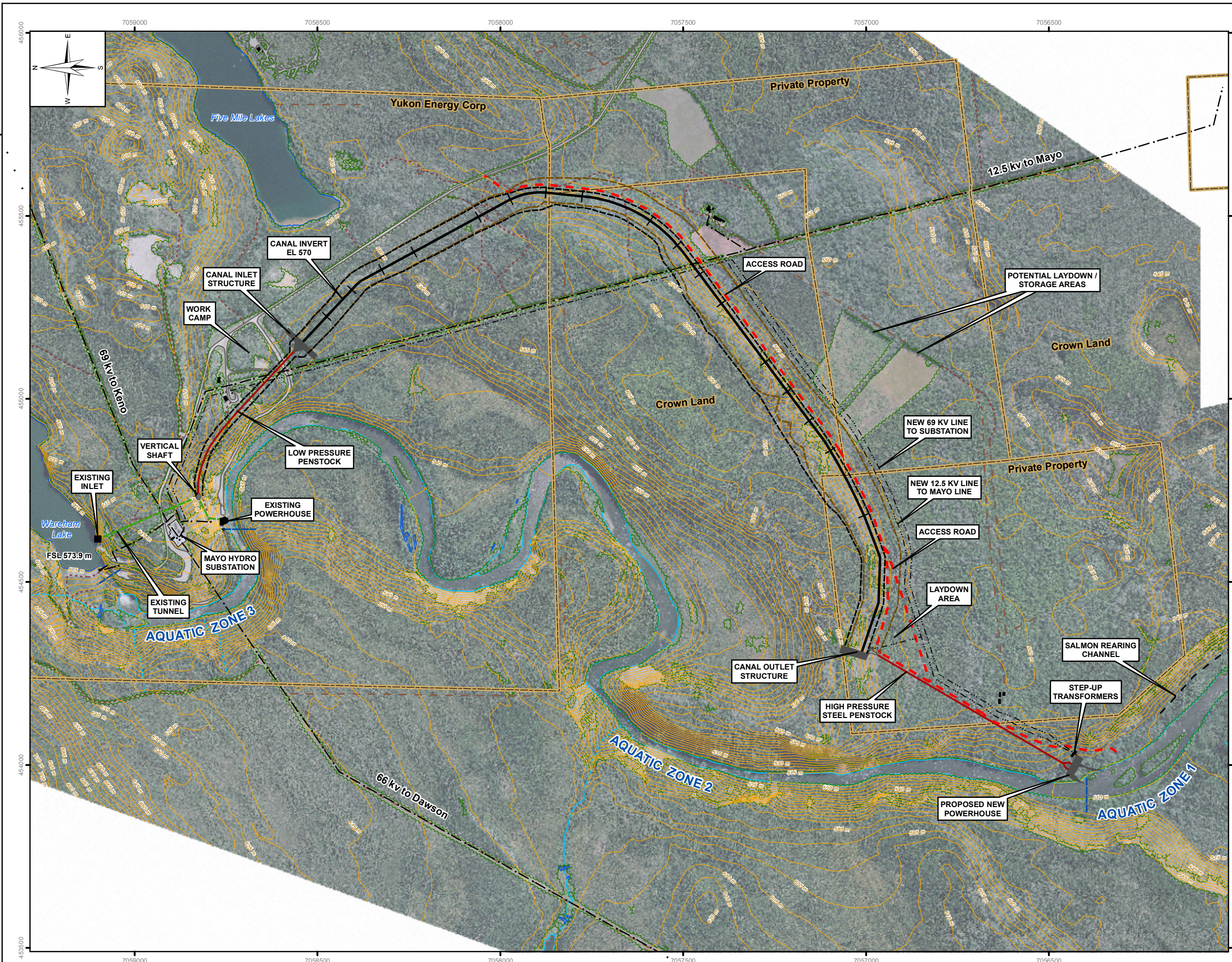
The Proposed Project is located in the Yukon interior, north of the Village of Mayo. The Project will add additional infrastructure to the existing Mayo Hydro facility downstream of Wareham Lake to increase generating capacity. The immediate Project Construction Footprint Area ("Construction Footprint Area") south of Wareham Lake is adjacent to the Silver Trail Highway between km 54 and km 57 (see Figure 2-1).

At a larger scale, the system enhancement will affect water levels at Mayo Lake and flows in the Mayo River. The entire Project lies within the Traditional Territory of the First Nation of Nacho Nyak Dun ("NND").

As reviewed in more detail in Chapter 3, the region of study for the Project Proposal (“Project Study Region”) is that portion of the Northern Tutchone Planning Region between the Village of Mayo and Mayo Lake that is generally in close proximity to the Silver Trail Highway and the Mayo Lake access road. This Project Study Region also falls within YESAB’s Central Assessment District. A schematic of the Project Study Region is provided in Figure 2-2 below.

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Y:\TechData\GIS\Projects\Yukon_Energy\MXD\ENV\RO_SUB\Key_Project_Components.mxd



Legend

- Canal
- Top of Cut
- Top of Edge
- Existing Tunnel
- Penstock
- Proposed Access Road
- Proposed Transmission Line
- Intake
- Powerhouse
- Vertical Shaft
- Salmon Rearing Channel
- Building
- Proposed Powerhouse
- Land Interest Property
- 5 m Index Contour
- Existing Power Transmission Line
- Road
- Lake or Pond
- River
- Trail
- Cutline
- Trees

1:10,000 (11 x 17 Plot)

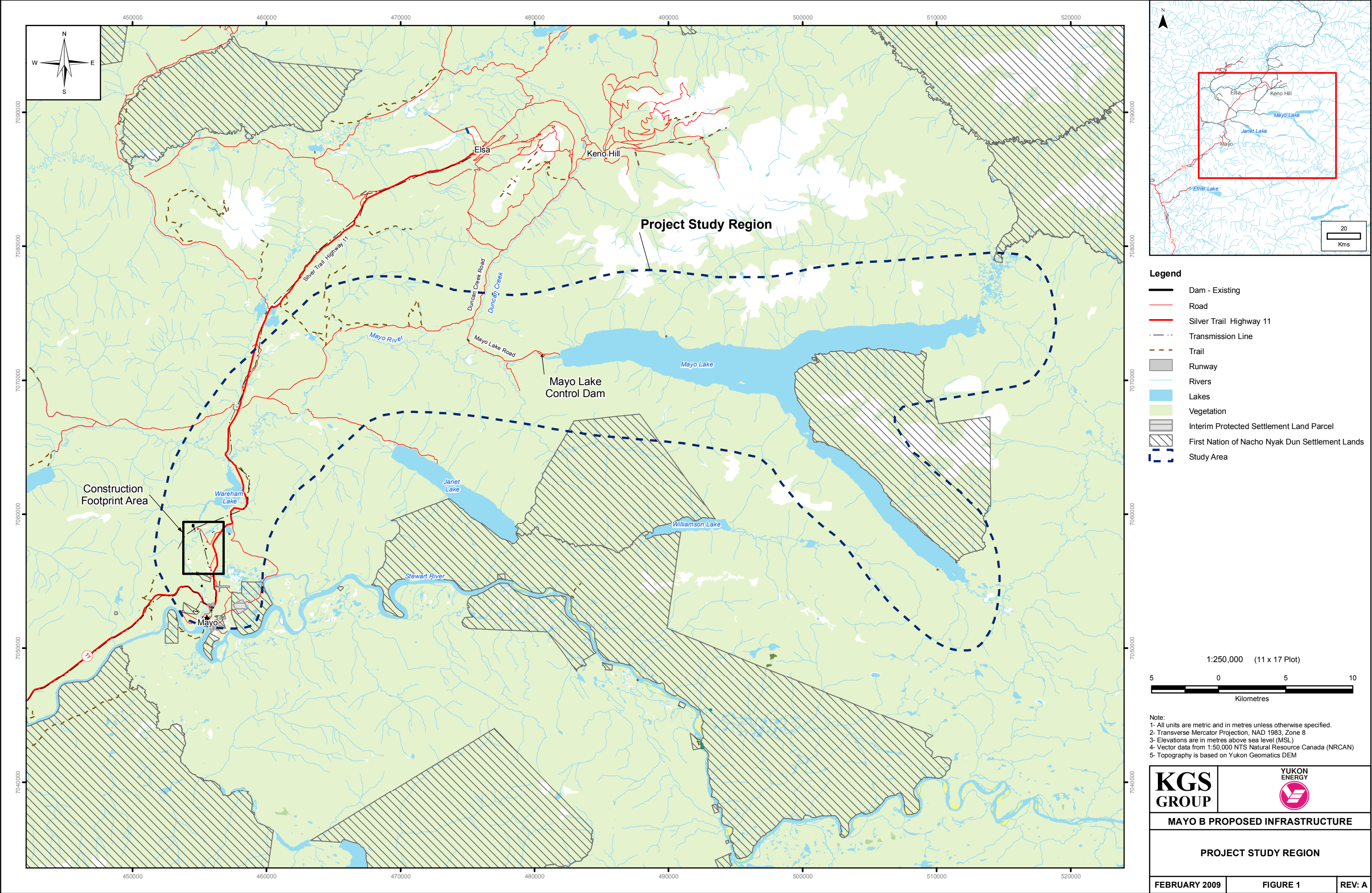
100 0 100 200 300 400 500 Metres

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 8
Elevations are in metres above sea level (MSL)

KGS GROUP	YUKON ENERGY
MAYO B PROPOSED INFRASTRUCTURE	
CONCEPTUAL CONSTRUCTION FOOTPRINT AREA	
FEBRUARY 2009	REV: A

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Y:\TechData\GIS\Projects\Yukon_Energy\MXD\Mayo_Flyer\Yukon_Energy_Project_Study_Region.mxd



The Project Study Region is located within the Boreal Cordillera Ecozone and the Yukon Plateau-North ecoregion. This area is generally characterized by tablelands and rolling uplands separated by wide and U-shaped valleys. The Project Study Region is also within the Yukon River Major Drainage Area which encompasses approximately 66% of the Yukon Territory and is its largest drainage area. The Mayo River is a tributary of the Stewart River, which in turns flows into the Yukon River. Details on the drainage basin, topography and ecoregions are found in Chapter 5, Section 5.2.1. The Project Study Region includes the community of Mayo, located on the Silver Trail Highway No. 11, and was the focal geographic community for the public consultation outlined in Chapter 4.

2.2 PROJECT COMPONENTS

The Project consists of the following additions to the existing Mayo Hydro facility:

- A new **powerhouse** approximately 3.9 km downstream of the existing powerhouse
- A new **penstock-canal system** that will divert water from the existing intake tunnel to the new powerhouse, comprising a new tunnel extension that conveys flow to a low pressure “upstream” penstock approximately 460 metres long that extends from the existing tunnel to a new canal (approximately 460 m); a surface-run canal (approximately 2,500 m); and a pressurized “downstream” penstock from the canal to the new powerhouse (approximately 800 m).
- A new **all-weather access road** to the new powerhouse from the existing YEC access road serving the current Mayo hydro facility
- A new **distribution line** of approximately 1,700 m operating at 12.5 kV from the new powerhouse to the existing 12.5 kV distribution line to provide station service power and communication to the new powerhouse
- A new **transmission line** of approximately 3,600 m operating at 69 kV from the new powerhouse to the existing Yukon Energy substation (S249)
- **Temporary construction-related facilities** including a work camp for a peak workforce of 50-75 workers, lay down areas, a concrete batch plant, and related facilities.

Details on each of the Project components are provided in Chapter 6, Project Description. Approximate **Universal Transverse Mercator Coordinate System (UTM)** and Latitude/Longitude coordinates for the Project's Construction Footprint Area which encompasses the zone of activity for proposed physical works, are provided in Table 2-1:

Table 2-1
Location of Project Components

Project Component	Existing Land Parcel Overlapped by Project Component	Parcel Geodetic Location		Comments
		Lat / Long	UTM	
Existing surge tank Wareham control structure Existing powerhouse Existing tunnel Canal/Penstock Transmission line	Fee Simple Lot 91 Quad 105 M/12 CLSR# 43369	63° 39' N 135° 54' W	454965 E 7058820 N	Transected by transmission line and canal/penstock
New powerhouse Canal/Penstock Transmission line	Utility Reservation 2008-1660 Quad 105 M/12	63° 38' N 135° 54' W	454769 E 7057517 N	Transected by new canal/penstock, new transmission line
Canal/Penstock Transmission line	Fee Simple Lot 41 Quad 105 M/12 CLSR# FB19712	63° 38' N 135° 55' W	454384 E 7056767 N	Transected by new canal/penstock and transmission line
Canal/Penstock Transmission line Access Road	Fee Simple Lot 49 Quad 105 M/12 CLSR# FB22096	63° 38' N 135° 53' W	455294 E 7056856 N	Transected at southwestern corner by new canal/penstock
Tailrace	Utility lease # 105M12-044 Quad 105 M/12 CLSR# 43369	63° 39' N 135° 55' W	454721 E 7059316 N	Lease , being the bed of the Mayo River, as shown as plan of survey 43369
Some existing and proposed Project Components	105M12-070 Quad 105M/12	63° 37' N 135° 52' W	456898 E 7054682 N	Airport Notation ¹
Existing 12.5 kV Distribution line	Right of way 105M12-047 Quad 105 M/12	63° 37' N 135° 53' W	455685 E 7056256 N	Transected by access road, canal/penstock

2.2.1 Legal Land Description

A detailed legal land description of the Project components will be available after detailed engineering design, construction and land dispositions are finalized with the Crown and private property owner.

¹ No Project infrastructure exceeds 25m in height. As it is within an airport notation, it will be reviewed by YG Aviation and Marine Branch (B. Binder, pers. communication, February, 2009).

2.3 LAND TENURE WITHIN THE PROJECT STUDY REGION

A land tenure search within the Project Study Region, focusing on areas in close vicinity to Mayo Lake and the Mayo River, is provided in Appendix 2A. Corresponding maps are located in Appendix 2B.

Further information regarding the socio-economic setting as it respects land tenure and associated land use is presented in Appendix 7C. In regard to specific land tenure noted to be of interest in the Proponent's Guide, the following items are noted:

Protected Areas and Parks:

The Project Study Region contains the following protected areas and parks (more detail is provided in Appendix 7C – Socio-Economic Setting):

Five Mile Lake Campground

- Located at km 56.8 of the Silver Trail Highway, the campground is 90 hectares and has 20 campsites, with a user fee of \$12.00 per night. The park is gazetted as a Recreation Park in the *Parks and Land Certainty Act* (2001). There is a separate day use parcel at the North East end of Five Mile Lake, and a trail around the lake which crosses the Yukon Energy Reserve (A. Jones, personal communication December 9, 2008). Park usage can be difficult to assess, as there may be high day usage at certain times of the year (A. Jones, personal communication December 9, 2008). See Appendix 2B for map of the Five Mile Lake Campground.

Mayo Lake Campground Reserve

- Although not a protected area pursuant to legislation or regulation, Yukon Parks holds an 18.2 hectare reserve at the mouth of Mayo Lake, disposition#105M14-003, as well as fee simple lot 1056. The reserve at the lake mouth is not gazetted under the *Parks and Land Certainty Act* (2001). Yukon Parks does not maintain the reserve, or charge fees (A. Jones, personal communication December 9, 2008). The public is able to access the water at a boat launch at the park.

These areas are not spatially overlapped by the Project's physical infrastructure.

The Project is not in the vicinity of any other lands designated under the *Parks and Lands Certainty Act*, National Parks, Special Management Areas, Habitat Protection Areas, Canadian Heritage Rivers, National Wildlife Areas or Wildlife Sanctuaries.

Trapping and Outfitting Concession Areas:

There are six trapping concessions within or adjacent to the Project Study Region: 74, 84, 85, 86, 89 and 407, the last of which is a community trapping concession encircling the Village of Mayo. In addition, there are five small trapping leases, three of which are located on the banks of Mayo Lake, one is on Unnamed Island on Mayo Lake, and another is at the confluence of Davidson Creek and Mayo River. See Appendix 2B for a map of trapline concession areas in the Project Study Region. More detailed information is found in Appendix 7C Socio-Economic Setting.

The Project Study Region falls entirely within Yukon Outfitting Concession 7, a 2.2 million hectare area. Concession 7 is held by Rogue River Outfitting, run by Jim Shockey. See Appendix 2B for a map of the outfitting concession. More detail is found in Appendix 7C Socio-Economic Setting.

Mineral, Aggregate and Agricultural claims:

Placer mining is an important source of revenue in the Mayo area, to the extent that “[p]lacer mining and mineral exploration provide a non-governmental economic base for the [c]ommunity” (*Village of Mayo Integrated Community Sustainability Plan page 5*). Placer and Quartz claims in close vicinity to Mayo Lake and the Mayo River in the Project Study Region are listed in tables and illustrated on maps along with other land dispositions in Appendices 2A and 2B respectively. In addition, Section Appendix 7C Socio-Economic Setting provides an overview of the Yukon Placer mining regulatory framework and provides specific details about the infrastructure and activity level of the placer mining claims in the Project Study Region compiled from the mining land use applications and water use licenses of each claim holder, supplied by the Yukon Water Board.

There are placer claims on 12 tributaries running into Mayo Lake, and one placer lease on Unnamed Island on the southern arm of Mayo Lake. Duncan Creek and its tributaries Parent Creek, Lightening Creek, and Thunder Gulch descend into the Mayo River from Keno Hill to the north and the site of heavy placer activity. There are also placer claims on Davidson Creek. Quartz claims in the Project Study Region are on Ledge Creek on the southern arm of Mayo Lake, and along the Mayo River, slightly north of the Village.²

Yukon Highways and Public Works identified five aggregate pits in the Project Study Region, two of which are gravel and used for aggregate production, three are noted as active (two of which are “gravel” use and one is “other” use), and two are identified as closed.

In addition, three other pits have been identified in the Project Study Region that are not under the jurisdiction of Highways and Public works and do not appear to be dispositions under any Yukon legislation. One of these is on NND Lot 1082, C-48B, and material from the area is used by local contractors for bulk fill and pit run gravel (W. Hidinger, personal communication Dec 12, 2008). The two

² Outside the Project Study Region, quartz exploration is taking place on Keno Hill, Sourdough Hill and Galena Hill, the site of the former United Keno Hill Mine Property.

other pits are identified from Topographical Map 105M12, as follows: (1) located within YEC Lot 91, near Five Mile Lake; and (2) slightly north of Wareham Dam within YEC lot 91. These aggregate sources were developed as part of the original facility construction and have been used periodically for the on-going operational and maintenance needs of the Proponent.

Greater detail on mining and aggregate materials can be found in Appendix 7C.

There are no specific agricultural leases, dispositions, or applications within the Project Study Region. Lots 1059 and 1061 near the Wareham bridgehead are fee simple dispositions and are used for agricultural purposes.

Water Use Licence Holders:

Numerous Water Licences exist for activities in close vicinity to Mayo Lake and the Mayo River in the Project Study Region, primarily related to placer operations (see above).

Outside of mining activity, water licences exist for the Village of Mayo (Type A) and for NND (Type B).

Table 2-2
Water Licences within Close Vicinity to Mayo Lake and the Mayo River
in the Project Study Region

License number	License holder	Project	Location (Approximate)	Description
MN00-029	Village of Mayo	Type A water license	Stewart River and Mayo River at Mayo	Maximum water consumption of 3,300m ³ /day, 2000m ³ /day from Cold Water Well and 1300m ³ /day from Warm Water Well
HY99-012 ³	Yukon Energy Corporation	Type A water license Power Class 2	Mayo Lake and Mayo River	Operation of the Mayo Generating Station and the Mayo Lake Dam
MN06-068	Nacho Nyak Dun First Nation	Type B water license	Centre latitude 63° 36' 1" N Centre Longitude 135° 54' 42" W	To obtain water for a municipal water supply from well PW05-01 not exceeding 900m ³ /day for a geoexchange system, municipal water use and waste deposit.
PM07-575	Frank Plut	Class IV Placer MLU	Curly Creek, tributary to No Name Creek, tributary to Mayo River	1476m ³ /day water use on 13 claims
PM05-473	Melvin Lee Zeiler	Class IV Placer MLU	Williams Creek and Duncan Creek	8183m ³ /day water use on 25 claims
PM04-366	Manfred Wozniak	Class IV Placer MLU	No Name Creek Tributary to Mayo Lake	5000m ³ /day water use on 6 claims
PM04-387	Aurora Mines Inc.	Class IV Placer MLU	Anderson Creek Tributary to Mayo Lake	8400m ³ /day water use on 9 claims
PM06-517	W. Joris Brinkerhoff	Class IV Placer MLU	Dirksen Creek Tributary to Mayo Lake	190m ³ /day on 4 claims
HY90-001	W. Joris Brinkerhoff	Class '0' hydropower generation for mining operation and residence	Dirksen Creek	Not to exceed 6 910.06 m ³ /day ⁴

³ YEC License HY99-012 is located in Appendix 2D.

⁴ Converted from license at 1,520,000 imperial gallons a day.

License number	License holder	Project	Location (Approximate)	Description
PM04-398	Silke Wissner	Class IV Placer MLU	Ping Pong Creek Tributary to Mayo Lake	1100 m ³ /day water use on 3 claims
PM03-312	Frank Taylor	Class IV Placer MLU	Duncan Creek and Duncan Creek Bench	33,120m ³ /day on numerous claims
PM05-479	Richard Rivest	Class IV Placer MLU	Davidson Creek tributary to Mayo River	8200m ³ /day water use on 16 claims
PM03-341	J.P. Rivest	Class IV Placer MLU	Davidson Creek tributary to Mayo River	8200m ³ /day water use on numerous claims
PM03-351	Ralph Barchen	Class IV Placer MLU	Owl Creek Tributary to Mayo Lake	21,600m ³ /day on 20 claims

Private Landholdings:

The Project Study Region is dominated by Crown Lands. Private land holdings are shown in Appendix 2A. All private land holdings required for Project infrastructure are set out in Table 2-1.

2.4 TRADITIONAL TERRITORY

The proposed Project is located entirely within the traditional territory of the First Nation of Nacho Nyak Dun. There are approximately thirteen main **Settlement Land** parcels within the Project Study Region, codified in the *First Nation of Nacho Nyak Dun Final Agreement* ("Final Agreement"). In regards to NND Settlement Lands within the Mayo Village boundary, the *Village of Mayo Official Community Plan (2005)* states that the First Nation has followed Village by-laws for development within Village boundaries, which include 24 First Nation land selections, making up 68.5 lots. "Under section 28.1 of the Nacho Nyak Dun First Nation's Self-Government Agreement, the First Nation has agreed not to exercise its right to make laws of a local or private nature in respect to planning, zoning and land development (sec.13.3.11)" (*Village of Mayo Official Community Plan, 2005* p. 25). The largest parcel of Settlement Lands in the Project Study Region is Lot 1000, NND R-2A lying between the Roop and Nelson arms of Mayo Lake. The Mayo B Project infrastructure is not located on any NND Settlement land.

Table 2-3
Nacho Nyak Dun Settlement Lands in the Project Study Region⁵

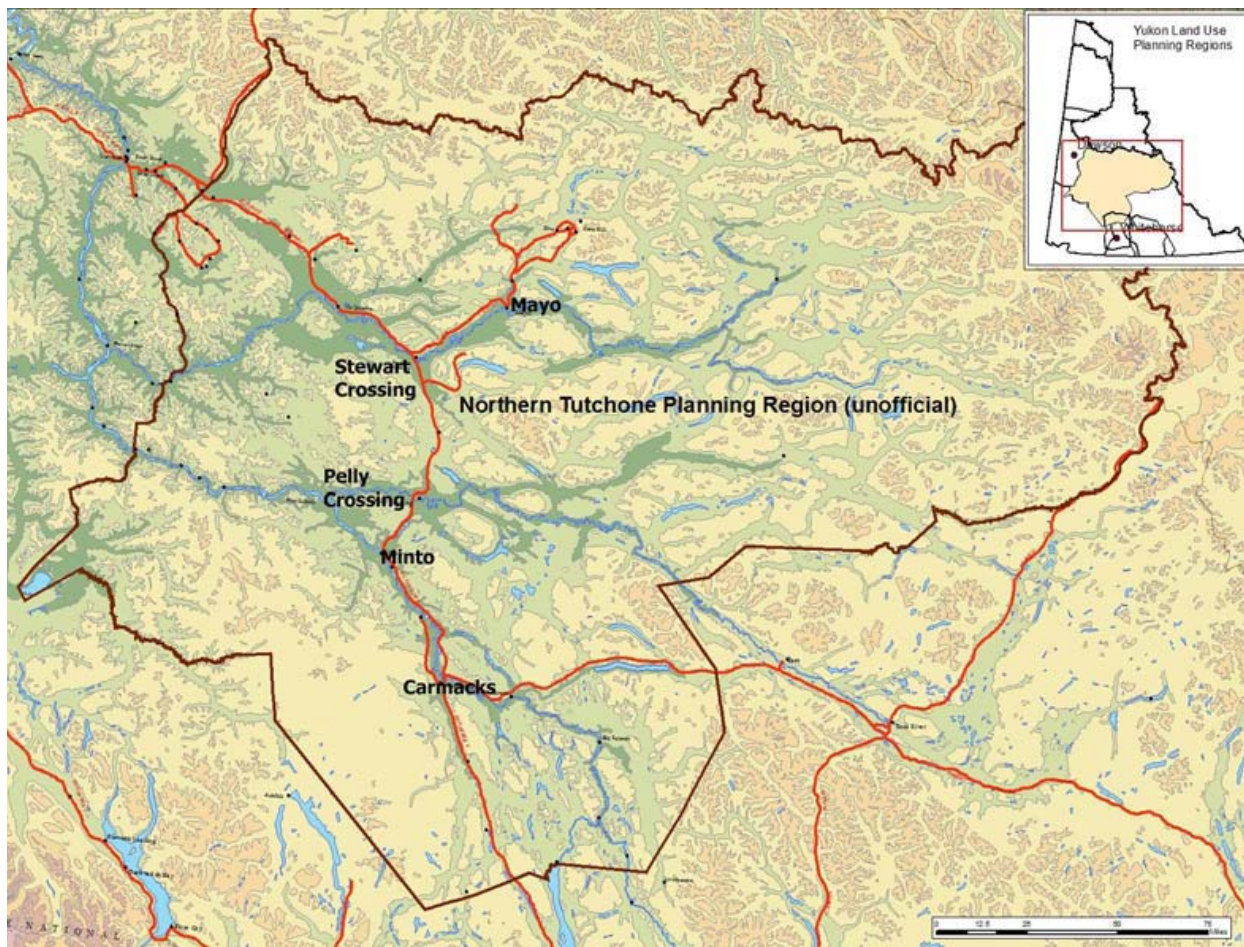
Lot	Group/ Quad	CLSR #	LTO#	Tenure Type	C. of Title#	Rights
Lot 1001 NND S-194B1	105 M/10	82707	99-0163	FN Settlement Land	NA	Surface
Lot 1002 NND S-177B1	105 M/10	85214	2002-0013	FN Settlement Land	NA	Surface
Lot 1000 NND R-2A	105 M/10	80398	97-125	FN Settlement Land	NA	Surface & Sub-surface
Lot 1005 NND S196B1	105 M/14	80394	97-121	FN Settlement Land	NA	Surface
Lot 1082 NND C-48B	105 M/12	82309	99-0047	FN Settlement Land	NA	Surface
Lot 84 Parcel 'A' NND C-19FS	G. 1004	42389	21237	Fee Simple	95Y801	Fee Simple
Lot 84 Parcel 'B' NND C-53FS	G. 1004	42389	21237	Fee Simple	95Y802	Fee Simple
Lot 1075 NND C-6B	105 M/12	82306	survey in progress	FN Settlement Land	NA	Surface
Lot 1081 NND C-47B/D	105 M/12	82306	99-0044	FN Settlement Land	NA	Surface
Lot 1077 NND C-8B	105 M/12	82310	99-0048	FN Settlement Land	NA	Surface
Lot 1073 NND S-153B1	105M/12	80385		FN Settlement Land		Surface
Lot 95 NND C-21B	G.1004	51735		FN Settlement Land		Surface
Lot 26 NND 20-FS	G.1004	FB194 09		FN Settlement Land		Fee Simple

2.5 YUKON LAND USE PLANNING REGION

The Mayo B Project is located within the Northern Tutchone Land Use Planning Region as illustrated in Figure 2-3. The Northern Tutchone Land Use Plan has not been completed at this time.

⁵ A number of smaller NND Settlement lands within or in very close proximity to the Village of Mayo boundary are not included in the above table.

Figure 2-3
Northern Tutchone Planning Region



2.6 CONSISTENCY WITH OTHER PLANS

The proponent has reviewed publicly available fish and wildlife and community plans in the Project Study Region in order to ensure that the proposed Project is consistent with local plans.

2.6.1 Current Land Use & Management Plans

There is one land use plan currently in place in the Project Study Region – the Village of Mayo **Official Community Plan** 2005. In addition, there are several management plans that are applicable. These plans include the Village of Mayo Integrated Community Sustainability Plan, the Yukon Wildland Fire Management Plan, and the Community Based Fish and Wildlife Management Plan for Nacho Nyak Dun Traditional Territory 2002-2007 which is currently undergoing updating and revisions for 2008 forward. A summary of the plans considered in relation to the Project is provided in Table 2-4.

Table 2-4
Land Use and Management Plans

Plan	General Description	Objectives Related to the Project, if any
Village of Mayo Integrated Community Sustainability Plan	Outlines the village of Mayo's vision for an economically and environmentally viable future.	Foresees future resource development in the Mayo area, and seeks to accommodate such development in a sustainable manner.
Village of Mayo Official Community Plan 2005 ("OCP")	Guides aspects of land planning and management, including zoning, development and land use.	Foster local and regional economic diversity which is environmentally sustainable. Plan collaboratively with NND and other local governments.
Village of Mayo Zoning Bylaw 2005	The Zoning bylaw accompanies the OCP and "provides the regulatory framework for orderly, economic and environmentally responsible development". (page 1)	Construction Footprint Area is not within Village of Mayo Boundaries.
Yukon Wildland Fire Management Plan	The program aims to protect Yukoners, their communities and resources by enforcing the Forest Protection Act and suppressing wildfire from a priority-based approach which places human life, community value and firefighter safety above all else.	
Community Based Fish and Wildlife Management Plan for Nacho Nyak Dun Traditional Territory 2002-2007	This is the third plan, and is based on a collaborative planning exercise between the Mayo District Renewable Resource Council, First Nation of Nacho Nyak Dun, citizens of Mayo, and the Yukon Government.	Addresses habitat and populations of moose, caribou, Chinook salmon, lake trout in Mayo Lake, grizzly bears and wolves in the Mayo area.

2.6.2 Project Consistency with Other Plans

The Project planning and assessment took into consideration the objectives of various management plans that are currently in place, and these objectives informed the public involvement and consultations with Nacho Nyak Dun.

The *Village of Mayo Integrated Community Sustainability Plan*, the *Village of Mayo Official Community Plan 2005* and the *Village of Mayo Bylaw No. 228* identify the need to dovetail environmentally and economically sustainable development within Village boundaries, and in the larger Mayo region. Appendix 2C provides a summary of the objectives of the applicable management plans, identified whether the objective was acknowledged during public consultation, and describes how the Project is consistent with

each plan objective. The following provides a summary description showing that the Project is aligned with the objectives and strategies of these management plans.

The Project meets the environmental protection and stewardship objectives of the above documents. The Project, which builds on pre-existing infrastructure, will be located in mostly pre-disturbed environment. The Project work camp will be located outside the Village of Mayo's municipal boundaries thereby reducing interactions with Village residents and services. Furthermore, it will reduce greenhouse gas emissions by reducing reliance on diesel generation that will be needed to serve the electrical needs of the community and region. Economically, the Project will create employment in the construction phase, and will produce enough power to meet the future electrical needs of residential, small business and industrial customers in the region. The *Village of Mayo Official Community Plan 2005* states specifically that “[f]uture resource development is anticipated in the Mayo area and the community recognizes the need to prepare in order to maximize and sustain the benefits of resource extraction”. The Mayo B Project is part of ongoing sustainable (renewable) resource use.

In regards to the *Community Based Fish and Wildlife Management Plan for Nacho Nyak Dun Traditional Territory 2002-2007*, the plan, in part, identifies the need for education, monitoring and reporting on animals in the Mayo area, such as moose and caribou. The public involvement process for this Project, which included workshops with resource users and consultation with First Nations, contributed to regional dialogue about aquatic and terrestrial fauna and contributed some local and traditional knowledge to the assessment. The biophysical studies undertaken as part of preparing this proposal added to the existing scientific literature on the fauna in the Project Study Region, particularly fish. Lake trout was identified as an environmental component of interest in the *Community Based Fish and Wildlife Management Plan*. The aquatic field studies addressed lake trout habitat and populations in Mayo Lake, as reviewed in Appendix 7A. Impediments to salmon and whitefish spawning due to beaver dams is also identified as a concern, as is water quality in regard to all fish. Chinook salmon spawning and habitat within the Project Study Region are reviewed in Appendix 7A. In addition, the *Community Based Fish and Wildlife Management Plan* identifies the need for more key wildlife habitat maps. The biological fieldwork conducted for the Proposal resulted in the production of habitat maps, which could later serve as references and points of discussion for local and traditional knowledge holders.

3.0 ASSESSMENT APPROACH

Chapter 3 reviews the assessment approach in the Project Proposal, focusing on the following items:

- Overview of Approach
- Assessment Framework including Cumulative Effects
- Determining Significance of Residual Effects
- Sources of Information

3.1 OVERVIEW OF APPROACH

The Project Proposal has been prepared in accordance with YESAA, the YESAB Guides¹ and standard environmental and socio-economic assessment practice. It sets out the information required from Yukon Energy (the Proponent), for a screening assessment of the Project by the YESAB Executive Committee. In accordance with the matters to be considered under s. 42(1) and 42(2) of YESAA, likely environmental and socio-economic effects of the Project, as well as likely cumulative adverse environmental and socio-economic effects of the Project and their significance are identified after considering the implementation of proposed mitigation, monitoring and follow-up measures. The submission utilizes and integrates available scientific, **traditional knowledge** (TK), local knowledge and other information relevant to the assessment of Project effects.

Following the direction of s. 50(3) of YESAA, the assessment approach has incorporated an extensive consultation and public involvement process which sought views from the First Nation of Nacho Nyak Dun (NND) and residents of Mayo where the Project is to be located or might have significant environmental or socio-economic effects (Chapter 4). Early and meaningful ongoing opportunities have been provided for NND, other local residents, other segments of the public and governments to receive information on, and provide views and information about the Project and the environmental and socio-economic planning and assessment process. These consultations have contributed in a material way to the mitigation of adverse environmental and socio-economic effects that could potentially be associated with the Project as well as a consideration of alternatives to the Project or alternative ways of undertaking or operating the Project that would avoid or minimize any significant adverse environmental or socio-economic effects.²

The scoping of the Project, as well as a description of Project activities and components, is provided in Chapter 6. The assessment approach addresses the distinct phases of the Project (i.e., construction,

¹ YESAB Guides refers to the Assessor's Guide to the Assessment of Environmental Effects, v. 2006.01; the Guide to Socio-economic Effects Assessment 2006.06; Assessor's Guide to the Assessment of Cumulative Effects v. 06.01.

² These matters are required to be considered under s. 42(1)(e) and 42(1)(f) of YESAA.

operation and maintenance) and their effects on environmental components (e.g., air, land and water environments and associated aquatic and terrestrial life) and socio-economic components (e.g., resource and other land use, economies, and social components including infrastructure and services, cultural/heritage sites and resources, traditional and other lifestyles, culture, human health, and social well being).

The Project Proposal ultimately assesses (see Chapter 7) the effects of a preferred conveyance option, generating station and associated infrastructure; as well as water management options for use of Mayo Lake.

The assessment approach focuses on the effects of Project construction and operation. At this time there is no timetable for decommissioning of the Mayo B facilities, and it is currently not feasible to provide a meaningful assessment of any likely Mayo B decommissioning plans or the anticipated effects of decommissioning. If at a later date it is determined that the Mayo B facilities are no longer required, then Yukon Energy would adhere to the legislation and regulations in place at that time and would review decommissioning plans with regulatory authorities and affected First Nations and other local communities.

3.2 ASSESSMENT FRAMEWORK

For the purpose of assessing environmental and socio-economic effects of the Project, current conditions in areas potentially affected by the Project and the projected evolution of these conditions without the Project are considered as the baseline. Potential environmental and socio-economic effects of the Project on this existing baseline are predicted separately in the Project Proposal for each environmental and socio-economic component by comparing:

- a) **What would be expected without the Project** (i.e., the “existing conditions” or baseline expected for each environmental and socio-economic component without the Project, including as relevant consideration of other projects or activities that have been or will be carried out without the Project); and
- b) **What would be expected with the Project** (i.e., each environmental or socio-economic component as modified or affected by the Project based on direct and indirect effects pathways³ from the Project to the environmental or socio-economic component, including as relevant consideration of other projects or activities that have been or will be carried out in combination with the Project).

Following from the Project description and determination of the Project scope (Chapter 6), and reflecting the YESAB Guides and standard environmental and socio-economic assessment practice, the assessment

³ As reviewed in the YESAB Guides, “direct effects” are the initial, immediate effects caused by a specific activity and “indirect effects” are caused by a given action, but occur later in time or further removed in distance.

framework for the Project Proposal (including cumulative effects assessment) to assess effects of the Project includes the following five basic steps:

1. **Scoping of Assessment:** It is critical at the outset to address assessment scope issues, including selecting **valued environmental and socio-economic components (VCs)** for the assessment⁴, sources of Project effects for each VC, and scope of geographic and temporal assessment boundaries for each VC. Scoping of the assessment is generally addressed below in Section 3.2.1; however, determination of specific VCs and their respective scoping is addressed in setting the framework for review of relevant environmental and socio-economic baseline conditions (Chapter 7). Overview of other specific methods of assessment approach for specific VCs is reviewed as required in Chapter 7.
2. **Baseline Conditions:** This is a baseline analysis and includes review of current and evolving future VC conditions without the Project, as affected by past, current and other future projects included in the cumulative effects assessment. Each existing VC is described in the baseline analysis only to the extent needed to predict the effect of the Project on that VC as set out in the assessor's guides.
3. **Effects and Mitigation:** This describes quantitatively and qualitatively both positive and adverse effects on VCs likely to result from the Project, after consideration of the baseline conditions without the Project as well as proposed mitigation measures with the Project beyond those already included in the Project description. Further details on approach are provided in Section 3.2.2 below. In accordance with YESAA and the assessor's guides, the scope of this assessment includes an examination of both environmental and socio-economic effects arising from the Project and is described for each VC in Chapter 7.
4. **Cumulative Effects Assessment:** The cumulative effects assessment (CEA) is integral to the assessment approach and examines the likely effects of the project in combination with the likely effects of other past, existing and future projects and activities. Further details on the CEA approach are provided in Section 3.2.3 below. Section 5.4 reviews other projects and activities specifically considered as part of the CEA. To be considered a cumulative effect, the other past, existing and future projects being considered in the assessment must affect a VC that is also being affected by the principal project; in this way the projects act cumulatively upon a valued component. The CEA is provided for each VC in Chapter 7.
5. **Residual Effects and their Significance:** This describes summaries of the nature and extent of any residual environmental effects of the Project after implementation of proposed mitigation, and includes characterization with rationale as to whether adverse residual environmental and socio-economic effects are significant or not significant, as defined in

⁴ Valued Environmental and Socio-economic Components (VCs, sometimes referred to in YESAB Guides as VESECs) are elements of the Project Study Region valued for environmental, scientific, social, aesthetic, or cultural reasons. Selecting project-specific VCs (i.e., VCs that could be potentially affected by the Project) is essential in the YESAB Guides for focusing assessments, and for determining the significance of effects.

S. 58 of YESAA (see Section 3.3 below for further explanation of approach). Included as part of mitigation are any plans for responding to any known or predicted residual effects, and procedures for identifying and responding to effects that were not predicted or foreseen. This assessment is included in Chapter 7.

6. **Monitoring and Follow-up:** This is a description of the proposed monitoring and follow-up activities should the Project proceed. This description is included in Chapter 8.

This framework is reviewed in more detail below for the following elements:

- Scoping of the Assessment
- Analysis of Effects (combines baseline conditions with effects and mitigation steps)
- Cumulative Effects Assessment
- Evaluation of Significance and description of Residual Effects
- Monitoring and Follow-Up

3.2.1 Scoping of the Assessment

This step includes:

- Identifying issues of concern related to the Project,
- Selecting VCs for further examination,
- Identifying potential sources and pathways of effects from the Project to each VC selected,
- Identifying spatial and temporal boundaries for assessing effects of the Project for each selected VC; and
- Identifying other actions and effects pathways that may act cumulatively with the Project to affect the same VCs.

It is standard practice to focus an assessment on specific environmental and socio-economic components which are determined to be of particular importance. A VC based approach is intended to ensure that potential significant adverse effects to important environmental and social components will be detected and mitigated through the assessment process. Measures designed to mitigate adverse effects on major components should serve to also minimize likelihood of adverse impacts on other environmental and social components.

In considering the existing biophysical environment and existing socio-economic conditions, the scope of study focused on examining components that could be linked to the Project. The Guide to the Assessment of Environmental Effects (YESAB, 2006a) sets out that the assessor should look at both project-specific issues and also identify regional environmental and socio-economic issues relevant to the project, with the goal of delineating valued components and associated project effects on those components through the life of the project. The Guide to Environmental Effects Assessment states in this regard:

It is not possible for an assessment to consider all possible ecological and socio-economic interactions with respect to a project; an ecosystem alone may contain thousands, or perhaps millions, of variables. A pragmatic and widely accepted method for overcoming this challenge and focusing the assessment is to delineate priorities—valued environmental and socio-economic components (YESAB, 2006a, p. 13).

Similarly, the Guide to Socio-Economic Effects Assessment states:

The assessor must bear in mind that, as discussed in Step 2 – Determine Assessment Scope, only those elements of the socio-economic environment within the established study area that are potentially affected by the project need be further identified and characterized (YESAB, 2006b, p.47).

In this assessment VCs were determined after consultation with interested parties and experts, field studies undertaken on the terrestrial and aquatic environments, socio-economic data collection and consideration of TK and local knowledge as well as any plans and policies applicable to the regional area. The selection of VCs helped to focus the analysis on components deemed to be of particular importance or of special interest to residents or to the ecosystem. Well chosen VCs can also provide a representative measure of the Project's effects on the non-selected environmental and socio-economic components.

Based on the YESAB Guides, VCs for this assessment were identified and grouped under one or more of the following headings:

- Focal species and habitat (environmental VC defining landscape attributes required to meet the needs of biota, and also the management regimes that should be applied to them).
- Socio-economic context (socio-economic VC recognized as being important because of its integral connection to, or reflection of, the socio-economic system; its commercial or economic value; and/or its role in maintaining quality of life in a community).
- Representation (seek to maintain an appropriate representation of ecosystem networks and populations on the landscape over time, while recognizing and managing for natural temporal fluctuations in composition that occur).

- Special elements (may include rare or under-represented ecosystems, rare and/or threatened flora or fauna species, important harvested species, and unique landforms).
- Ecological processes (processes of social or environmental importance).
- First Nation/Resident/Community values or concerns.

The YESAB Guides provided considerable initial guidance as to scoping. Public consultations and further analysis were used to focus assessment of specific environmental and socio-economic components to define effects pathways, and to identify temporal and spatial boundaries for the assessment of Project effects on selected VCs. Section 3.2.4 reviews the overall approach to identify other actions or projects to address cumulative effects assessment requirements.

Temporal and geographic study area boundaries for Project effects were identified separately for each VC based on predicted links with the Project.

The time periods examined include the Project construction, operations and decommissioning periods as required to assess duration and/or timing of specific effects related to the Project. In summary, the following distinct time periods are assessed in which Project related effects accrue:

- **Construction Phase:** This phase generally consists of the estimated two years required to complete the construction of the Project, including commissioning of the facilities.
- **Operation Phase:** The time period following construction, through the life of the relevant components of the project, during which time the project will be used for its primary purpose of power generation.
- **Decommissioning Phase:** For construction-related activities (i.e. work camp and storage areas, etc.), comprises the time period immediately following Construction Phase. For the main facilities associated with the Proposed Project, there is no timetable or plan for final disposition or decommissioning of the facilities. The design life of the facility, before substantial refurbishment, is 50-100 years. When such plans need to be developed, Yukon Energy would submit these plans as then required for regulatory review and approval prior to its implementation. Accordingly, the Project Proposal does not provide any further assessment of the Proposed Project final disposition.

The assessment process commenced with the definition of a general geographic location for the Project and a Project Study Region (Section 2.2) as well as the Construction Footprint Area for the generating

station, conveyance options and associated infrastructure. For assessment purposes the following areas were defined⁵:

- **Construction Footprint Area:** Construction Footprint Area is the geographic area needed for construction and operation of the physical infrastructure associated with the Mayo B Project (e.g., generating station, water conveyance option, powerline, access road, work camp etc.) (See Figure 2-1). Included in the Footprint Area is the lower Mayo River where construction activities occur.
- **Project Study Region:** A broader Project Study Region for examining potential environmental and socio-economic effects is defined as the portion of the Northern Tutchone Planning Region between and including the Village of Mayo and Mayo Lake that is generally in the vicinity of the Mayo River, Mayo Lake and Mayo Lake Access road (See Figure 2-2). The maximum geographic extent of most potential environmental and socio-economic effects is expected to be included in this region, including the effects of changing water levels and flows at Mayo Lake and along the upper Mayo River. The generic nature of the definition adopted for this study region reflects the absence of any specific administrative area available for overall data collection or mapping purposes relevant to this assessment. Within this Project Study Region, the Construction Footprint Area represents the much smaller local region examined to assess potential effects of the project's physical structures on the environment, as well as the potential effects of changing water levels and flows on the lower Mayo River.

Regardless of whether the Mayo B Project is developed, the Mayo facility will return to operating at its full potential as loads grow and new mines go into production, including the full range of Mayo Lake storage. Therefore, the "baseline conditions" for assessment purposes equal full capacity of the plant (near 40 GWh) and use of the full licensed storage range of Mayo Lake (2.59 m). The analysis of baseline conditions is provided in Chapter 7, followed by the effects assessment related to each specific VC.

3.2.2 Analysis of Effects & Mitigation

To determine the Project's effects the baseline conditions for the selected VCs were considered. Following the YESAB Guides, the consideration of baseline conditions for VCs may include information on existing project components (including operation of the Mayo system), technologies/approaches, test results, existing environmental and socio-economic conditions and anticipated Project effects. Understanding the past, current and evolving conditions in which each VC exists is considered important for providing a baseline against which present and future effects of the Project may be measured and determinations of significance of Project effects may be made.

⁵ It should be noted that field studies undertaken early in the Project do not reflect the above definitions; rather they reflect study-specific requirements, and as such definitions such as "study area" used in the field reports in Appendices 7A, 7B and 7D do not in some cases correspond with the Project Proposal definitions indicated above.

The Project's baseline conditions need to be understood in the context of the operation of the existing Mayo system, including the management of water levels and flows. The Mayo facility supplied the loads of both the United Keno mine and the community of Mayo from 1951 until the mine closed in 1988/89. During this period, the plant typically operated near its then full capacity of approximately 38 GWh, and the licensed storage range at Mayo Lake was largely used each year. After the closure of the mine and up until the Mayo-Dawson line was energized in 2003, the plant generated power only for local loads in Mayo and Keno. The result of this reduced load was that only about one metre of Mayo Lake's licensed storage range was used each year. Since the Mayo-Dawson line went into service, the plant has also provided power to Dawson and Stewart Crossing. The Mayo facility continues today to operate below its current full capacity, typically using approximately 1.5m – 2.0 m of Mayo Lake storage range (depending on inflows). Winter flow levels are driven by the loads on the system at any given time. Further details on the existing Mayo facility can be found in Section 5.4.

Regardless of whether the Mayo B Project is developed, the Mayo facility will return to operating at its full capacity in the near term as loads continue to grow on the Mayo Dawson grid (with connection of the Alexco mine) and on the interconnected system (once the CSTP Stage 2 is completed), including its full storage range at Mayo Lake. For the purposes of assessment as provided in Chapter 7, the "baseline conditions" equal the full capacity of the plant (approximately 38 GWh/year) and use of the full licensed storage range of Mayo Lake (2.59 m).

Once baseline data was collected for each VC the assessment considered the effects of the Project, as well as other actions which may act cumulatively with the Project, on the selected VCs. Effects were examined for the construction, operation and maintenance phases of the Project. Applying standard practice and the YESAB Guides, the assessment of each VC provides a description of the existing baseline environment as scoped, before providing an analysis of Project effects expected to interact with the VC.

The analysis of Project effects considers both the temporal and spatial scope of effects on selected VCs. The temporal scope is VC specific and extends as long as the Project effects are predicted to occur, taking special consideration of the seasonality of effects where necessary. The spatial scope includes all areas of overlap and interaction between Project effects and VCs within either the Construction Footprint Area or Project Study Region (depending on the specific VC) including determinations regarding whether Project activities overlap with one or more VCs seasonally or year round and duration of such effects.

In accordance with standard assessment practice, YESAA and the YESAB Assessor's Guides, the Project Proposal includes identification of mitigation as part of the effects analysis. Mitigation measures considered during the assessment process include measures to reduce, eliminate or control adverse affects. As set out in YESAA and the guides such measures may also include compensation and alternative ways of undertaking or operating a proposed project that would avoid or minimize any significant adverse effects.

3.2.3 Cumulative Effects Assessment – YESAA Requirements and Overall Approach

As noted in Section 3.2 above, the cumulative effects assessment (CEA) is integral to the assessment approach and examines the likely effects of the Project in combination with the likely effects of other past, existing and future projects and activities. Section 3.2.3.1 below outlines the YESAA requirements for CEA and Section 3.2.3.2 outlines the overall approach.

3.2.3.1 YESAA Requirements

YESAA requires that an Executive Committee Screening consider the significance of any adverse cumulative environmental or socio-economic effects of a project in combination with the ongoing effects of existing projects or the predicted effects of projects that will occur in the future. In environmental assessment practice the effects pathways from other projects and human activities must overlap with the effects pathways identified for the project being assessed in order to be considered to act cumulatively on identified VCs.

Although YESAA does not require that a project proposal submission to the Executive Committee consider cumulative effects⁶, CEA is standard to good environmental assessment practice and has been included as part of this submission. The cumulative effects analysis conducted is designed to assist in determinations regarding whether there will be any significant adverse cumulative environmental or socio-economic effects.⁷

YESAA⁸ describes the criteria for projects that must be included in a CEA as:

- Other projects for which proposals have been submitted under Subsection 50(1) of YESAA.
- Other existing or proposed activities in or outside Yukon that are known to the Designated Office, Executive Committee or Panel of the Board from information provided to it or obtained by it under YESAA.

Only those projects whose effects are likely to act in combination with the anticipated effects of the proposed Project must be considered for the purposes of a CEA under YESAA.

3.2.3.2 Overall Approach

The *Assessor's Guide to the Assessment of Cumulative Effects* (YESAB, 2006c) suggests the application of a cumulative effects framework which closely mirrors the process outlined for the assessment of environmental effects and includes:

⁶ See, YESAA, s. 50(2)(a).

⁷ See, YESAA, s. 42(1)(d).

⁸ At, YESAA, s. 42(1)(d).

- The identification of regional VCs,
- The compilation of cumulative effects VC baseline information,
- The determination of spatial boundaries for the assessment,
- Identification of other projects and activities and a determination regarding their residual effects,
- The determination of the temporal boundaries of the assessment,
- Identification of potential cumulative effects, the characterization of such effects and identification of mitigation measures; and
- Determination of significance of identified cumulative effects.

Following the above-noted guidance from YESAB, the assessment approach considered other projects and activities which may potentially act cumulatively with effects of the Project and affect selected VCs. The CEA identified all inputs from other projects that could act in concert with effects of the principal Project and influence the VCs identified, including:

- Past, present and likely future projects and activities in the area that may affect identified VCs
- Other existing or anticipated pressures (direct or indirect) on identified VCs.

In identifying future projects or activities to be included in the cumulative effects analysis the assessment considers:

- Projects or activities that have already been approved;
- Projects or activities that are already in a government approvals process and on the YESAB registry;
- Other eligible projects or activities not subject to (or yet submitted to) a formal government approvals process are included if there is a high degree of certainty they will occur; and
- The environmental effects of uncertain or hypothetical projects were not considered.

Section 5.4.2 describes the existing and likely future projects and activities in the area that may affect identified VCs.

Following standard assessment practice, where adverse cumulative effects were considered probable, mitigation was applied and determinations were made regarding the significance of the residual adverse cumulative effects after the application of those mitigation measures. While the effects of other projects

on selected VCs must be considered, mitigation could only be applied with regard to the Project being proposed.

3.2.4 Residual Effects and Evaluation of Significance

This step evaluates the significance of adverse residual effects likely to result from the Project after consideration of recommended mitigation. Evaluation of significance was carried out in accordance with YESAA, and involves (where feasible) comparing such residual effects against thresholds for a VC. Examples of thresholds that may be used include specified goals or targets, standards or guidelines, carrying capacity or limits of acceptable change. Significance may also be measured by land use objectives or trends, as well as a range of other methods.

In the absence of thresholds or other specified guides, YESAB Guides set out criteria such as likelihood, duration, magnitude and extent that can be used to provide a preliminary identification of potentially significant effects (further details on approach are provided in Section 3.3 below).

3.2.5 Follow-up & Monitoring

This step sets out recommended monitoring and effects management measures. The need for monitoring environmental and socio-economic effects is required for consideration for screenings by the Executive Committee under YESAA. Effects monitoring may be necessary to ensure the success of any mitigation measures that are to be implemented and to ensure the accuracy of any assumptions made regarding predicted effects and their mitigation.

Follow up monitoring may prove valuable to ensure that the Project does not have any unanticipated adverse significant effects through providing additional information regarding whether predictions were accurate, whether any unanticipated effects occur and whether the Project remains in compliance with any terms and conditions specified in its approval.

3.3 DETERMINING SIGNIFICANCE OF RESIDUAL ENVIRONMENTAL EFFECTS

Predicted residual environmental and socio-economic effects of the Project (i.e., effects after implementation of mitigation measures) are set out in Chapter 7 for the identified VCs. Environmental and socio-economic effects, including the potential effects of accidents and malfunctions, are examined at all stages of the Project's life-cycle from construction to operation and maintenance activities. As indicated in Section 3.2.1, there are no plans for decommissioning the Mayo B facilities. The assessment approach looks at both positive and adverse residual effects of the Project and includes full consideration of cumulative effects. As required by YESAA (S. 58), the assessment includes a determination as to whether adverse residual effects are significant, or not significant, and the rationale for this determination.

3.3.1 Significance Determination Approach

Environmental and socio-economic effects and their significance are identified and determined using standard assessment practice, the requirements of YESAA, and methodologies set out in the YESAB Assessor's Guides. (YESAB, 2006a; YESAB, 2006b)

Deciding whether a project is likely to cause significant adverse environmental or socio-economic effects is central to the concept and practice of project assessment under YESAA and other assessment legislation. The concept of "significance" in this regard cannot be separated from the concepts of "adverse" and "likely".⁹

Determining "significance" involves scientific (including TK and local knowledge) analysis and interpretation of environmental and socio-economic effects, and consideration of effects of environmental or socio-economic changes caused by the Project on the following (YESAA, s.42):

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

Mitigation measures and strategies can be important in the assessment of residual effects. Possible mitigation options include (a) integral parts of the Project design and implementation, (b) a specific "no net loss" habitat regeneration measure approved by a specific regulatory authority, and (c) other measures to manage specific risks (including adaptive management strategies that identify and respond in the event of unexpected adverse effects or when mitigation measures may not be effective).

The determination of significance of residual effects may involve comparing such effects against thresholds for environmental components such as specified goals or targets, standards or guidelines, carrying capacity, or limits of acceptable change. Land use objectives and trends may also be utilized to determine significance of residual effects. However, it is recognized in standard assessment practice that the assessment of project effects is often hindered by a lack of specific thresholds.

⁹ YESAA S.58, regarding ultimate decisions for an Executive Committee screening assessment of a project. See *Assessor's Guide for the Assessment of Socio-economic Effects*, YESAB, 2006 (sections 11 and 12) on the need to determine significance only for adverse effects. See *Assessor's Guide for the Assessment of Environmental Effects*, YESAB, 2006 (section 2.8) on the relevance of "likely". Also, *Determining Whether a Project is likely to Cause Significant Adverse Environmental Effects: A Reference Guide for the Canadian Environmental Assessment Act (Federal Environmental Assessment Review Office.1994)*. The CEAA Guide also notes; "The 'likely' applies to the environmental effects of the project that are both adverse and significant." Notwithstanding differences in wording of YESAA and CEAA on this matter, the ultimate assessment requirement remains to determine significance for effects that are adverse and likely.

Pursuant to standard assessment practice and YESAB Guides, the following criteria were used in the Project Proposal to evaluate the significance of adverse residual environmental and socio-economic effects:

- **Direction or Nature of the Effect:** Positive, neutral, or negative/adverse; in the case of socio-economic effects, as noted in the YESAB Guides, effects may at times be considered to be both positive and negative (see comments below).
- **Magnitude of the Effect** (level of detectability of effect):
 - Low (effect unlikely to be detectable or measurable, or below established thresholds of acceptable change; for some environmental assessments, less than 5% of the VC population or area is affected).
 - Moderate (effect could be detectable within normal range of variation with a well designed monitoring program,¹⁰ or below established thresholds of acceptable change; for some environmental assessments, from 5 to 10% of the VC population is affected).
 - High (effect would be readily detectable without a monitoring program and outside normal range of variation, or exceeds established thresholds of acceptable change; for some environmental assessments, greater than 10% of the VC population or area is affected).
- **Geographic or Socio-Economic Extent of the Effect:**
 - Low (effect extends only within the Construction Footprint Area).
 - Moderate (effect extends beyond footprint and is within the Project Study Region; for socio-economic effects, extends to include the community of Mayo).
 - High (effect extends beyond Project Study Region and is within Yukon, or extends outside Yukon).
- **Duration of the Effect** (how long the effect would last):
 - Low (short-term effects lasting less than one year, or not materially beyond the duration of the construction phase of the Project).
 - Moderate (medium-term effects lasting from 1 to 10 years, or no more than one-generation span of the species affected).
 - High (long-term effect lasting more than 10 years or more than one generation of the species affected; effects lasting throughout a major portion of the operations phase of the Project).
- **Frequency of the Effect** (how often the impact would occur):
 - Low (never, once, seldom).
 - Moderate (occasionally).
 - High (continuously - on a regular basis or at regular intervals).

¹⁰ Implies that effects are statistically significant as determined by such a well-designed monitoring program.

- **Reversibility of the Effect** (is the effect reversible and if so can it be reversed in the short or long term):
 - Complete Reversibility (immediate, or reversible over very short periods i.e., less than one year).
 - High Reversibility (good probability of effect being reversible, periods 1 to 10 years or no more that one-generation span of the species affected).
 - Low Reversibility (Irreversible, or reversible over the period of more than one generation of the species affected).
- **Ecological or Socio-Economic Context** (sensitivity to environmental or socio-economic disturbance, capacity to adapt to change):
 - Low (VC is resilient to imposed change).
 - Moderate (VC has some capacity to adapt to imposed change).
 - High (VC is fragile and has low resilience to imposed change).

The assessment of significance for environmental effects typically can determine a clear overall direction of change (positive, neutral or negative/adverse) for a specific VC, although issues can arise when a specific species or habitat has positive effects in some areas and is harmed in other areas. In contrast, the assessment of significance for socio-economic effects also considers the following:

- The relevance of perceptions in affecting how people view changes;
- Differing perspectives and values among different groups of people about their community and region, as well as their individual and family circumstances; and
- The problems inherent in assessing separately effects on different aspects or components (i.e., different VCs) of people's lives that each contribute to an overall "effect" on any group of people, i.e., effects may be either positive or negative, depending on the people affected, and may be both positive and negative when different groups are affected differently or when different VCs are considered for the same group.

Potential adverse effects that are likely were initially ranked in the Project Proposal based on three of the above criteria: duration, magnitude and geographic or socio-economic extent of the effects. The rating of these likely adverse residual effects used the following definitions:

- **Significant - High Residual Effect:** Effects are long-term (high) duration, large (high) magnitude, and extend beyond the Project Study Region (high geographic or socio-economic extent).
- **Potentially Significant – Moderate Residual Effect:** Effects which fall between "high" and "low" in this list of initial definitions, and thus are "potentially significant" and merit consideration of additional significance criteria. In essence, "moderate" effects are either

- Within the Project Construction Footprint Area (low in extent) and high in both magnitude and duration; or
 - Beyond the footprint and into the Project Study Region (moderate in extent) and either high in magnitude (regardless of duration), or moderate in magnitude and high in duration; or
 - High in extent (Yukon region or beyond) and either moderate or high in magnitude (regardless of duration).
- **Not Significant or Insignificant - Low Residual Effect:**
 - Low in magnitude (regardless of duration or extent), as the effect cannot be detected; or
 - Low in extent (e.g., footprint of Project) and not high in both magnitude and duration, or
 - Short-term (low) or moderate in duration, and not high in magnitude or extent (i.e., not extend beyond the Project Study Region).
 - **Not Significant or Negligible (Insignificant) Residual Effect:** No definable effects at any level or insufficient to be termed a low effect, and generally indistinguishable from project baseline conditions.

Figure 3-1
Potentially Significant and Significant Effects on Environmental or Socio-Economic VCs¹¹

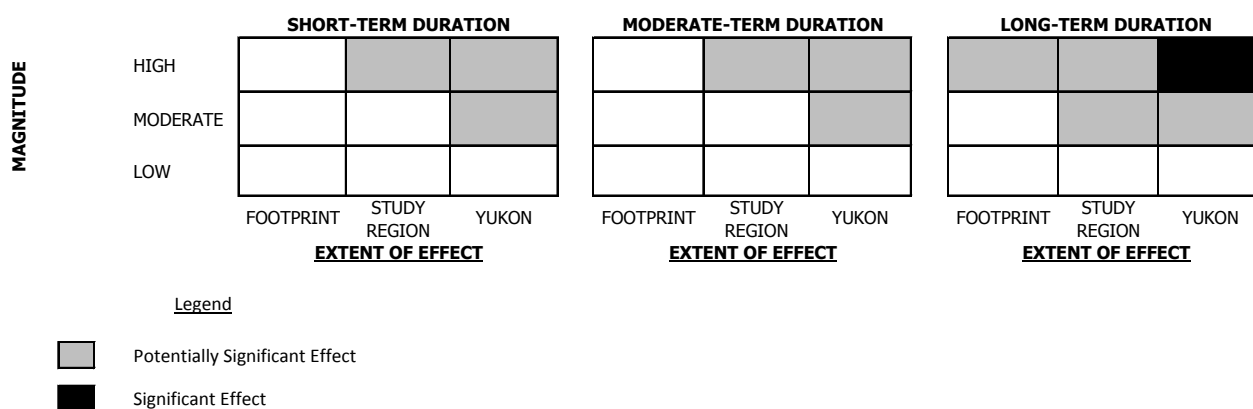


Figure 3-1 above demonstrates that when the criteria of duration, magnitude and geographic extent are applied in order to determine if there are significant or potentially significant effects, there is no practical distinction between effects that are short-term in duration and effects that are moderate-term in duration. Accordingly, to simplify the discussion in Chapter 7, the duration of effects is addressed as being either “short-term” or “long-term”.

For “potentially significant” and “significant” effects, initially ranked on the above basis, it is relevant to consider other significance criteria such as frequency, reversibility, and ecological/socio-economic context

¹¹ In addition to the above criteria, “potentially significant effects” are further assessed in terms of frequency, reversibility, and ecological or socio-economic context (resilience).

or resilience. For example, if an environmental VC is known to be highly resilient (i.e., adaptable and recovers well from disturbance), effects that would otherwise be considered significant could be determined as insignificant, despite magnitude and/or duration or the extent of the effects. Conversely, thresholds or guides may identify highly vulnerable environmental VCs where the loss of even a few individuals may affect the long-term status of the population. For socio-economic VCs, additional factors that may need to be considered include concurrent effects on other socio-economic VCs affecting the same group of people or others in the same community or region, effectiveness of mitigation measures and the degree to which the affected people have any control over mitigation (which may affect “vulnerability” in socio-economic terms), the extent to which the socio-economic component is affected by the Project (magnitude, frequency, reversibility of the effects), and overall confidence in the assessment after consideration of proposed mitigation measures.

In the event that significant adverse effects are predicted for residual effects on VCs, the likelihood is discussed in terms of both the probability of occurrence of the significant adverse effect and the degree of “scientific uncertainty”.

Assessment conclusions are supported by technical information, TK and local knowledge based on experience in Yukon and elsewhere. In this regard, TK and local knowledge are addressed on an integrated basis throughout the assessment process.

Deficiencies in the information base about potential effects have been noted and are addressed further in Chapter 8 Follow up Programs.

3.4 SOURCES OF INFORMATION

The assessment incorporates original studies commissioned by Yukon Energy specific to the Project, including identification of potential facility design prepared by engineers and scientific and technical reports and papers on topics relevant to the Project, and local knowledge and available experience. Other information sources include meetings with NND resource users, regulatory agencies and existing public and unpublished information.

The assessment process for the Project has emphasized consultation and involvement with potentially affected First Nation of Nacho Nyak Dun, the local community of Mayo, and other interested groups. This consultation and public involvement has provided the Project Proposal with important information with regard to local knowledge, concerns and interests as well as available experience.

Meetings with territorial and federal departments were also held to discuss the status of the environmental and socio-economic studies and provide information to assess ongoing changes to this program.

Detailed literature searches and personal contacts were conducted to identify both published and unpublished information. A list of documents utilized and depended on in this assessment is provided in the reference section in Chapter 10.

4.0 FIRST NATIONS AND OTHER PUBLICS CONSULTATION

An overview of the public and community¹ involvement activities is provided in Section 4.1 of this chapter. Section 4.2 describes the principles and approach to consultation, while Section 4.3 describes the methods used. Section 4.4 reviews the activities undertaken with various stakeholders and Section 4.5 describes the key perspectives and issues that were provided. Section 4.6 explains how the key perspectives and issues influenced the project. Section 4.7 describes what will occur in terms of communication about the project upon the filing of a submission to YESAB.

4.1 OVERVIEW

Yukon Energy developed a public involvement approach in order to incorporate community input in the Project design and environmental assessment, and to meet the regulatory requirements for public consultation in an effective and credible manner, and as a standing corporate principle for good planning. Public involvement is required under YESAA, and is consistent with the guidance provided by YESAB (2005) in its *Proponent's Guide to Information Requirements for Executive Project Proposal Submissions*. Section 2.0 of this guidance document states:

Before submitting a proposal to the Executive Committee, the proponent of a project shall consult any First Nation in whose territory, or residents of any community in which, the project will be located or might have significant environmental or socio-economic effects.

Public involvement focused largely on the stakeholders that reside in closest proximity to the Project, and to which the potential effects of a project would most likely accrue, including NND and the Village of Mayo, among other organizations and individuals. This included community members from Mayo, private landowners, resource users such as trappers and placer miners, and the Mayo District Renewable Resources Council (MDRCC). In addition, potentially affected non-government organizations, major customers and various federal and territorial government departments were identified throughout the Yukon. A list of the potentially affected or interested publics is provided in Appendix 4A.

The process was designed to provide on-going opportunities for potentially affected and interested parties to participate in the Project planning by providing information, allowing for sharing of key perspectives and interests regarding the Project, and assisting in devising measures to mitigate potential Project-related effects through the environmental and socio-economic assessment process.

¹ The term 'community' in this document refers to both place-based communities, which can be defined geographically, and interest-based communities defined by a common interest or activity, also sometimes referred to as a 'stakeholder' group.

4.2 PRINCIPLES AND APPROACH TO CONSULTATION

4.2.1 Guiding Principles

Yukon Energy has developed the following principles for public involvement in the project planning:

- **Value of Public Involvement:** Engaging the public in a participatory manner improves the project planning and assessment and will yield better outcomes for the project.
- **Opportunities for Ongoing Involvement:** Provide opportunities for interested or potentially affected parties to learn about the Project and provide inputs with respect to interests, concerns and opportunities. Where possible, work through the consultation process to resolve issues and enable participants to have inputs recorded at each stage.
- **Opportunities at Various Stages:** Before and after filing the Project Proposal, provide opportunities for public input.
- **Provide Various Communication Mechanisms:** Provide a variety of mechanisms to communicate and interact with the public.
- **Required Consultation with Aboriginal Peoples:** Recognize the unique status of First Nations who may be affected if the Project is developed. In particular, discuss the location and effects of the Mayo B Project which is located in the traditional territory of NND.
- **Adaptive Approach:** Adjust the public involvement activities, as required and feasible, throughout the environmental review and planning process, in response to issues, concerns and challenges.
- **Full and Fair Consideration:** Provide clarity on how submitted views and information have been considered and how they have informed Yukon Energy's project planning and assessment.

These principles are consistent with the YESAA intentions, and the YESAB guidelines which direct the proponent to provide notice of the proposed project in sufficient form and detail to allow the party (to be consulted) to prepare its views on the matter, a reasonable period of time for consultation activities, and fair and full consideration of the views presented. It is expected that the public will have further opportunities to participate in the Project review during the YESAB review process.

Yukon Energy, in its consultation with NND also took guidance from the First Nation's Guiding Principles Towards Best Practice Codes for Mineral Interests within Na-cho Nyak Dun First Nation's Traditional

Territory (Appendix 4C). Among the goals and objectives delineated in this document that were particularly captured in the consultation process were:²

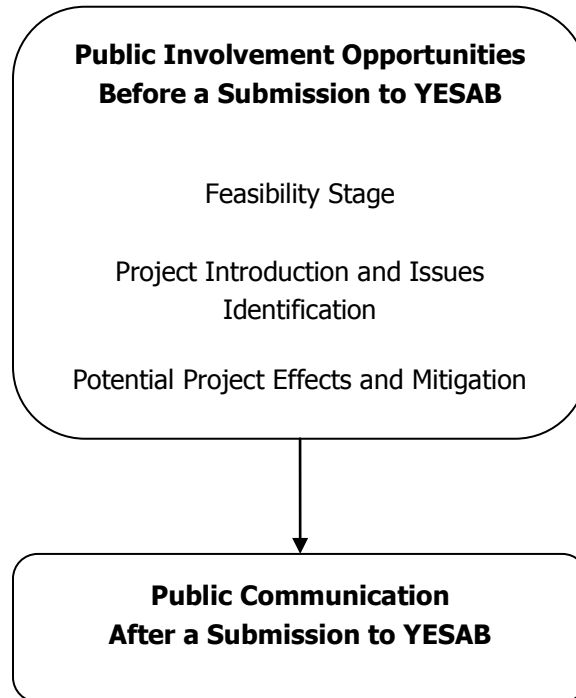
- **Keeping the Commitment Strong:** The parties are committed to working together to achieve environmentally sound and socially responsible developments.
- **Information Sharing:** The parties will ensure effective decision making through impartial sharing of accessible and accurate information in a timely manner.
- **Open Consultation:** The parties will work together to establish appropriate cooperative agreements which will encourage and provide opportunities for meaningful participation.
- **Protecting Environmental Integrity:** The parties are committed to protect and maintain environmental integrity and minimize the impact on the environment.

Yukon Energy also followed NND's Cooperative Engagement Process for Economic Activities Proposed in the Traditional Territory of the First Nation of Na-cho Nyak Dun (2008) (included in Appendix 4C). Protocol was followed to engage the Chief and Council and the staff of NND (described in detail in Section 4.4.1.2) Stages of Public Involvement.

Yukon Energy's public involvement activities were guided in part by discussions held early in the feasibility stage with key stakeholders in the vicinity of Mayo (NND, Village of Mayo, and the MDRCC). Additional opportunities for public consultation occurred prior to the filing of a submission to YESAB. Further opportunities to communicate with the public after filing with YESAB will also occur. These opportunities are described in brief by Figure 4-1. The detailed account of these activities and events associated with public involvement are provided in Section 4.4 and associated appendices.

² Since the guidelines were developed specifically for mineral development, not all of the goals and objectives are relevant – for example the goal regarding opportunities and capacity building which strives towards things such as “ensuring NND citizens receive the benefits derived from their mineral endowment”.

Figure 4-1
Stages of Public Involvement



4.2.1.1 Opportunities before a Filing with YESAB

As per the YESAB (2005) *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions*, Yukon Energy endeavoured to provide sufficient notice to stakeholders about the Project, as well as time for stakeholders to prepare and present their views. This included multiple opportunities before filing the Project Proposal with YESAB:

- **Feasibility Stage:** Yukon Energy approached NND, the Village of Mayo Council, and the MDRRC during the summer of 2008 as preliminary aquatic studies and geotechnical surveys were beginning. The purpose of this was twofold. First, Yukon Energy wanted to keep local stakeholders apprised of the activities that were taking place in the area. Second, Yukon Energy wanted to be made aware of any key interests and issues that might arise should they decide to move ahead with completing studies and consultation required for a submission to YESAB.
- **Project Introduction and Issues Identification:** In the fall of 2008, Yukon Energy began more formal public involvement activities to introduce the Project and its components/options. This stage provided an opportunity for the public to express key perspectives and issues it may have about the proposed Project. These activities focused largely on stakeholders in the Mayo area.

- **Potential Project Effects and Mitigation:** As studies progressed, opportunities to discuss potential Project effects and proposed mitigation measures were provided. Once again, feedback on key perspectives and issues was sought.

Over an eight month period Yukon Energy provided multiple opportunities for stakeholders to learn about the Project, as well as time to consider, prepare, and express their views. Where stakeholders expressed particular concerns, efforts were made to address the issues specifically and in as much detail as possible (based on the status of studies). Feedback was welcome up to the date of filing, and will continue to be accepted and incorporated into the Project planning throughout the review by YESAB and the public. Written feedback of specific issues was provided to key stakeholders and an issues questions and answer newsletter was prepared and direct mailed to all members of the public that left Yukon Energy with their contact information at one of Yukon Energy's public information sessions.

4.2.1.2 Public Communication of the Filing with YESAB

Yukon Energy will communicate its filing of an Executive Committee Screening Report with YESAB with the stakeholders identified in Appendix 4A. This will continue the open dialogue that has been established with local stakeholders such as NND, the Village of Mayo and local residents to ensure that issues they may have identified about Project implementation are addressed.

4.3 METHODS

Several methods to facilitate public involvement were adopted for the Project. These methods were designed to ensure that Yukon Energy was providing information about the Project in a reasonable manner, as well as providing opportunity to receive information and perspectives from potentially affected and interested parties. The audience and methods used for communication varied and included face-to-face interaction, telephone conversations, and electronic and paper communication.

4.3.1 Face-to Face Interaction

Face-to-face interactions with First Nations, stakeholders in Mayo, government, and other parties took a variety of forms depending on the desired level of interaction from the consulted party. This section describes the various formats of interactions that occurred with different groups, while the subsequent section provides details of the activities that occurred.

4.3.1.1 Interaction with NND

- **Meetings with Chief and Council:** As per the guidance provided in Cooperative Engagement Process for Economic Activities Proposed in the Traditional Territory of the First Nation of Na-cho Nyak Dun (NND, 2008b), protocol was followed to engage the Chief and Council, and subsequently the Lands and Resource Department. This included a written request for a meeting with Chief and Council, subsequent initial meeting, and finally in a

formal engagement process related to the Project. Although prior contact/meetings with NND had occurred prior to formal engagement, this process resulted in three main streams of activity with NND in addition to meeting with Chief and Council: 1) Meetings with the NND Lands and Resources Department; 2) Meeting with the NND Project Agreement Working Team, and 3) Meetings with NND membership.

- **Meetings with NND Lands and Resources Department:** The Land and Resources Department for NND acted and continues to act as a major point of contact for public involvement. Meetings have been held in both Mayo and in Whitehorse in order to discuss the proposed Project, associated field studies, and proposed mitigation measures with NND staff and its consultants. Where appropriate NND Lands and Resources staff would identify other relevant NND departments (e.g., Heritage) and community members to participate in meetings (e.g., resource users).
- **Meetings with NND Project Agreement Working Team:** NND and Yukon Energy each identified representatives for a Project Agreement Working Team. This group was tasked with working towards project related agreements including the potential business and investment opportunities for NND related to the project. Initial discussions resulted in a Letter of Contribution Agreement signed by NND and YEC to enable NND to participate in the Planning Phase of the Project up to the end of March 2009, including funding fees and expenses for NND external consultants to assist NND with their review of the proposed Project.
- **Meetings with NND Membership:** Although the majority of contact with NND focused on the Lands and Resources Department and the Project Agreement Working Team, efforts were also made to inform NND membership about the Project. This included invitations to a community drop-in event as well as a community meal and information session which were targeted not only at NND, but the entire community of Mayo.
- **Personal Communications:** Various other conversations occurred with NND Government representatives, largely to facilitate public involvement activities, but these interactions also enhanced the level of understanding about the socio-cultural setting and resource use in the region, as well as the key community interests and concerns regarding the Project. These communications were accomplished in person, by telephone and by email.

4.3.1.2 Interaction with Local Stakeholders and Municipal Government

- **Meetings with the Village of Mayo:** Meetings were held with key staff from the Village of Mayo as well as with the Mayor and Council. These meetings focused on informing the Village of the Project as well as to understand the key issues and concerns that arose from a municipal perspective.
- **Meetings with the MDRRC:** Meetings were held with the MDRRC. These meetings focused on informing the MDRCC of the Project as well as to understand key issues and perspectives.

- **Meetings with Community Members:** A community drop-in event as well as a community meal and information session were held to inform the community about the Project as well as to understand any key issues and perspectives associated with the Project.
- **Personal Communications:** Various key person conversations occurred, in part to coordinate the public involvement process, but also in order to address the key issues and concerns regarding the Project. These communications were accomplished by telephone and email.

4.3.1.3 Interaction with Other Government

- **Small Group Meetings:** Small group meetings were held with various interested federal, territorial and municipal government departments.
- **Open House:** Interested federal, territorial and other municipal government departments were invited to a Project open house in Whitehorse.
- **Personal Communications:** In many instances, consultation with government departments did not warrant a small group meeting and communication occurred via email and telephone.

4.3.1.4 Interaction with Other Publics

- **Small Group Meetings:** Small group meetings were held with various interested parties in order to provide information as well as to understand any key perspectives and potential issues associated with the Project.
- **Open House:** Potentially interested individuals and groups were invited to participate in a Project open house in Whitehorse.
- **Personal Communications:** Not all of the identified organizations/individuals with potential interest in the Project felt that holding a meeting was necessary as they had no major concerns. In such cases, communication occurred via email and telephone.

4.3.2 Electronic, Paper, and Other Media Communication

Electronic, paper and other media communication were used to inform stakeholders and interested publics about the project. The details and contents of each of these forms of communication are provided in Appendix 4B.

4.3.2.1 Mayo Area Activity Bulletins

In order to inform the community of activities associated with the planning of the Project occurring in the Mayo area, bulletins were posted in various locations throughout the community. This included postings at the NND offices, Village of Mayo offices, and the local Yukon Energy office.

4.3.2.2 Mayo Hydro Enhancement Project Newsletters

Two newsletters were produced to provide information about the Project. The first newsletter (November, 2008) described the need for and benefits of the Project, the regulatory approvals and reviews required, the existing Mayo hydro facility, the components of the proposed Project, ongoing studies, and the public involvement opportunities. Copies were mailed to the list of identified potentially affected or interested stakeholders, as well as used throughout public involvement activities.

The second newsletter (February, 2009) provided a summary of the key issues and perspectives provided by stakeholders to date. Distribution of the second newsletter included all individuals who have received the first newsletter and every mailbox in Mayo.

Both newsletters were also posted on the Yukon Energy website (see section 4.3.2.5).

4.3.2.3 Mayo B Posters and Fact Sheets

Project-related posters and fact sheets were developed based on on-going results from technical studies, engineering and environmental field work, and socio-economic and public consultation activities. These were used at the community meal and information session in Mayo and at the Whitehorse open house during January, 2009.

4.3.2.4 Mayo B Technical Status Update

In January 2009, Yukon Energy released a *Technical Status Update for the Proposed Mayo Hydro Enhancement (Mayo B)*. This document was circulated to stakeholders that had participated in on-going discussions on the Project, including NND, the Village of Mayo, MDRRC, the federal Department of Fisheries and Oceans, YG Environment, and the Canadian Wildlife Service. The update report incorporated on-going results from technical studies, engineering, environmental fieldwork, socio-economic baseline work, and public consultation activities (up to January, 2009).

4.3.2.5 Yukon Energy Website

In the fall of 2008, Yukon Energy created a link on their website posting a brief description of the Project. Along with describing the overall Project and providing links to the electronic version of the newsletters, the website described the contingencies for the development of the Project, such as securing the necessary approvals and permits.

4.3.2.6 Event Notification – Print and Radio

Yukon Energy used several means to notify the public about Project public involvement activities. This included posters in the community of Mayo, advertisements in the Whitehorse Star, and public service announcements on the radio (CKRW and CHON-FM) to inform the public of open community events.

These announcements were also sent to CBC North, but unlike the other stations were not guaranteed airtime.

4.4 REVIEW OF PUBLIC INVOLVEMENT ACTIVITIES TO DATE

The following sections summarize the public involvement activities with various groups of stakeholders. Appendices 4C, 4D, 4E, and 4F provide the supporting consultation materials including meeting notes and any materials used during meetings. In many instances, the same materials were used with different stakeholders. As such, some materials are cross-referenced to the first location in which they appear. Appendix 4G provides a summary of personal communications with various individuals and organizations.

4.4.1 Activities Involving NND

As previously indicated in Section 4.3.1.1, activities involving NND focused on four groups: 1) Chief and Council, 2) the Lands and Resources Department³, 3) the Project Agreement Working Team, and 4) NND membership. Table 4-1 provides a summary of these activities, while the presentation materials used and meeting notes produced are provided in chronological order in Appendix 4C.

³ Other departments and community members were involved in these meetings at the discretion of the NND Lands and Resources Department.

Table 4-1
Summary of Activities Involving NND

	Date	Location	In Attendance	Notes
Feasibility Stages	July 2, 2008	Mayo	NND Chief and Council, Yukon Energy	Operations overview & summer field studies notification
	August 5, 2008	Mayo	NND Lands and Resources, Yukon Energy	Summer field studies notification
	September 19, 2008	Mayo	NND Lands and Resources, Elders, Yukon Energy	Meeting to explain the Wareham Dam structure and safety facts
	September 25, 2008	Mayo	NND Lands and Resources, Yukon Energy	Socio-economic field work introduction
Project Introduction and Issues Identification	November 17, 2008	Mayo	NND Chief and Council, Yukon Energy	Proposed Project briefing with Chief and Council
	November 26, 2008	Mayo	NND Lands and Resources, Yukon Energy	Proposed Project briefing
	November 28, 2008	Whitehorse	NND Project Agreement working team, Yukon Energy	Proposed Project briefing
	December 3, 2008	Whitehorse	NND Project Agreement working team, Yukon Energy	Discussion on a contribution arrangement to assist in planning and process towards the signing of an MOU and Project Development Agreement
Potential Project Effects and Mitigation	December 4, 2008	Whitehorse	NND representatives, Yukon Energy	Land and Resource Use Workshop
	December 5, 2008	Whitehorse	NND representatives, Yukon Energy	Aquatic Environment Workshop
	December 16, 2008	Mayo	NND representatives, Yukon Energy	Briefing on Land and Resource and Aquatic Environment workshops
	January 19, 2009	Mayo	NND, residents of Mayo, Yukon Energy	Community meal and information session
	January 20, 2009	Mayo	NND Lands and Resources, Yukon Energy	Project Status Update
	February 17, 2009	Whitehorse	NND Lands and Resources, Yukon Energy	Project briefing on the water flow modeling

4.4.1.1 Feasibility Stages

During the feasibility stage of the Project, Yukon Energy wanted to ensure that NND was kept well apprised of the fieldwork activities that were occurring in the area. This included field studies that were occurring in the Project Construction Footprint (e.g., heritage and geotechnical work), as well as aquatic and terrestrial studies occurring within the Project Study Region. At the time, Yukon Energy had not entered into a formal consultation process with NND, however still endeavored to ensure that a relationship between the organization and NND was maintained.

Yukon Energy was open to the identification of any key interests issues that might arise should they decide to move ahead with completing studies and consultation required for a submission to YESAB. One of the issues identified was concerns over dam safety, and as such, Yukon Energy organized a session with NND staff and Elders to explain how the safety of the existing facility was ensured. This dam safety session occurred on September 19, 2008.

The on-going dialogue with NND before the feasibility of the project was completed allowed for an easy transition to a formal consultation process. The transparency of the process was noted and appreciated by representatives of NND.

4.4.1.2 Project Introduction and Identification of Issues

November 17, 2008, marked the beginning of official consultation, as per NND's Cooperative Engagement Process for Economic Activities Proposed in the Traditional Territory of the First Nation of Na-cho Nyak Dun (2008) (included in Appendix 4C). Protocol was followed to engage the Chief and Council, and the meeting resulted in agreement between the Chief and the CEO of Yukon Energy to have their staff and contractors work diligently and cooperatively in further consultation on the Project. A letter to Yukon Energy from the Chief of NND (and on behalf of the council), dated November 21, 2008 (see Appendix 4C) identified the key staff from the NND Lands and Resources Branch, as well as the negotiation team for NND. The letter acknowledged and supported the efforts that had been made to engage the community and were being proposed as the project proceeded.

Upon entering into a cooperative engagement process with NND, Yukon Energy proceeded with meetings with the NND Lands and Resource Department, the NND Project Agreement Working Team, and with the broader community to inform them of the project.

Activities eventually resulted in the signing of a Contribution Letter of Agreement between Yukon Energy and NND. The letter delineated the purposes of an accountable advance provided to NND to facilitate their participation in the review of the Project, including meetings from November 2008 through to the filing of the YESAB Executive Committee Project Proposal Submission. Among the activities undertaken between Yukon Energy and NND were socio-economic and resource use data collection, community consultation, and interaction with the Lands and Resources Department. The scope of the funding also included professional fees and disbursement for expenses for external consultants hired by NND to assist in their review of the Project.

By entering into a cooperative engagement process with NND, including the funding of external consultants to assist NND in reviewing the Project, Yukon Energy demonstrated its commitment to meet the duties set forth in YSEAA and YESAB's *Proponents Guide to Information Requirements for Executive Committee Project Proposal Submissions* regarding public consultation namely:

1. "By providing notice to the party to be consulted:
 - a. Notice of the matter in sufficient form and detail to allow the party to prepares its views on the matter;
 - b. A reasonable period for the party to prepare its views; and
 - c. An opportunity to present its views to the party having the duty to consult."(YESAB, 2005)

4.4.1.3 Potential Project Effects and Mitigation

Yukon Energy shared details on its current assessment of effects and mitigation to NND as studies progressed. This included workshops addressing the aquatic and terrestrial environments in December, 2008, status updates as the assessment process progressed in January, 2009, and sessions on water level and flow modelling as engineering for the Project was finalized (February, 2009). The workshops and sessions often focused on the concerns of NND, and as consultation activities progressed, NND was offered opportunities to set the agenda and topics of discussion in order to discuss any remaining areas of concern.

The Contribution Letter of Agreement between Yukon Energy and NND also included funding for a community meal and information session. More information on the community meal and information session is provided in Section 4.4.2.3 as the event was open to all community members in Mayo, not solely NND members.

Further discussions remain underway to ensure NND has all the necessary information to complete its own review of this project.

4.4.2 Local Stakeholders and Municipal Government

Activities with local stakeholders were focused on three groups: 1) the Village of Mayo Mayor and Council, 2) the MDRRC, and 3) community members. Table 4-2 provides a summary of these activities, while the presentation materials used and meeting notes produced are provided in chronological order in Appendix 4D.

Table 4-2
Summary of Activities with Local Stakeholders & Municipal Government

	Date	Location	In Attendance	Notes
Feasibility Stages	August 5, 2008	Mayo	Village of Mayo representatives, Yukon Energy	Project feasibility and field studies update
	September 23, 2008	Mayo	MDRRC, Yukon Energy	Project feasibility and field studies update
Project Introduction and Issues Identification	November 25, 2008	Mayo	Village of Mayo Mayor and Council, MDRRC, Yukon Energy	Proposed Project briefing
	November 26, 2008	Mayo	Community drop-in, Yukon Energy	Community drop-in event to introduce the Project
Potential Project Effects and Mitigation	January 19, 2009	Mayo	Village of Mayo Mayor and Council	Effects and mitigation discussion including review of concerns expressed in the Mayor's letter (dated December 18, 2008)
	January 19, 2009	Mayo	NND, residents of Mayo, Yukon Energy	Community meal and information session
	January 20, 2009	Mayo	MDRRC, Yukon Energy	Effects and mitigation discussion,

4.4.2.1 Feasibility Stages

Similarly to the early stages of involvement with NND, Yukon Energy strived to ensure that local community stakeholders were aware of the activities taking place in the Project Construction Footprint (e.g., heritage and geotechnical work), as well as aquatic and terrestrial studies occurring within the Project Study Region. Yukon Energy was open to the identification of any key interest and potential issues that might arise should they decide to move ahead with completing studies and consultation required for a submission to YESAB.

4.4.2.2 Project Introduction and Issues Identification

Yukon Energy introduced the Project to local stakeholders and municipal government in November, 2008. This provided the first opportunity for residents of Mayo and the surrounding area to learn about the Project as well as express any concerns or perspectives they had about the project. Generally speaking, people were receptive to the Project and considered it a preferable alternative to development of a new hydro electric generating site at a location not yet developed for hydro power. Representatives of the Village and the MDRCC maintained an on-going dialogue with Yukon Energy and its consultants from this point forward in regards to the Project.

In addition to meetings with the Village of Mayo and MDRCC, Yukon Energy also hosted a drop-in Mayo community event (November 26, 2008) to introduce the Project. This event was advertised with posters and on the radio, and individuals with leases in the Project Study Region were also called and personally invited to the event. Copies of the first newsletter were distributed at the event, and Yukon Energy staff and consultants were on hand to field questions and receive feedback from community members regarding the Project.

4.4.2.3 Potential Effects and Mitigation

Yukon Energy provided details on effects and mitigation to local stakeholders and municipal government as studies progressed. Yukon Energy also consulted directly with local stakeholders to gain a better understanding of the existing environment and related interests and potential concerns.

The Village of Mayo expressed some of its concerns in a letter dated December 18, 2008 (see Appendix 4D). The letter provided the outcomes of a discussion with Mayor and Council that resulted in 12 questions and concerns regarding the existing environment and proposed Project. This letter provided the basis for the next meeting with Mayor and Council on January 19, 2009, where Yukon Energy worked to address the concerns identified in the letter.

Other stakeholders with specific interests and concerns were welcomed to provide written commentary or ask questions of Yukon Energy, the details of which are captured in the Record of Personal Communications in Appendix 4G. As a result of this process Yukon Energy has committed to further discussion with the village in regard to maximizing benefits from construction camp infrastructure, for example.

Mayo Community Meal and Information Session

On January 19, 2009 Yukon Energy hosted a community meal and information session for local stakeholders in Mayo, including residents of the Village and surrounding area, as well as NND. The event was advertised in the Whitehorse Star on January 16, 2009 and January 19, 2009, as well as on the radio (CKRW and CHON-FM), and in posters posted in various locations in Mayo.

This event was designed not only to provide the current understanding of the Project and its components, but to describe what was known about the assessment of effects to date. This event was attended by 48 community members, not including Yukon Energy employees and consultants. It included an excellent meal catered by NND members, as well as a presentation by Yukon Energy on the Project status. Newsletters, posters and fact sheets providing more detailed information on the Project were available at the event (See Appendix 4D for materials).

4.4.3 Other Government

Table 4-3 provides a summary of these activities. The presentation materials used and meeting notes produced are provided in chronological order in Appendix 4E. Considerable informal interaction occurred as well with government agencies. Record of this communication is included in Appendix 4G.

Table 4-3
Summary of Activities with Other Government

	Date	Location	In Attendance	Notes
Project Introduction and Issues Identification	November 4, 2008	Whitehorse	Department of Fisheries and Oceans, Yukon Energy	Proposed Project briefing
	November 24, 2008	Whitehorse	Yukon Department of Tourism & Culture, Yukon Energy	Proposed Project briefing
	December 3, 2008	Conference Call	Yukon Environment (Regional Biologist), Yukon Energy	Proposed Project briefing
	December 3, 2008	Whitehorse	Canadian Wildlife Service (Environment Canada), Yukon Energy	Proposed Project briefing
	December 4, 2008	Whitehorse	Yukon Environment – Fish and Wildlife, Yukon Energy	Proposed Project briefing
	December 16, 2008	Mayo	Yukon Environment (Conservation Officer), Yukon Energy	Proposed Project briefing
Potential Project Effects and Mitigation	December 4, 2008	Whitehorse	Department of Fisheries and Oceans, Yukon Energy	Proposed Project briefing, including effects and mitigation discussion
	January 22, 2008	Whitehorse	Yukon Environment – Fish and Wildlife, Yukon Energy	Proposed Project briefing, including effects and mitigation discussion

Yukon Energy consultation with federal and territorial governments focused on departments identified either by Yukon Energy or government as having potential interest in the Project. In addition to the meetings listed in the above table these departments received copies of the Technical Status Update (see Section 4.3.2.4 and Appendix 4B). Federal, territorial and municipal (i.e., Whitehorse) government departments were informed about the Project through newsletters and other media as well as being invited to the Whitehorse Open House (See Section 4.4.4.1).

4.4.4 Other Publics

The consultation efforts sought feedback from various non-government organizations and well as private citizens. For the most part, these potentially affected or interested parties were contacted with the newsletter, although efforts were made to contact people that were likely to have concern or interest in the Project, such as lease holders around Mayo Lake, placer miners, ENGOs and other organizations. Any materials used and meeting notes produced with other publics are provided in chronological order in Appendix 4F.

Several non-government organizations with potential interest in the Project were contacted to see whether they had interest in being involved in consultation activities. Among the organizations contacted were the Yukon Conservation Society (YCS), CPAWS, the Wilderness Tourism Association of the Yukon (WTAY), Silver Trail Tourism Association, Klondike Placer Miners Association, Association of Yukon Communities, and the Silver Trail Chamber of Commerce. Of these organizations, only YCS expressed interest in meeting with Yukon Energy. Numerous other non-government organizations were also informed of the project by newsletters, as well as invited to the Whitehorse Project Open House (e.g., Utilities Consumer Group, the Yukon Salmon Sub-Committee, etc.).

Efforts were taken to notify potentially interested publics about the consultation events associated with the Project. For example, phone calls were placed to all trappers, placer miners and lease holders in the Mayo area to inform them of the Community Drop-in Event (November 26, 2008 in Mayo); and notices were placed in all Village of Mayo post-office boxes for the community information session (January 19, 2009). For individuals and organizations with addresses in Whitehorse, letters of invitation were sent for a Project Open House on January 21, 2009 (held at the High Country Inn, Whitehorse). All personal communications are summarized in Appendix 4G, while the list of Whitehorse Open House invitees is provided in Appendix 4F.

4.4.4.1 Whitehorse Open House

On January 21, 2009, Yukon Energy hosted an open house at the High Country Inn in Whitehorse for interested publics. This event was attended by 20 individuals interested in hearing about the Mayo B Project, the need for the project, and potential project effects. The event was advertised in the Whitehorse Star on January 16, 2009 and January 19, 2009, as well as in public service announcements on the radio (CKRW and CHON-FM). Letters of invitation were sent to stakeholders in Whitehorse, including individuals with leases in the Mayo area with Whitehorse addresses (see Appendix 4F for the list of Whitehorse Open House Invitees).

4.5 KEY ISSUES & PERSPECTIVES HEARD TO DATE

Participants in the public involvement activities provided a wide range of issues and perspectives over the course of consultation activities. Some concerns were very specific, while others were more general. Some similar perspectives were raised on numerous occasions, while others were only cited by a single individual or organization. In many cases, the individual or group consulted had no identified issues or concerns with the Project, and many saw it as an opportunity for the Yukon.

4.5.1 Key Issues Related to the Existing Environment and Mayo Facility

Stakeholders identified concerns related to the existing environment, as well as the operation of the existing Mayo Hydro electric facility. These concerns are documented in the meeting notes presented in Appendices 4C, 4D, 4E, and 4F, as well as the record of personal communications presented in Appendix 4G.

4.5.1.1 Existing Environment Concerns

On several occasions, people expressed interests and concerns that related to conditions in the existing environment, often in relation to issues that have arisen in recent years. Although these concerns have been identified as part of the existing conditions in the Project Study Region, in most instances no pathway of effect can be identified in relation to the Mayo B Project.

Dam Safety

Residents of the Mayo area expressed concerns about the safety of the existing dams, particularly about the Wareham Dam. There are concerns that if the Mayo Lake Dam or the Wareham Dam breach, people and homes in Mayo could be flooded. There are also concerns about the amount of time necessary to react if such an emergency were to occur (emergency measures, planning and protocol).

The process of inspecting the existing Mayo hydroelectric to ensure the safety of the operation was shared with stakeholders. This includes routine inspections (day-to-day observations, monthly check-list driven inspections as required and 24-hour equipment monitoring), annual formal inspections by Yukon Energy engineering staff, and an independent dam safety review every five years by independent contractors as per the Canadian Dam Association guidelines and current operating licence. The most recent five-year review was conducted in November of 2005. The proposed Project does not include building any new dams or substantive changes to the existing structures. Yukon Energy will continue the inspections as noted above. Yukon Energy also maintains an Emergency Preparedness Plan for the Mayo Hydro facility that is shared with EMO and Village of Mayo officials. It contains a very detailed response, communication and in a worst case event, an evacuation plan.

Fish Passage at the Wareham Dam

The question of upstream fish passage on the Mayo River has been noted at times by community members since Wareham Dam was constructed in the early 1950's. The Mayo River traditionally had a run of Chinook salmon which migrated over 50 km upriver to, and through, Mayo Lake. Wareham Dam was constructed 12 km upstream from the mouth of the Mayo River, greatly reducing the length of river available to Chinook salmon, including access to spawning sites immediately downstream of Mayo Lake.

The local community has expressed concern over the loss of access by Salmon to the upper Mayo River. It has been reported by the local community that provision of a fish ladder was requested as a condition for the construction of Wareham Dam by the Northern Canada Power Commission (NCPC) in the 1950's. Interviews with some Elders and other long-time residents of the area relay that a fish ladder was understood to be part of the original project design. While some accounts suggest that NCPC agreed to build a fish ladder at the Wareham Dam, others have no recollection of such commitments being made (Buchan, 1993). At numerous meetings over the past six decades, local residents and community representatives have reintroduced and enquired about a fish ladder at Wareham Dam to facilitate the rehabilitation of salmon runs in the Mayo River. Separately, YEC is aware that a fish collection and transport facility ("trap and truck") around the Wareham Dam has also been contemplated by other parties. Yukon Energy conducted a very extensive research of its files and the NCPC files in its possession and can find no mention of a fish ladder.

Construction of a fish ladder at Wareham Dam would be a technically-challenging and very expensive endeavour.

In the event trap and truck fish passage was to be put in place by the local community or government resource managers, assessment of the habitat quality and fish productivity of the Mayo River above Wareham Dam would be necessary. A number of factors over the past several decades may have negatively impacted this section of the river for production of juvenile salmon, including placer mining activities and related increased seasonal turbidity, as well as components of the Mayo Hydro project (the Mayo Lake control structure, the use of Mayo Lake for water storage and seasonally regulated flows in the Mayo River), among other factors.

In respect of the development of Mayo B, no new pathways of effect exist with respect to fish passage beyond Wareham Dam. Yukon Energy has focused efforts in this Project Proposal on mitigation and enhancements to salmon habitat in the lower Mayo River as part of the Project description (see Section 6.6.5).

Icing and Inland Water Inundation

In the past couple of years, residents have noted some concerns about water overtopping the ice on the Mayo River, as well as inland water inundation in and around the Village of Mayo. Among the issues noted over the course of public involvement activities were icing issues on the Mayo River (water

overtopping the ice), flooding of McIntyre Park (including the benches getting frozen into the ice), possible erosion of a portion of the dyke between the village and the river, standing water in and around the community (resulting in issues such as a need for increased mosquito control), and flooding of basements.

Community members offered various opinions as to why these issues were occurring, which included observations on regarding both the Mayo River and the Stewart River, groundwater flows in the area, changing discharges into the Mayo River, and anomalous precipitation over the last couple of years. Although a direct pathway between the existing environment concerns and the operation of the Mayo hydroelectric facility could not be clearly identified, Yukon Energy is in the process of undertaking activities to better characterize the issue and to work with the Village to address outstanding concerns as appropriate (see Appendix 7C).

Wareham Lake Levels near the Minto Bridge

The construction of the Wareham Dam in the 1950s has contributed to the creation of wetland habitat in the vicinity of the Minto Bridge. This wetlands area was created from back-flooding from the dam in 1951. This area has been identified by local residents and stakeholders as an important area for migrating waterfowl, aquatic mammals such as beaver, and moose. Concerns were expressed that changes in water levels could affect the habitat, in particular in relation to nesting ducks.

The area is also used for harvesting berries and medicinal plants. It was the site of a traditional fishing camp in the past, and is now an area used boat launching point for the upper Mayo River.

The Mayo B project will not affect the operation of Wareham Lake, and as such is not expected to have any pathways of effect to water levels in the vicinity of the Minto Bridge.

Occasions of higher than normal Wareham Lake levels also raise concerns regarding flooding of lands used for agricultural purposes in the vicinity of the bridge. Although there is a dyke in place to help protect the property, there is a garden on the property that has experienced some flooding in recent years. Yukon Energy has committed to following up with the property owner to address this concern.

4.5.2 Key Issues Related to Mayo B Project

Stakeholders identified issues related to both the construction and operation of the proposed Project. These concerns are documented in the meeting notes presented in Appendices 4C, 4D, 4E, and 4F, as well as the record of personal communications presented in Appendix 4G.

Generally speaking, with respect to the overall project, stakeholders were pleased that Yukon Energy was focusing its efforts on enhancement of existing facilities as opposed to the development of green field sites (i.e., new dams). They saw it not only as an opportunity to reduce reliance on fossil fuels, but also

as an opportunity for the community of Mayo to benefit from job opportunities and other economic benefits of a major project in the region.

4.5.2.1 Potential Aquatic Effects

Concerns about the potential effects of the Project on the aquatic environment stemmed from the changes to water levels and flows once the new powerhouse is operational. During operation, this included the potential for any rise in Mayo Lake water levels above the current license, as well as the potential of lowering Mayo Lake water levels below the current license as well as changes to flows on the Mayo River.

The interests and concerns related to changes in water levels include:

- Chinook salmon are known to spawn in reaches of the Mayo River downstream of the existing plant. In recent years, First Nations have noted declines in the salmon run throughout the Yukon, and although the Mayo River is not typically used for salmon fishing due to the availability of other salmon fishing locations on the nearby Stewart River, declines to salmon stocks are an overall concern.
- Lake trout and whitefish, along with arctic grayling and northern pike are fished on Mayo Lake. Changes to Mayo Lake water levels, in particular at the bottom range of the existing license or lower, could affect spawning habitat for fall spawners such as lake trout and whitefish.
- Wetland habitat such as those found at the Roop and Nelson arms of Mayo Lake, was identified by various stakeholders as important habitat for a variety of wildlife, as well as to resource users.

4.5.2.2 Potential Terrestrial Effects

- Potential effects on culturally important species such as moose and beaver.
- Effects on access to locations where collection of plants (berries and medicinal plants) occurs throughout the Project Study Region.
- Construction activities for the conveyance options in proximity to the Five Mile Lake campground could potentially effect recreation activities (e.g., cross country skiing, camping), due to increased noise and traffic.

4.5.2.3 Potential Effects on Resource Use

- During the construction period an influx of workers could potentially increase pressure on local hunting and fishing activities, which could affect local resources and existing resource users.

- Concerns about navigation and access on Mayo Lake were expressed by a variety of stakeholders, particularly when the lake is operating at the upper or lower limits of its water license.
- Low water levels in spring could affect barge access to Mayo Lake, in particular at the west end of the lake, affecting the timing of activities associated with placer mining.
- Placer miners expressed concerns about the suggestion of a fish ladder at Mayo Lake as the re-introduction of salmon to the area would affect the regulatory requirements for managing their mining operations.

4.5.2.4 Potential Socio-Economic Effects

- People expressed interest in the training, employment and business opportunities associated with the project.
- Concerns were identified about increased pressure on local infrastructure (such as the highways, roads, landfill site, water supply, and sewage lagoon). Opportunities were also noted to develop infrastructure for the project construction camp that could leave a positive “legacy” for the local residents.
- Community members expressed concerns about an influx of workers and the potential for alcohol related incidences.
- People expressed concerns about the Project’s potential to affect utility rates across the Yukon.
- Some people expressed concerns about the overall cost and the potential for the Project to draw upon moneys that could be used for other developments (e.g., funding from the federal infrastructure program).
- If the grids are interconnected, there is concern that Mayo will begin to experience the same sort of power outages that have occurred in Whitehorse recently.

4.5.3 Other

Some community members noted that Yukon Energy used to have an office in Mayo where people could pay their bills. This is a service that some people in the community have interest in seeing reinstated.

4.6 FIRST NATION AND OTHER PUBLICS INFLUENCE ON THE PROJECT

The key issues, concerns, and perspectives raised during the public involvement process to date have been considered by Yukon Energy and incorporated in the Project design and environmental assessment

process. The issues and perspectives raised by various stakeholders were balanced with other aquatic, terrestrial, socio-economic, cultural, technical and cost considerations, and met the duty set for by YESAB's *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (2005) to "consider fully and fairly any views so presented".

Public influence can be broadly categorized as general influences on the Project and site specific influences. Additionally, public involvement also identified opportunities and constraints that without consultation would not have been incorporated in the Project design. Examples of opportunities included location of the work camp and associated infrastructure needs (e.g., potable water). Examples of constraints presented include the identification of historic sites.

The following are some of the areas where feedback from public involvement activities was considered in the environmental and socio-economic assessment process:

Existing Environment Concerns

- Yukon Energy endeavored to characterize concerns about the existing environment (Section 4.5.1.1) in order understand whether there were potential pathways of effects between existing conditions and the proposed Project.

Inviting Stakeholders to Influence the Public Involvement Activities

- Yukon Energy has worked cooperatively with NND to understand their concerns and address their information needs. This began with initiation of the first steps identified in NND's *Cooperative Engagement Process for Economic Activities Proposed in the Traditional Territory of the First Nation of Na-cho Nyak Dun*, and working within its protocol throughout the process of public involvement (NND, 2008b). In addition, Yukon Energy was cooperative in scheduling additional meetings at the request of NND to ensure that they were apprised of the state of studies throughout the course of the assessment. Yukon Energy also provided funding for NND to hire external consultants to help them in the review of information.
- Yukon Energy responded to the concerns expressed by the Village of Mayo by using their letter of interests and concerns (see Appendix 4D) to set the agenda for meetings held in January, 2009. Issues raised in these exchanges remain under discussion.

On-going Commitment of Work with Stakeholders after Filing

- While Yukon Energy strived to address public concerns prior to filing with YESAB, in some instances it is necessary and sensible to initiate YESAB review of the proposed Project prior to finalizing all discussion with stakeholders on each item of concern. Yukon Energy recognizes that NND, the Village of Mayo and other local stakeholders may have concerns regarding the implementation of the Project. Yukon Energy is committed to maintaining an

on-going dialogue with these stakeholders in order to ensure that issues and concerns are considered and addressed in a timely and thoughtful manner.

The following are some of the areas where public influence resulted in refinements to the Project:

- Location and Operation of the Work Camp.
 - The preferred location of the work camp was determined after considering feedback from residents regarding their preference to see it located outside of the community.
 - Issue of potable water – opportunity to have Yukon Energy drill a new Village well for long-term community benefit; and have NND haul the water to the camp as a business endeavour is being explored.
- Mitigating Potential Issues Resulting from an Influx of Non-Local Workers.
 - In order to address concerns about increased pressure on hunting, Yukon Energy will restrict the possession of firearms in the Project Construction Area and work camp. Such a policy should help to reduce opportunities for non-resident workers to engage in hunting while in the Project Study Region.
 - In order to address concerns about increased pressure on fishing, Yukon Energy will engage in further discussions with the MDRRC and the Village of Mayo, and government resource managers to determine more suitable locations in the area for those workers interested in fishing.
 - A zero tolerance policy for alcohol possession and use will be put in place for the work camp.
 - The Village of Mayo proposed various measures that could help to alleviate potential concerns associated with an influx of workers. Yukon Energy will continue the dialogue in this regard, as well as appoint an ongoing Project Liaison person to address any concerns once construction is underway.
- Mayo Lake levels/Wetlands at ends of Mayo Lake Arms.
 - Yukon Energy originally considered scenarios in which water levels on Mayo Lake could be raised or lowered. Raising water levels was discarded as an option due in part to concerns expressed about shoreline erosion and associated effects.
 - Yukon Energy initially considered the full range of a 1 metre additional draw-down, with unconstrained use as required, including on an annual basis. This has been amended in the Project Description (Chapter 6) to incorporate a more restrictive operating regime in part response to the concerns expressed related to fall spawning fish at Mayo Lake.
 - Wetlands, such as in the Roop Lakes area, were identified as being of ecological importance to NND, and as such, was given specific consideration during the environmental and socio-economic assessment.

4.7 FUTURE STEPS IN PUBLIC CONSULTATION

Yukon Energy will make efforts to continue communication with stakeholders about the filing of its submission to YESAB.

Public consultation activities will continue prior to and during construction and operation/maintenance. Throughout construction activities, Yukon Energy will ensure open and timely communication with potentially affected publics to minimize any interference between construction activities and resource use. This may include posting of bulletins in the community, provision of a liaison person for direct communication to Yukon Energy in the event of incidents to report, and/or notices on YEC's website. An additional newsletter after the YESAB filing will be produced to describe the proposed Project and summarize the key issues that were heard.

5.0 ENVIRONMENTAL AND SOCIO-ECONOMIC SCAN

This chapter provides a high-level environmental and socio-economic scan of relevant conditions in the vicinity of the Project, as required to address items set out in the *Proponent's Guide* Section 4.0, Description of the Existing Environment and Socio-Economic Conditions. It is comprised of a summary of existing and known evolving conditions in respect of the following:

- Overview
- Environmental Conditions
- Socio-Economic Conditions
- Existing and Planned Developments

The description of the Existing and Planned Developments includes a description the existing Mayo hydro plant, its associated facilities as well as operation of the existing facility (including water levels and flows). Beyond the existing Mayo facility, there are a variety of past and current projects and activities that comprise the existing and evolving built environment in the Project Study Region. These projects are identified in Section 5.4.2.1, and along with proposed and future known projects, form the basis of the cumulative effects assessment in Chapter 7.

The chapter focuses on conditions and relevant developments that exist as a backdrop for the Project. Specific baseline conditions of identified VCs for the purposes of assessment consider this existing condition as well as the expected evolution of conditions in the future without the Project, and are addressed in Chapter 7.

5.1 OVERVIEW

The Mayo Hydro Enhancement Project is proposed to occur within an existing environmental and socio-economic setting that has seen considerable development and activity over a sustained period of time. Of particular note, a dominant feature of the existing conditions arises from the presence and influence of the existing Mayo hydro facility. This facility was constructed in 1951 and is currently owned and operated by Yukon Energy. It has been in continuous operation for the past 58 years.

The existing conditions provide a key input for the selection of valued components, for the baseline analysis of each valued component, for determining relevant projects to be considered in the cumulative effects assessment, and for the assessment of Project effects, cumulative effects and mitigation which is detailed in Chapter 7.

Chapter 3 of this Project Proposal sets out the key geographic areas of focus for the assessment work, including the specific Construction Footprint Area, and the larger Project Study Region.

Further detail in respect of the existing conditions is provided in the reports contained in Appendices associated with Chapter 7 as follows:

- Aquatic Existing Conditions – Appendix 7A
- Terrestrial Existing Conditions – Appendix 7B
- Socio-Economic Setting – Appendix 7C
- Heritage Resources – Appendix 7D

5.2 EXISTING ENVIRONMENTAL SETTING

The Mayo region is situated within the Boreal Cordillera ecozone, and is bordered to the north by the Wernecke Mountains, and by the Stewart Plateau to the south. To the west of the Stewart Plateau is the Tintina Trench, a linear, geological fault and large valley. The topography around Mayo is characterized by tablelands and rolling uplands with wide u-shaped valleys (Smith et al 2004).

Elevation, slope, aspect, precipitation, fire cycles and permafrost influence vegetation and wildlife habitat around Mayo. Following is a description of the general physiography, surficial geology, soil conditions and climate of the Mayo region, as well as the vegetation, fish and wildlife and water resources of the area.

5.2.1 General Physiography, Surficial Geology/Soil Conditions and Climate

Mayo sits in the Selwyn Basin, a geological region characterized by chert, shale and schist, which transects the Yukon, parallel to the Tintina Trench (Roots, 2006a). The Selwyn Basin has several granite masses with nearby gold-tipped veins rich in silver, lead, zinc and quartz. The mountains in the area are sedimentary and metamorphic rock, underlain and case-hardened by granite (Roots, 2006b).

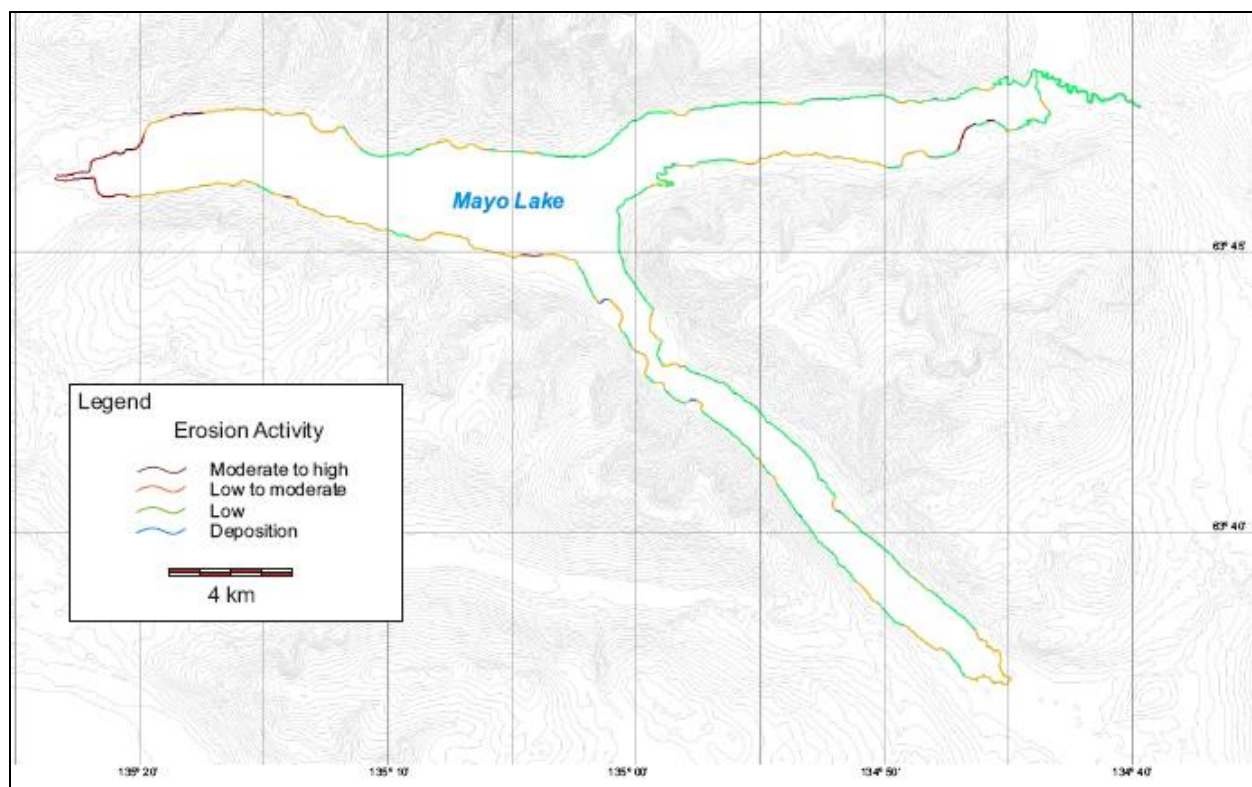
In the Quaternary ice age, parts of central and western Yukon were uncovered by ice, and formed a cold, dry habitat corridor known as Beringia. Fossil evidence from Beringian flora and fauna are found around Mayo and present-day descendants of plants and animals from Beringia exist in the region (Burn, 2006a). More recent glaciations which left deposits of sediment and moraine in the Mayo area were the McConnell glaciation and the Reid glaciation (Burn, 2006b).

The Mayo region is underlain by discontinuous permafrost, which covers 50 to 90% of the ground below the active layer. The permafrost layer can thaw and cause sinking or slumping of the active layer, evidenced by the “drunken” forest near Wareham Lake and the thermokarst lakes near the Halfway lakes (Burn, 2006c).

Mayo is relatively dry and experiences extreme temperature variations and temperature inversions, where the higher elevations can be warmer than low lying valleys. There is relatively little wind, save at higher altitudes. Average monthly temperatures measured in Mayo between 1904 and 2001 are -25.8°C for January and 15.4°C for July. About 42% of the precipitation in Mayo is snowfall, which begins sporadically in the late fall and leaves about 40cm on the ground by March. The melt period occurs primarily in May, and lakes and rivers in the valley bottoms flood in May and June. The summer is generally a season of higher precipitation than the spring, due to evaporation from lakes and transpiration from vegetation. April has an average monthly precipitation of 11.0mm, while the average for August is 47.1mm (Burn, 2006d)

Preliminary analysis of erosion conditions on Mayo Lake using topographic maps, photos and video evidence of the lake’s shoreline areas indicates that the majority of the shoreline is characterized by relatively low bluffs that experience relatively low rates of erosion. About 26% of the shoreline has hard surfaces such as bedrock, which experience very slow rates of erosion. The remainder of the shoreline consists of varying types of sediment materials which are more susceptible to erosion, depending on water level and wave conditions. There is a wide range of materials in this remaining shoreline, however, including coarser sediments that are less susceptible to erosion, and fine-grained materials that are highly susceptible to erosion. The shoreline areas most susceptible to erosion on Mayo Lake are the bluffs at the west end of Mayo Lake. See Figure 5-1 for locations of shoreline areas most susceptible to erosion. Appendix 5A provides a more detailed analysis of existing shoreline conditions.

Figure 5-1
Erosion conditions along the Mayo Lake shoreline



5.2.2 Water Resources and Aquatic Species in the Region

Water Resources

Hydrology

The Mayo River is located in the Stewart River basin that drains into the upper Yukon River. The headwaters of the Stewart River originate in the Werneke and Hess Mountains. In the Project Study Region, the Mayo River flows out of Mayo Lake into the Stewart River just south of the Village of Mayo. Mayo Lake itself is fed by numerous creeks and tributaries, including the Keno-Ladue River which runs into the Roop Lakes north of Mayo Lake's Roop Arm, as well as Granite, Edwards and Nelson creeks.

The peak discharge of water into the Stewart River drainage system occurs in May and June from snowmelt. Inflows slow considerably in July and August (depending on the year). There is relatively little natural lake storage in this region during the peak discharge. After the ground freezes in December and the surface is covered with snow, deep groundwater is the only ongoing source of water.

Water levels on the Stewart River tend to peak between May 17th and June 25th, at times resulting in floods. Sediment loads in rivers are lowest in winter and highest during the spring runoff season. Freeze-up begins in October and is usually complete in December (Burn, 2006e).

The Mayo River flows downstream of Mayo Lake are partially regulated by Yukon Energy for the purposes of power generation. Flows upstream of Mayo Lake are modified by the permitted operation of Mayo Lake as a storage reservoir, and releases are regulated by Yukon Energy except when the lake is at or above the licenced Controlled Maximum Level. Up to one third of the Mayo River inflows to Wareham Lake come from uncontrolled local inflows downstream of Mayo Lake with natural unmodified seasonal flows. As a result, Wareham Lake and the lower Mayo River retain a substantial natural spring freshet.

See Appendix 5B - Mayo Generating Station Hydrometric Data for a detailed summary of hydrometric data sources.

Groundwater

The Project Study Region currently experiences an active water table that results in groundwater exchange with surface water sources such as the Mayo River and Mayo Lake, and causes groundwater upwelling into back channels in many areas surrounding the Mayo River. During spring, summer and fall, groundwater can provide a cooling influence on surface water sources. In the winter, groundwater provides a warming influence that can keep areas of river environment from freezing. As a result, winter open water occurs in places on the local rivers, including the Mayo River. This groundwater effect can be seen by winter open water occurring in areas where the current is not otherwise fast enough to prevent ice from forming.

Aerial monitoring of winter snow cover across the Project Study Region during 2008 showed many areas in the main river channel and in back and side channels where groundwater had melted surface snow and ice, indicating the possible presence of groundwater influences in the specific location. The aerial monitoring supported comments provided during public consultation that indicate groundwater influences are very active in Zone 1 of the Mayo River region adjacent to the Village of Mayo. Other areas with indications of groundwater influence are seen in the lower Mayo River (downstream of the Wareham Dam), as well as a high level of open water occurring near the outlet of Edwards Creek and a few small areas at Roop Lakes.

Edwards Creek, which empties into Mayo Lake near the Roop Lakes, does not freeze completely and as such, the stream can be difficult to cross during the winter months. The rest of the Roop Lakes area experiences extensive ice coverage, although small areas of groundwater discharge were observed throughout the wetland complex. Open water was also noted in Granite Creek near its outlet to Roop Lakes, which may be an indication of groundwater inputs.

No potential groundwater influences were identified in the specific area of Zone 2, between the existing powerhouse and the proposed powerhouse, or along the Upper Mayo River between Wareham Lake and Mayo Lake.

See Appendix 7A for a more detailed discussion of groundwater in the Project Region.

Water Chemistry

Lakes in the Mayo region tend to have a neutral PH, buffered by calcium carbonate, which originates from local bedrock. Nutrient levels in lakes in the region are generally low and overall productivity is limited by lake size and depth (i.e., the amount of shallow littoral area). Nitrogen levels are low and phosphorous levels are low to moderate in Mayo Lake making it less productive thus less capable of supporting zooplankton and phytoplankton (oligotrophic).

River Channel

The lower Mayo River exhibits specific characteristics in respect of channel structure and profile. A summary of survey data compiled by Yukon Energy through the lower Mayo River can be found in Appendix 5C. The survey data reflects flows during the summer of 2008 ranging from high flow conditions down to approximately 11.2 cms. Consideration of water levels that would arise when flows are below this level can be extrapolated from the data, and also subjected to ground-truthing during future low flow events.

Aquatic Species

The water bodies around Mayo are habitat for anadromous, or ocean dwelling fish that spawn inland, as well as non-anadromous fish that stay in local lakes and rivers year round. Chinook salmon migrate up the Yukon River from the ocean and reach the Stewart and Mayo Rivers by mid-July-August. They spawn in tributary streams to the Stewart on gravelly river bottoms (redds). The alevins hatch in the late winter/early spring and feed on their yolk sacks. Fry (yolk sack used up) can move into tributaries and smaller creeks and clearer larger streams to feed in the spring and summer. They rear in freshwater for a year before migrating down the Yukon River to the ocean. In four to seven years, Chinook salmon return as adults to the same rivers and creeks to spawn, and die shortly afterwards. The McQuesten and Mayo rivers are prominent spawning rivers in the Stewart River Watershed. Some Chinook reach the headwaters of the Stewart River upstream of Mayo, however, many do not get farther than Fraser Falls, about 60 km upstream of the village (O'Donoghue, 2006a).

In 2004, the First Nation of Na-Cho Nyak Dun (NND) completed a pilot side channel restoration project with the goal of improving juvenile Chinook salmon rearing opportunities in the lower Mayo River. Two side channels were lowered to increase habitat and groundwater recruitment into the channels. A five year post construction monitoring program (2009 being the last year) is being conducted to determine the biological and physical success of these projects. One site (Site B, located near McIntyre Park) has been used by notable densities of juvenile Chinook throughout most of the year. The groundwater inputs to this channel provide warmer water temperatures in the fall and early winter compared to adjacent, natural habitats. As such, this channel appears to be especially valuable to juvenile Chinook during this critical time of year. Through the conduct of these projects, notable knowledge of Chinook rearing and

channel restoration has been gained that will help guide future channel restoration/enhancement projects throughout the Yukon.

Chum salmon are known to migrate the Stewart River and spawn in the late summer/fall on back sloughs or tributaries with gravelly bottoms, often near groundwater sources. The eggs hatch in late winter/early spring, and the juveniles head back to the ocean that spring, returning to the sea for three to four years before making the trip back as adult spawners. There is inconsistent documentation on the use of the Mayo River by chum salmon, most of which is anecdotal (see Appendix 7A).

Lake trout, a non-anadromous char, live in the deepest, coolest lakes of the Mayo Region, including Mayo Lake, Janet Lake, Williamson, Minto, Ethel, Big Kalzas and Little Kalzas. They generally spawn in September on rocky shoals or lake bottoms and hatch in the spring. Juveniles grow slowly and do not reach sexual maturity until they are between 9 and 11 years old. They can weigh over 25kg, and are piscivorous, in that they tend to prefer eating whitefish and cisco. Lake trout do not die after spawning and have a long lifespan. In some lakes, the adults feed on aquatic invertebrates and remain smaller in size, and develop a reddish flesh (O'Donoghue, 2006a).

There are five species of non-anadromous fish in the whitefish family around Mayo, including lake whitefish and round whitefish, which live in most lakes, larger rivers and creeks in the region. Least cisco are smaller and swim in schools. The inconnu is the largest whitefish in the region, and tends to live in the Stewart and Pelly rivers, but is less abundant. Broad whitefish are known to migrate relatively far to spawn, and to over-winter in larger water bodies (O'Donoghue, 2006a).

Arctic grayling are also common in the watercourses, as are northern pike. Northern pike prefer shallow, weedy sloughs and lake shoals. They can eat smaller furbearers and waterfowl, and even other pike, as they are extremely territorial. Lake chub, longnose sucker, and burbot are also widely distributed, however, the slimy sculpin is the fish with the most extensive geographical reach in the Mayo area, as they are found in virtually all creeks, rivers and lakes (O'Donoghue, 2006a).

5.2.3 Vegetation and Wildlife Common to the Region

5.2.3.1 Vegetation

Typical northern boreal forest is present at elevations up to approximately 1,500 m with shrubs and lichen dominating in alpine areas (Smith et al. 2006). Extensive shrub lands are present at mid elevations and in valley bottoms due to cold air drainage. The most common forest type is comprised of open black spruce with a moist feathermoss understory or a drier understory comprised of lichens. On warmer and better drained sites, white spruce and occasionally aspen or lodegpole pine are present. Throughout the region, paper birch is found scattered throughout and is usually found in cooler locations. Due in part to the high frequency of thunderstorms within the region, forest fires are frequent and result in mixed canopy forests. The high incidence of fires often results in extensive stands of lodegpole pine and

occasionally aspen. Steep, south facing slopes along the large rivers (including the Stewart River) within the ecoregion are inhabited by grassland communities which are remnants of the last glacial period.

The forests at lower elevations tend to include stands of balsam poplar growing among white spruce, with an understory of willow, rose, Labrador tea, northern comandra, bluebells, and lowbush cranberry. At mid-elevations, white and black spruce are populous, with the typical underbrush being willow, Labrador-tea and rose. Lodgepole pine grows in recently burned areas and in drier, sandier soils along with other pine species. Sub-alpine fir and black spruce are indigenous to the lower reaches of north-facing slopes and paper birch also prefers ridges where the temperature is lower. Aspen can be found on warmer, south-facing slopes. Crowberry, blueberry and bearberry are also boreal plants in the area (O'Donoghue, 2006b).

Post-fire secession tends to begin with grass and fireweed, followed by willow, then aspen and pine emerge, or black spruce, if the site is wetter. The aspen are eventually succeeded or replaced by white spruce (O'Donoghue, 2006b).

In the Project Study Region, localized wetlands include the Frog Ponds behind the Mayo airport, which are marshes with bulrushes and cattails, two wetland complexes north of Wareham Lake along the Mayo River, one towards Janet Lake, and another to the south of the Halfway Lakes, as well as smaller wetlands north of Wareham Lake along the Mayo River. The Roop Lakes wetland complex on the north eastern Roop Arm of Mayo Lake, fed by the Keno-Ladue River, and Granite Creek, is another wetland within the Project Study Region, as is the wetland at the south end of the Nelson Arm of Mayo Lake. Neither the Roop Lakes wetland nor the wetland at the southern end of Nelson Arm has a specific designation by Yukon Environment.

Within the Construction Footprint Area, there are several small woodland bogs located near Five Mile Lakes. Bogs produce peat, are precipitation fed, and are often populated with sphagnum moss and feather moss (Appendix 7B).

Larger wetland complexes in the Mayo area outside the Project Study Region are located along the Stewart River at Horseshoe Slough and at U-Slough. McQuesten Lake is also the site of a large wetland complex. Larger wetland complexes in the region tend to be a mixture of different wetland types. Horseshoe Slough has been designated a Habitat Protection Area under the *Yukon Wildlife Act* and is described in the Nacho Nyak Dun Final Agreement. *The Community Based Fish and Wildlife Management Plan, Nacho Nyak Dun Traditional Territory*, identifies Devil's Elbow along the Stewart River as an important moose calving and waterfowl nesting site.

5.2.3.2 Birds

The Tintina Trench, west of the Mayo region, is an important migratory flyway for many bird species. Many migratory birds stop to nest in the area, including a number of boreal-breeding shorebirds, waterfowl, flycatchers, warblers and sparrows.

The airport near Mayo is a popular nesting area for Canada Goose. Waterfowl nest in wetlands in late April and May. Roop Lakes and other wetlands are important breeding habitat for species such as American Wigeon, Mallard, Green-winged Teal, Northern Pintail, Ring Necked Duck, and Lesser Scaup. Common, Red-throated and Pacific Loons, and Horned and Red-necked Grebes nest near smaller water bodies near Mayo in the summer. Buffleheads and Red-breasted Mergansers are known to nest along lakes and rivers in the region, and Barrow's Goldeneye nest inland up to several hundred metres from lakes. Other resident birds in the Mayo area include corvids, grouse, owls, woodpeckers, finches, grosbeaks and chickadees. The Rusty Blackbird breeds in wetlands and are considered as regular occurrences in the Mayo area. The Olive-sided Flycatcher (considered a "sensitive" species by the Canadian Endangered Species Council) is not recorded in the Birds of the Yukon database; however there has been one record on the Mayo Landing Breeding Bird Survey route (see Appendix 7B for further details).

The Yukon Government's Wildlife Key Areas Database identifies two key wildlife areas within the Project Study Region:

- WKA ID 2726 for "unspecified raptors" – along the Mayo River from the Stewart River to 6km upstream of Wareham Lake; and
- WKA ID 2734 for Bald Eagle summer nesting at the eastern end of Roop Arm in Mayo Lake.

Bald Eagle, Golden Eagle, Northern Goshawk and Gyrfalcon are raptors living year round in the area, while Osprey, Red-tailed Hawk, Northern Harrier, Sharp-shinned Hawk, American Kestrel, Merlin and Peregrine Falcon are all summer residents (O'Donoghue, 2006c). Peregrine falcon nest on cliffs, usually near water and would be expected to be found within the Project Study Region along the lower Mayo River.

5.2.3.3 Mammals

Nineteen rodent species are resident in the Mayo region. Red squirrels are found in spruce or pine stands, and northern flying squirrels are found in dense, low elevation forests. Least chipmunks tend to live near waterbodies. Arctic ground squirrels and hoary marmots are often in the alpine tundra. Beavers are found in watercourses throughout most of the area, from lowland marshes to subalpine creeks. Muskrats are also found in creeks, rivers and streams. A number of smaller rodents and voles are present, including meadow and tundra voles, deer mice, and bog lemmings. Shrews, including the masked shrew, the dusky shrew, and the pygmy shrew can be found at most elevations and in most types of vegetation cover (O'Donoghue, 2006d).

Snowshoe hares tend to be found in dense shrub thickets near wetlands and shorelines, and in areas with regenerating vegetation in burns less than 30 years old. Porcupines are also found in the area. Red fox, wolf and coyote are abundant in the area. Coyotes moved into the area from the south around the turn of the twentieth century (O'Donoghue, 2006d).

Least weasels and ermine live in the Mayo region, hunt small rodents, and tend to fluctuate in population. Marten are larger and live in old forests. Mink live near watercourses and wetlands. River otters are an aquatic member of the weasel family, common to the large creeks and rivers in the Mayo area. Wolverines, which travel extensively to hunt and mate, are rarely seen residents. Lynx, another seldom-seen, local animal, stock snowshoe hares in wet places where willows grow and burned out forests. Lynx populations follow the snowshoe hare cycle (O'Donoghue, 2006d).

Black bears and grizzly bears are resident, and are often sighted at the junction of the Mayo and Stewart Rivers. Grizzlies and black bears hibernate for about seven months of the year. Black bears hibernate in forested areas, where they stay most of the year. Grizzlies hibernate on south-facing slopes at higher elevations, and tend to spend the summer and fall in the subalpine. The bears feed primarily on berries, plant shoots and roots, turning to fish and other animals, particularly when berries are scarce (O'Donoghue, 2006d). A black bear den located in the western portion of the Construction Footprint Area appeared active with fresh scat found in the vicinity of the den; and a black bear was encountered by a geotechnical drilling crew while working at the proposed location of the new powerhouse in August 2008. Black bear scat and tracks were observed in the northern and western portions of the Project Study Region.

Moose are widely dispersed in the Mayo area, with an estimated 200 animals per 1000km². Calving occurs in late May in densely forested shoreline habitat, and the summer is spent feeding on plants and shoots in wetlands and along streams and creeks, or in recently burned patches. They mate in mid-September and then move to higher altitude willow thickets, where they form feeding groups, descending back into dense spruce forests along the larger rivers by mid-winter (O'Donoghue, 2006d).

Caribou used to be more abundant within the broad Mayo region. The Ethel Lake woodland caribou herd to the south of the Stewart River, which numbers about 300 animals, and the Clear Creek woodland caribou herd to the north and west of McQuesten River (northwest of Mayo), numbering about 900 animals, are the closest herds. Neither of these herds frequent the Project Study Region. Mule deer are often sighted along the Silver Trail highway between Wareham Lake and Stewart Crossing. They prefer open south-facing bluffs and open areas such as the Mayo airport (O'Donoghue, 2006d).

5.3 EXISTING SOCIO-ECONOMIC CONDITIONS

The dominant socio-economic conditions in the Mayo region relate to the Village of Mayo and the First Nation of NND, as well as various resource-related developments. Appendix 7C provides the Socio-Economic Setting in greater detail; the following provides a high-level scan.

5.3.1 Resource Use

The Project Study Region is characterized by relatively extensive use of the local resources, both for domestic traditional and for commercial purposes.

5.3.1.1 Traditional and Domestic Resource Use

Hunting, trapping and fishing are important to the community of Mayo and to NND for both traditional and domestic purposes. The Mayo River and Mayo Lake are used both directly for resource use, as well as indirectly by providing access to resource use areas.

Hunting for species such as moose, beaver, porcupine, ducks, and grouse is common in the Project Study Region, and the Mayo River and Mayo Lake offer varying degrees of access to hunting areas. Moose are a species of particular importance to the community, and the *2002-2007 Community-Based Fish and Wildlife Management Plan*¹ (First Nation of Nacho Nyak Dun et al., 2003) suggests that management planning for moose reflect the fact that moose densities in the Mayo area are about 200 moose per 1000 km², which is higher than much of rest of the Yukon. Concern voiced through the public consultation program identified increased pressure on moose hunting within the broad Mayo region, including the Project Study Region, primarily due to the voluntary closure of McQuesten Lake to moose hunting, and due to southern Yukon hunters traveling to the Mayo region to hunt.

Fishing occurs at various locations along the Mayo River, as well as on Mayo Lake. Species of importance to the community include Chinook salmon, lake trout, lake whitefish, northern pike and Arctic grayling. Chinook salmon are a commercially important species in the Yukon, and are also of traditional importance to First Nations. Only very limited salmon fishing occurs on the Mayo River. Salmon harvest on the Stewart River is common, although harvests on the Stewart River have decreased in recent years, with NND reporting a 27 per cent lower catch in 2007 than the average catch between 1997 and 2006 (Yukon River Joint Technical Committee, 2007). NND members “do not understand or agree with catch and release management, and feel that all fish that are caught should be kept and eaten” (First Nation and Nacho Nyak Dun et al., 2003).

Trapping within the area provides economic and sustenance benefits for trappers. The Project Study Region in the vicinity of Mayo Lake and the Mayo River includes portions of registered trapping concessions (“RTC”s) #84, # 85, #86, #89, and RTC #407 which is a community trapping concession. Local stakeholders identified beaver, marten, muskrat and lynx as species of importance for trapping. Summary trapping data² from Yukon Environment suggest that mink, squirrel, weasel, and wolf have been trapped in recent years.

Collection of berries along with other medicinal plants occurs throughout the Project Study Region, including along the Mayo Lake access road and inland from the shores of Mayo Lake.

¹ The next *Community-Based Fish and Wildlife Management Plan* for the traditional territory of NND was being prepared at the time of writing this report. Personal communication with the regional biologist indicated there were no wildlife issues of concern in the next plan that were of relevance to the project area.

² Trapping data from Yukon Environment is released in blocks of ten RTCs. Since the community trapping concession is used infrequently, the data provides was for 11 RTCs including #73, #74, #84, #85, #86, #87, #89, #90, #92, #95, #407.

5.3.1.2 Other resource use

Much of the other resource use is based on the natural surroundings of Mayo. Tourism, outfitting and outdoor recreation all use the Village of Mayo as stopping/starting points for activities. Mayo is part of the Silver Trail – a scenic drive that features not only the mining history of the region, but also offers views of the Stewart River and local wildlife. Mayo is also a jumping off point for activities such as wilderness canoeing in the Peel River watershed, and outfitting in the Peel River and the upper Stewart River drainage systems. The Project is located in Rogue River Outfitters' hunting concession.

5.3.1.3 Mining and other private/commercial land use

Mining has played a major role in the Mayo area historically, and continues to be active.

Placer mining occurs on numerous tributaries of Mayo Lake and the Mayo River. Although the total number of placer mining operations has decreased over the years, it remains an important activity to many residents of the Mayo area. "The majority of the Mayo area placer mines continue to be family-run, with deep commitments to the land and the industry" (Bleiler et al., 2006, pp. 109). Placer mining typically begins with the spring thaw, and continues over the summer until the freeze-up in fall (approximately 120 days). The mouth of Mayo Lake is the site of leases and properties where miners with claims along Mayo Lake launch their barges or boats. For a complete table of mining activity within the Project Study Region see Table 5-1 of this chapter, and for maps showing placer claims see Appendix 2B. There are numerous placer claims on the tributaries of the Mayo River and Mayo Lake, ranging from smaller family-run operations to larger operations with staff of up to 6-10 people.

There are two fairly active placer miners at Mayo Lake within the Project Study Region who access their claims during the summer by boat and barge; and if necessary, by snowmobile or truck in the winter (generally considered more expensive than using a barge). The main season for placer mining activity is late May/early June up until late October – depending on ice and water levels. The water needs to have risen with the spring freshet to a point where the barges can float, and access at their placer claims is close enough to enable off-loading of equipment. The barges are usually parked at the west end of the lake to over-winter (personal communication, Wozniak and Barchen, 2008).

Other commercial land uses in the Project Study Region include the Mayo airport, a commercial land treatment facility for contaminated soils near Five Mile Lake, a silt and clay quarry on the Janet Lake Road, and two gravel pit reservations. There is also a quartz claim near the bridgehead north of the Village of Mayo on the eastern bank of the Mayo River. Private land uses within the Project Study Region include a small lot owned by the Canadian Broadcasting Corporation at the south end of Wareham Lake, two fee simple lots used for agricultural purposes at the Wareham bridgehead, and a residential agreement for sale at Wareham Lake. Within the Construction Footprint Area, there is a large lot owned by Yukon Energy Corporation, and two lots owned by a private citizen. NND First Nation Settlement Land parcel C-48B and privately owned lot 88, are just outside the southern boundary of the Construction Footprint Area. NND Settlement Land Parcel S-153B1 is near the eastern boundary of the Construction

Footprint Area. Further description of privately held parcels in the Project Study Region up the Mayo River and at Mayo Lake are listed in Appendix 2A and described in Appendix 7C.

5.3.2 Local and Regional Economy

Although NND have lived throughout the Mayo area for generations, the community of Mayo began to establish itself with the arrival of gold seekers in the late 1800's. The Village of Mayo was officially established in 1903 as a river settlement and port that served the transportation requirements of the mining industry at the Keno mining district. The 1950's marked one of the most active periods of silver mining in the region (Mayo Historical Society, 1990). "Year round employment opportunities created by the expansion of the silver mines and the supporting businesses and government offices that sprang into service the mines, as well as jobs with highways and public works, road maintenance camps, and employment with the Northern Canada Power Commission all resulted in Mayo's steady growth as a community" (Bleiler, 2006, pg. 119).

Today, Mayo is no longer a primarily mineral-based economy. The community has recognized that diversification is necessary, and is promoting options such as tourism to strengthen local activity. Accommodation, food services, guiding and outfitting, and retail services provide work for local residents. Government services, including First Nation, territorial, and municipal administration provide over a third of jobs in the community. Placer mining and mineral exploration continue to be part of the local economy (Yukon Community Profiles, 2004).

Statistics Canada (2007) found that approximately 77 per cent of the eligible population of Mayo (i.e., >15 years) are active in the labour force, compared to approximately 78 per cent Yukon-wide. The unemployment rate for Mayo was reported at approximately 17 per cent, compared to nine per cent Yukon-wide. One of the reasons for these differences resides with the fact that little work available in Mayo is full-time and year round, reflecting the importance of seasonal work to the economy (Yukon Community Profiles, 2004).

5.3.3 The Social and Cultural Context

Traditionally, NND "ancestors lived on the land, maintaining a balance between the environment, the animals, and (the) people... People would travel long distances to follow food sources such a moose, caribou, mountain sheep, salmon, lake fish and beavers, and to find berries... There was a spiritual relationship with the animal that was honoured by certain traditions that need to be observed in order for that relationship to remain strong" (Peter and Hogan, 2008, pg. 86).

A heritage resource assessment of the Construction Footprint Area and shoreline inspection of Mayo Lake revealed several prehistoric artifacts, including lithic flakes and scrapers – items largely associated with traditional camps. The First Nation adapted to the dramatic changes that followed the early arrival of early explorers, traders, and later prospectors. Today, NND have taken on elements of both First Nation and non-First Nation culture. While people are more often educated and employed in the mainstream

system, they continue to practice their culture and traditional pursuits through the traditional teachings of their “families, Elders and the community” (Peter and Hogan, 2008, pg. 92).

Today, the Chief and Council of NND often work in close cooperation with the Village of Mayo Mayor and Council. The two governments hold joint council meetings on a regular basis to “discuss issues of mutual importance” (Cooper and Lecki, 2006, pg. 130). The two councils collaborated to establish a local youth centre, which is among the many services that the two communities share. In addition, provisions under the NND Umbrella Final Agreement have resulted in the establishment of the Mayo District Renewable Resources Council whereby members of NND and the Mayo community make recommendations on fish and wildlife management within the Mayo District.

J.V. Clark School recently re-opened its doors after major building improvements, including academic classrooms, a First Nations craft room, library, and gym/fitness complex that is used by the entire community. The school offers kindergarten through Grade 12, and for the 2008/2009 academic year had 76 students enrolled (Yukon Bureau of Statistics, 2008). Yukon College shares space in the overall building envelope, offering skills training and general educational upgrading services to the community.

Health services are provided at the Mayo Health Centre, which has a staff of three public health nurses, and a doctor who divides his time between Mayo, Pelly Crossing, and Carmacks. Mayo acts as the medical evacuation point from Pelly Crossing to Elsa, and each community has its own ambulance. Policing is provided by the RCMP. There is a volunteer fire department with two fire trucks.

The Village of Mayo has a shallow source well which is water chlorinated for drinking. The Village contracts water hauling and septic services from NND, which has a water tanker and two 2 septic trucks. The village contracts these services from NND. Residents are responsible for hauling their own waste, although NND does offer pick-up services for some of its members. Raven Recycling offers drop-off recycling services to both the Village of Mayo and NND. The municipal landfill and sewage lagoon were both designed for a population estimate of 2000, and are unlikely to reach capacity in the near future.

Some other businesses and services offered in Mayo include:

- Bedrock Motel
- Binet House Interpretive Centre
- Duncan Creek Gold Dusters
- Ewing Transport Ltd.
- Golden Heart Acres Bed & Breakfast
- Heartland Services
- K.P. Auto
- Kris' Small Repairs

- Mayo Bigway Foods
- Mayo Chinese Restaurant
- Mayo Laundromat
- Mayo Petroleum
- Mayo Taxi and Bus Service
- Mount Joy Wilderness Adventures
- North Star Motel
- Rick's Enterprises
- Silver Trail Inn / Halfway Lakes
- Wilf's Contracting
- Wind River Adventures
- Winterchild Jewellery
- Yukon Gold Mining
- Yukon Energy Corporation (service & maintenance)
- Yukon Liquor Store

(Village of Mayo, 2008; Canadian Phone Directories Inc. (2006))

5.4 EXISTING AND PLANNED DEVELOPMENTS

The Project Study Region contains a relatively extensive list of developments, including the existing Mayo Hydro Generation facility and related infrastructure ("Existing Facility"). In addition, there are many small developments and projects that are either licenced to occur, or are in the process of being reviewed for licencing. As noted in Section 3.2.3.2 of Chapter 3, the assessment approach considers other projects and activities which may potentially act cumulatively with effects of the Project and affect selected VCs. The cumulative effects assessment identified all inputs from other projects that could act in concert with effects of the principal Project and influence the VCs identified, including:

- Past, present and likely future projects and activities in the area that may affect identified VCs; and
- Other existing or anticipated pressures (direct or indirect) on identified VCs.

The Mayo Hydro Enhancement Project is proposed to occur within this context of existing and planned developments, and as such their presence is relevant to the assessment of effects from the Proposed

Project. Section 5.4.1 below describes the Existing Facility; and Section 5.4.2 Other Existing and Planned Developments.

5.4.1 The Existing Mayo Hydro Generation Facility

The Existing Facility, with an installed capacity of 5.4 megawatts, consists of structures at Mayo Lake and Wareham Lake. The facility is licenced under Water Licence HY99-012, a Type A Class 2 licence which expires December 31, 2025. A copy of the Water Licence is provided in Appendix 2D.

5.4.1.1 Existing Facility Components

The Existing Facility consists of the following components:

- **Mayo Lake Components:** Mayo Lake is a 96 km² naturally-occurring lake with a maximum depth of 120 meters. The outlet of Mayo Lake is controlled by a six meter high, rock-filled, timber-crib structure ("Mayo Lake Control Structure"). An original Mayo Lake Control Structure was built over a two year period in 1951 and 1952, and was entirely replaced by the existing structure constructed in 1988 and 1989. The current control structure has three valves that regulate flows out of Mayo Lake. When the lake is at high water levels, the structure serves to spill excess water. The licenced storage range on Mayo Lake is 2.59 metres, from a controlled maximum mean daily water surface elevation of 665.84 metres (full supply level or "FSL") to a controlled minimum elevation of 663.25 metres³ (lower supply level or "LSL"). The water licence requires that a minimum flow of 2.8 cms is maintained downstream of the Mayo Lake Control Structure.

³ The Mayo Lake Water Licence elevations are in Imperial measurements using Yukon Energy Corporation's datum, cited as a controlled maximum of 2211.5 feet and a controlled minimum of 2203.0 feet.

Figure 5-2
Mayo Lake Control Structure



- **Wareham Lake Components:** Wareham Lake is a man-made reservoir which serves as the headpond for the existing Mayo Generating Station. The majority of the Existing Facilities are located at and downstream of Wareham Lake, including an earth-fill dam, a concrete spillway, intake structure and tunnel, surge tower, and generating station. The earth-fill dam is 32 meters high, with an elevation difference of 36 meters between the reservoir and the powerhouse used to generate electricity. Two generating units are installed, with nameplate ratings of approximately 2.7 Megawatts each, with a total annual generation capability of approximately 38.4 GW.h per year. The licenced storage range of the Wareham Lake reservoir is 2.29 metres, ranging from a controlled maximum of 574.50 metres, and a controlled minimum of 572.21 metres⁴. The water licence also requires that a minimum release of 2.8 cms is maintained in the river channel downstream of the powerhouse. Yukon Energy now adjusts spills at the Wareham Spillway in accordance with a ramping procedure so as to ensure flow changes downstream of the spillway occur in a managed fashion. See Appendix 5-D.

In addition to the water control structures and powerhouse, the existing facility comprises an access road, a substation that provides 66/69 kV transmission to Elsa, Keno, Stewart Crossing, and Dawson City, 12.5kV distribution to Mayo, and various other infrastructure related to the original construction and ongoing operation of the Existing Facility.

⁴ The equivalent Imperial measurements cited in the Licence are 1901.5 feet for the controlled maximum and 1894.0 feet for the controlled minimum, measured using Yukon Energy Corporation's datum at the site.

Figure 5-3
Top of Wareham Spillway



Figure 5-4
Wareham Powerhouse



5.4.1.2 Existing Facility Water Levels and Flows

The operation of the Existing Facility in any given year reflects the specific power loads needing to be served, and the storage capacities of the system in relation to the inflows being experienced at any given point in time. The operation of the system reflects distinct seasonal patterns.

The hydrology of the system upstream of Mayo Lake is not affected by the Existing Facilities. Inflows to Mayo Lake are measured by Yukon Energy inclusive of direct precipitation and net of evaporation (i.e., inflows available for outflow⁵) as follows:

- Annual inflows to the lake average 445 million cubic metres ("mcm") (average annual inflow rate of 14.1 cubic metres per second, or "cms"), with 20 year variability indicating a range from 238 mcm (average flow rate of 7.6 cms) in the lowest inflow or drought year, to 653 mcm (20.8 cms) in the highest inflow year.
- Inflows are very low through the early months of the calendar year (2.0 to 3.8 cms), increasing dramatically in the last week of April or the first week of May.
- On average, approximately 51% of annual inflows occur in May and June (225 mcm, or 41.4 cms), with the last week of May being the average highest inflow for the year (the highest recorded single week of inflows is over 80 mcm, or 136.0 cms).
- Average inflows are relatively steady for July to September, comprising an additional 132 mcm (16.8 cms) or a further 30% of annual inflows.
- The remaining 7 months (October to April) contribute on average only 19% to annual inflows or 87 mcm (4.8 cms)

The Existing Facilities permit the releases from Mayo Lake to be managed as a system. To guide decisions on use of the water, Yukon Energy has adopted a set of Water Management Objectives which reflect the necessary balance that must be maintained:

- Use water before non-renewable energy sources such as diesel to produce power for Yukon Energy's customer needs
- Optimize the water in order to minimize electricity costs to Yukon Energy's customers
- Respect and protect the environment through a sustainability focus
- Utilize the Corporation's water management resources to the benefit of other water users

⁵ Inflows available for outflow is a measurement for each period in question of the amount of water released from the lake, plus the net change in lake storage over the same period.

To facilitate this water management, Yukon Energy's current water licence permits storage of approximately 256 mcm in the operating range of Mayo Lake (from the controlled Full Supply Level ("FSL") to Low Supply Level ("LSL") or approximately 100 mcm per metre of lake elevation). Over the period May to September, water management activities focus on the following aspects:

- **Average or higher conditions:** Under these conditions, inflows total 357 mcm or higher during the 5 month period, of which at least 37 mcm are required to be released to meet minimum outflow levels (2.8 cms through the Mayo Lake control structure). Consequently, in average or above average flow years Yukon Energy has the capability to fully refill the lake during this 5 month period even in the event the lake is at LSL to start the period. Actual operation will depend on power requirements during the summer months, but with Yukon winter-peaking power profiles (and in particular with future interconnection to the WAF system), storage is prioritized during this period.
- **Low to extreme low flow conditions:** In the lowest inflow year recorded since 1987 on the Mayo system, (calendar year 1998), the five month inflows to Mayo Lake total only 181 mcm, of which 37 mcm is required to be released to meet minimum flow constraints. In this situation, only 144 mcm is available to be put into storage (slightly under 1.5 metres of elevation). Consequently, water available for power generation the following winter will be less than under average or above average flow conditions.

Downstream of Mayo Lake, there is a substantial unregulated "local" inflow to Wareham Lake which contributes up to one third of the total inflows to Wareham Lake. This includes the tributaries of Minto, Duncan and Davidson creeks. These local flows, in combination with the managed outflows of Mayo Lake, comprise the waters available to be used at Wareham to generate power. Wareham Lake, similar to Mayo Lake, does have a licenced FSL and LSL; however given the much smaller size of Wareham, and the incentives to maintain Wareham at as high a level as practical to maximize head from the generation station, this range does not permit any notable use of seasonal storage similar to Mayo Lake.

The seasonal pattern of Wareham local inflows parallels the inflows to Mayo Lake, but approximately one half the magnitude.

Flows at Wareham are released downstream by one of two routes – either through the Generating Station or through the Wareham Spillway.

- **Generating Station:** The currently installed generating station can permit a design flow of up to approximately 18 cms through both hydro units⁶.
- **Spillway:** The spillway is used to release all flows that cannot be used in the generating station, or stored at Mayo Lake. Typically water is released through the spillway beginning in

⁶ At any given time, the maximum flow rate is affected by the head which is dependent on the level of Wareham Lake and the level of the plant tailwater, as well as other flow and load characteristics.

May and continues to fall freeze-up (often much earlier). Efforts are made to minimize or eliminate the need to spill in winter, due to operational constraints.

Given the capacity of the Generating Station, Wareham local inflows plus minimum releases from Mayo Lake are typically sufficient to supply power requirements from early May through June. During years of average flow conditions at Mayo Lake, May and June inflows are sufficient to increase lake storage levels towards FSL (assuming low to LSL lake levels at the end of April), and some degree of managed or unmanaged release from Mayo Lake (over and above the 2.8 cms minimum release) would typically begin. Consequently, Wareham spills typically continue throughout the summer and are sustained until September or October.

5.4.1.3 Existing Facility Loads

The loads on the Mayo plant have varied greatly since it was brought into service in the 1950s. For much of the life of the plant, the loads necessitated full utilization of the hydro system to ensure sufficient supply to retail and industrial loads. Since the closure of the Keno mine in 1988/89, the plant has been operated below its full capacity.

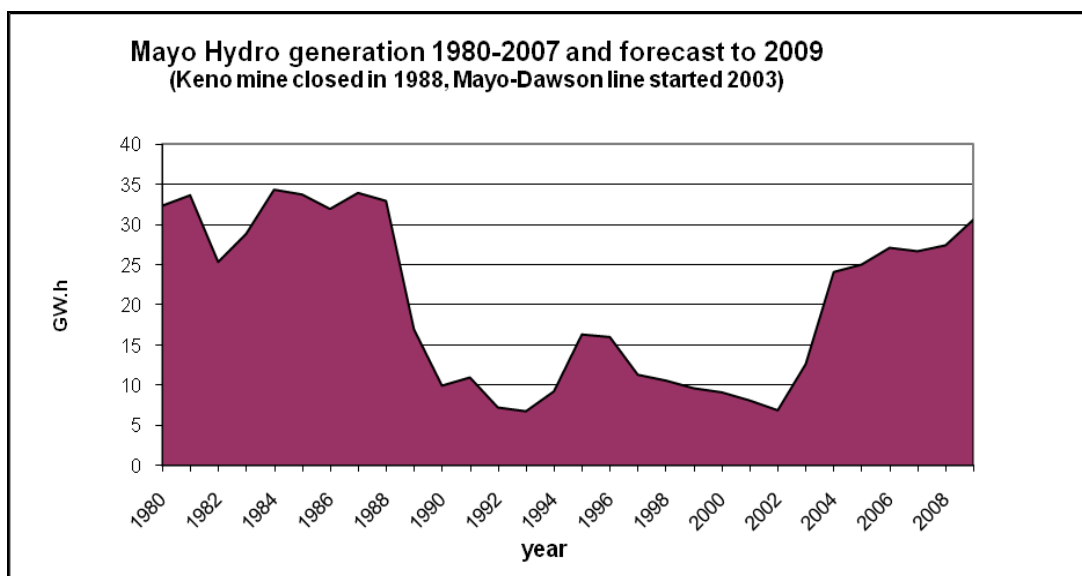
During the period of the United Keno Hill Mine operation, the plant typically operated near its then full capacity (30-35 GWh), and the licensed storage range at Mayo Lake was largely used each year.

After the closure of the mine and up until the Mayo-Dawson line was energized in 2003, the plant generated power only for local loads in Mayo and Keno (typically in the order of 8 GW.h) as well as any periodic dewatering or water treatment activity at the mine site (bringing total annual loads to approximately 15 GW.h in high load years). The consequence of this lower load level is that only approximately 1 metre of Mayo Lake's licensed storage range was used each year regardless of inflows. In addition, winter flows (once spills had stopped for the season) reflected only plant flows driven by the lower load condition. Consequently, winter flows were routinely sustained at or below 5-6 cms, particularly for night hours.

Since the Mayo-Dawson line went into service in 2003, the plant has provided power to Dawson and Stewart Crossing in addition to the existing loads in Mayo, Elsa, and Keno. The Mayo hydro facility continues to operate somewhat below its maximum hydro capability, typically using approximately 1.5 to 2.0 metres of Mayo Lake storage range each year, although this can vary to a degree depending on inflows.

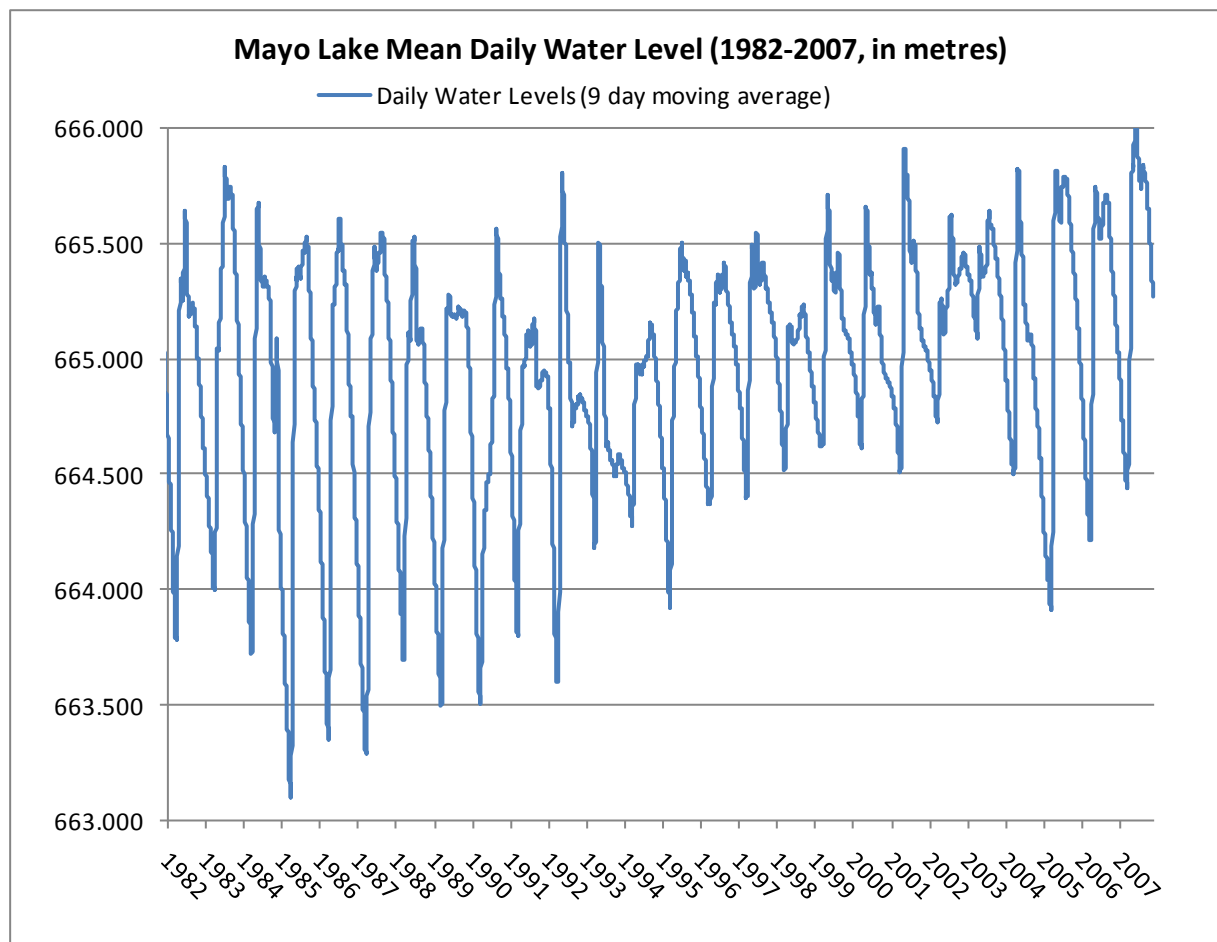
A summary of the historical load conditions are set out in Figure 5-5.

Figure 5-5
Mayo Hydro 1980 to 2009



The relationship between loads on the Mayo power station and the levels of Mayo Lake over the course of each year can be seen in Figure 5-6, which shows how annual variation in lake levels was reduced as loads on the power station declined with the closure of the Keno mine, and subsequently increased with the interconnection of the Mayo-Dawson transmission line.

Figure 5-6
Mayo Lake Storage Range 1982 - 2007



At the present time, the Mayo plant serves basically 100% of the loads on the Mayo-Dawson system. This means that all load variability from hour-to-hour, including daily load variations and winter variability linked to temperature, is reflected in varying plant flows. Further growth in the system necessitating baseload diesel generation (or alternatively interconnection of the WAF system) will likely provide for a more stable operating regime for the Mayo plant flows, as the addition of other units to the generating mix would provide opportunities to use other generators to absorb load “swings”.

5.4.2 Other Existing and Planned Developments

Outside of Yukon Energy’s Existing Facilities, a variety of past and current projects and activities comprise the existing and evolving built environment in the Project Study Region. These active and planned developments primarily reflect mining developments (including exploration) or general infrastructure.

As noted in Section 3.2.3.2, a identification of existing and future projects or activities is required for the purposes of cumulative effects analysis. Accordingly, projects identified in this section include:

- Project or activities that have already been approved (Section 5.4.2.1);
- Projects or activities that are already in a government approvals process and on the YESAB registry (Section 5.4.2.2);
- Other known projects with a high degree of certainty they will occur or be submitted to YESAB (Section 5.4.2.3).

The environmental effects of uncertain or hypothetical projects were not considered.

5.4.2.1 Existing Activities/Projects

The most significant single development in the YESAB Mayo Assessment District is the plans for resumed precious metal mining activities in the Keno area. Alexco Resource Corporation is conducting advanced underground exploration at the Bellkeno Mine site, on the former United Keno Hill Mines properties, aimed at opening a larger mining operation if suitable mineral deposits are found. Alexco is also responsible for care and maintenance of former mining properties, which includes closure studies, monitoring, and reclamation. The Alexco operations are not within the Project Study Region, but various activities related to Alexco do overlap with the Proposed Project, such as traffic, and the presence of workers in Mayo.

Placer mining operations are also prevalent in the Project Study Region. In particular, the Duncan Creek watershed is the site of heavy placer activity as silver and gold deposits tend to be rich around Keno Hill, Sourdough Hill and Galena Hill. Other creeks with active mining include Davidson, Owl Creek and an unnamed tributary to the SW shore of Mayo Lake. Ledge and Anderson Creek, tributaries to Mayo Lake, are also sites of placer activity. Steep Creek and Edmonton Creek are tributaries to Mayo Lake, with proposed placer exploration and existing barge landings. Placer operations located on tributaries of Mayo Lake typically use the lake for access purposes, such as by barge.

Other activities/projects in the area include road construction, quarries, waste facilities and buildings near the Construction Footprint Area. For example, the YG fuelwood access roads, at Wareham Lake, and particularly the site along the Mayo River, provide opportunities for access for recreational users such as for hunting and fishing.

A detailed list of existing current projects and activities is provided in Table 5-1, identified from either the YESAB online registry, or directly from the Yukon Water Board.

Table 5-1
Existing Projects and Activities Considered in the Cumulative Effects Assessment⁷

Proponent	Project	Dates	Location/Area	Comments
Roads, Buildings, and Quarries				
YG, Forest Management Branch	Wareham Lake access road, 11km north of Mayo, near Richard Reid Application	Permit issued Dec 14/07 Temporary 5 year access	NW Corner 63.6777 - 135.8500	Construction of a 380 meter access road off Keno hwy to a patch of fire killed timber to allow local access with locked gate.
YG, Forest Management Branch	Duncan Creek access road about 23 km north of Mayo.	Permit issued Dec 13/07 Temporary 5 year access	NW Corner 63.7333 - 135.8333	Construction of a 1019 meter long access road to fire killed timber for fuelwood off the Duncan Creek road, north of the Mayo River. No stream crossings. Locked gate
Richard Reid	Land Application 2006-0220 eastern shore of Wareham Lake, west of Silver Trail Hwy	Project recommendation issued October 18, 2006	NW Corner 63 41.398 -135 51.454	Clearing land, constructing residence, shop, driveway, septic and well. About 90 meters from Wareham Lake.
Kirn Dhillon, EBA Engineering	Nacho Nyak Dun Government House on lot 1075, NND C-6B, bench west of Mayo River	Site clearing began 2005-completing ancillary features	NW Corner 63.6008 - 135.9208	Groundwater well on site (license PW05-1) in NNDFN Aquifer. Open loop geo-exchange system
Wilf Tuck	Clay and Silt Quarry Janet Lake Road, 5km from Mayo	Decision Document issued Nov/08 3 year program	NW Corner 63.6476 - 135.8607	Drilling and testing for Clay and Silt, Quarry for use of material as liner for proponent's LTF

⁷ YESAB Public Registry, Mayo Assessment District, accessed January 20-22, 2009

Proponent	Project	Dates	Location/Area	Comments
Wilf Tuck	Test for Gravel, Quarry Gravel if test positive.	Permit issued July 2007 for three years	NW Corner 63.6073 - 135.9823, west of Mayo along Silver Trail Hwy	Application for LUP
Wilf Tuck Al's Environmental Cleanup Inc.	Continued operation of Commercial Land Treatment Facility (LTF) near Five Mile Lakes.	Permit expires Dec 2012	NW Corner- 63.6326 lat 135.8790 long	LTF for soils with hydrocarbon contamination on lease #105M12-050223, using a compacted silt liner, contained by berms and perimeter trench.
Mining				
Alexco Resource Corporation (based on work done by 650399 BC Ltd.)	Amended Class III MLU (LQ00186) to Class IV (Quartz) approval, and sought Type B water license	Issued October 2008, expires September, 2018	Bellkeno Mine, Keno Hill property	Advanced underground exploration, construct new Adit, rehabilitate existing adit, diamond drilling, hauling waste rock to surface, explosives, dewatering etc...
Elsa Reclamation and Development Company Ltd.	Care and Maintenance of the Keno Hill Mines	Water license granted Nov 14, 2007- expires November 30, 2012 (license amended)	Former United Keno Hill Mines properties on Keno Hill, Galena Hill, Sourdough Hill	Type B water use license WUL QZ06-74, sampling, dewatering, reclamation etc...
Strata Gold Corporation	Class III Mining Land Use Application- exploration of 398 Quartz claims, gold/arsenic antimony anomaly.	Decision document issued February 18, 2009 5 year program	NW Corner -63.9050 lat 135.7752 long Northeast of Halfway Lakes about 25km west of Keno City	Alexco letter Dec 16, 2008 voices concern about monitoring stations for Water License QZ06-074.
Frank Plut	Class IV Placer MLU	April 2008- March 1, 2017	Curly Creek, tributary to No Name Creek, tributary to Mayo River	1476 m ³ /day water use on 13 claims

Proponent	Project	Dates	Location/Area	Comments
Melvin Lee Zeiler	Class IV Placer MLU (original water license amended)	October 2005-December 31, 2014	Parent Creek Tributary to Duncan Creek	5000m ³ /day water use on 11 claims
Melvin Lee Zeiler	Class IV Placer MLU (original water license amended)	October 2005-December 31, 2014	Williams Creek and Duncan Creek	8183 m ³ /day water use on 25 claims
Manfred Wozniak	Class IV Placer MLU Type B water license	January 2005-December 31, 2014	No Name Creek Tributary to Mayo Lake	5000m ³ /day water use on 6 claims
Raymond Brasseuk	Class IV Placer MLU Type B water license	January 2005-December 31, 2014	Anderson Creek Tributary to Mayo Lake	8400m ³ /day water use on 9 claims
W. Joris Brinkerhoff	Class IV Placer MLU and hydro permit HY90-001 for dam on Dirksen Creek Type B water license	December 2006-April 30, 2016	Dirksen Creek Tributary to Mayo Lake	Type B water license is for 190m ³ /day on 4 claims
Silke Wissner	Class IV Placer MLU Type B water license	April 2005-December 31, 2014	Ping Pong Creek Tributary to Mayo Lake	1100 m ³ /day water use on 3 claims
Frank Taylor	Class IV Placer MLU Type B water license	May 2003-May 31, 2003	Duncan Creek and Duncan Creek Bench	33,120m ³ /day on numerous claims
Richard Rivest	Class IV Placer MLU Type B water license	August 2006-August 1 st , 2016	Davidson Creek tributary to Mayo River	8200m ³ /day water use on 16 claims
J.P. Rivest	Class IV Placer MLU Type B water license	May 2004-May 1 st , 2014	Davidson Creek tributary to Mayo River	8200m ³ /day water use on numerous claims
Ralph Barchen	Class IV Placer MLU Type B water license	June 2004-October 31, 2014	Owl Creek Tributary to Mayo Lake	21,600m ³ /day on 20 claims
Kerry Minor	Unknown-possibly Class I-Schedule 3 water use	Claims active Possible Class 1 work	Cascade Creek	Mining Land use permit and water license not found in public YESAB registry or Yukon Water Board registry

Proponent	Project	Dates	Location/Area	Comments
Berthold Liske	Unknown- possibly Class I- Schedule 3 water use	Claims active Possible Class 1 work	Ledge Creek	Mining Land use permit and water license not found in public YESAB registry or Yukon Water Board registry
Neil Vickers Regimbald	Unknown	Claims Active Possible Class 1 work	Dawn Gulch	Mining Land use permit and water license not found in public YESAB registry or Yukon Water Board registry
Jason Maxfield	Application phase, not posted		Tributary to Mayo Lake, southern arm	
Frank Taylor	Class III Placer MLU	2008-2013	Duncan, Lightening and Forty Pup Prospecting	Exploration drilling, trenching, stripping, line cutting on numerous claims
Frank Taylor	Class III Placer MLU	2008-2013	Keystone Creek Tributary to Mayo Lake	Exploration drilling, trenching, stripping, line cutting on numerous claims
Ralph Barchen	Class III Placer MLU	2008-2011	Edmonton Creek	Stripping, Trenching on one claim
Ralph Barchen	Class III Placer MLU	2008-2011	Steep Creek	Stripping, Trenching on one claim

5.4.2.2 Projects for which proposals have been submitted

There is one project identified within the YESAB Mayo Assessment District that is in the Project Study Region within the vicinity of Mayo Lake or the Mayo River. This is identified in Table 5-2 below.

In addition, the Strata Gold Corporation has applied for a Class III Mining Land Use for exploration of 398 quartz claims, gold/arsenic antimony anomaly. This project is outside the Project Study Region (i.e., 25 km west of Keno City).

Table 5-2
Projects Currently Undergoing Assessment⁸

Proponent	Project	Location/Area	Comments
Village of Mayo	Solid Waste Treatment Facility Lot 1103, 4.2 km from Mayo, along Silver Trail Highway	NW Corner- 63.6166 lat 135.9500 long	Renewal of solid waste permit, special waste permit and air emissions permit, to keep facility operating

5.4.2.3 Other Proposed Activities that are Currently Known

There are two known projects outside the Project Study Region that, if developed, will have a temporal overlap with the Mayo B Project:

- Alexco Resources' development of the Bellkeno Mine; and
- Strata Gold/Victoria Gold Corp.'s development of the Dublin Gulch gold mine.

Although specific details are not known about the development and operations of these projects, various activities related to both projects do overlap with the Mayo B Project, such as traffic, presence of workers in the Mayo area, and competition for labour. To the extent information is known, it is included in the cumulative effects assessment found in Chapter 7.

⁸ YESAB Public Registry, Mayo Assessment District, accessed January 20-22, 2009

6.0 PROJECT DESCRIPTION

6.1 PROJECT IDENTIFICATION/SCOPE OF PROJECT

The Mayo B Project is proposed to enhance the current power generation capacity installed on the Mayo River. The proposed Project is designed to improve power generation capacity at the Mayo hydro system to help displace diesel generation that would otherwise be required to meet the increased loads, including loads that are anticipated to arise following the completion of the Carmacks-Stewart Transmission Project.

The Project components are as follows:

- A new **powerhouse** approximately 3.9 km downstream of the existing powerhouse.
- A new **penstock-canal system** that will divert water from the existing intake tunnel to the new powerhouse, comprising a new tunnel extension that conveys flow to a low pressure “upstream” penstock from the existing tunnel to a new canal (approximately 460 m); a surface-run canal (approximately 2,500 m); and a pressurized “downstream” penstock from the canal to the new powerhouse (approximately 800 m).
- A new **all-weather access road** to the new powerhouse from the existing YEC access road serving the current Mayo hydro facility.
- A new **distribution line** of approximately 1,700 m operating at 12.5 kV from the new powerhouse to the existing 12.5 kV distribution line to provide station service power and communication to the new powerhouse.
- A new **transmission line** of approximately 3,600 m operating at 69 kV from the new powerhouse to the existing Yukon Energy substation (S249).
- **Temporary construction-related facilities** including a work camp for a peak workforce of 50-75 workers, lay down areas, a concrete batch plant, and related facilities.

The Proposed Project is consistent with Yukon Energy's 20-Year Resource Plan: 2006-2025 which identified a need to plan for new renewable power generation to meet future industrial and other electricity load growth on these grids. Specifically, the 20-Year Resource Plan called for planning activities to enable commitment to develop new hydro site resources to provide approximately 50 GW.h per year. Among the resources identified for priority investigation was Mayo hydro system enhancements.

By increasing the power output of the Mayo hydro plant, the proposed Mayo B project is expected to play a significant role in implementing Yukon Energy's 20-year Resource Plan and serves loads on the integrated WAF and MD system with renewable power. The Project will provide a long-term supply of renewable power at stable costs, for electrical users on today's WAF and Mayo-Dawson grids, and reduce the future consumption of diesel or other fossil fuels (either by Yukon Energy, or by large industrial loads

that may otherwise not connect to the utility system and instead utilize on-site generation), which is costly and has associated environmental concerns.

6.1.1 Identification of Key Project Components

The Proposed Project will expand the Mayo hydro system without changing its key Existing Facility. Chapter 5.4.1 identifies the Existing Facility and existing facility water levels and flows. Figure 6-1 shows a map of the key project components.

1. The **proposed powerhouse** of approximately 10 to 12 MW of nameplate generating capacity. The powerhouse will be located further downstream than the existing plant, at a location that provides an approximately 64 metre of head. This new powerhouse will become the primary power source for the Mayo hydro system. The new plant has a maximum design flow of approximately 19 cms.

The proposed powerhouse will house two Francis turbines. The turbines will each power 5 MW generators. The power produced by the Mayo B plant will be stepped up by two transformers, located directly outside the powerhouse, to 69 kV and transmitted 3.6 km to the transmission grid at the existing Mayo Hydro Substation S249. Each transformer will have the capacity to step up the entire output of the plant, effectively providing 100% spare on-line transformer capacity, ensuring a high degree of reliability of supply from this facility

2. The **new penstock-canal water conveyance system** will convey water from the existing Wareham Lake intake tunnel via an approximately 3.5 kilometre diversion system to the new powerhouse. Components from upstream end to downstream are as follows:
 - a) The first portion of the new conveyance system is a **new tunnel shaft** connecting the existing tunnel to a new “upstream” penstock. To minimize head losses due to friction, portions of the existing tunnel will require enlargement, which will be done with limited controlled blasting and then will be concrete lined. The new tunnel shaft extension will also be constructed in bedrock using controlled blasting and will then be concrete lined.
 - b) The **“upstream” or low pressure penstock** will be a 460-metre long and 3.35 metre diameter pipe buried beneath up to four metres of overburden. The penstock will be constructed of either plastic or steel (depending on bid costs at the time of construction). Although the exact specifications of each section of this pipe will depend on the material chosen, all joints will be welded. Flow from the upper penstock enters the upper end of the canal through a concrete inlet structure.
 - c) The upstream penstock will transition to an **open canal** to convey the water for approximately 2.5 km at an approximately constant elevation. The water will be flowing out of the upstream penstock at about 3 metres/second and consequently the outlet to the canal will not have a trash rack. The water level in the canal will be the same as the water surface of Wareham Lake. The surface-run canal will be cut into the slope of the ridge between the existing powerhouse and the proposed Mayo B powerhouse. The water surface of the proposed canal will be approximately 30 metres across with a maximum depth of

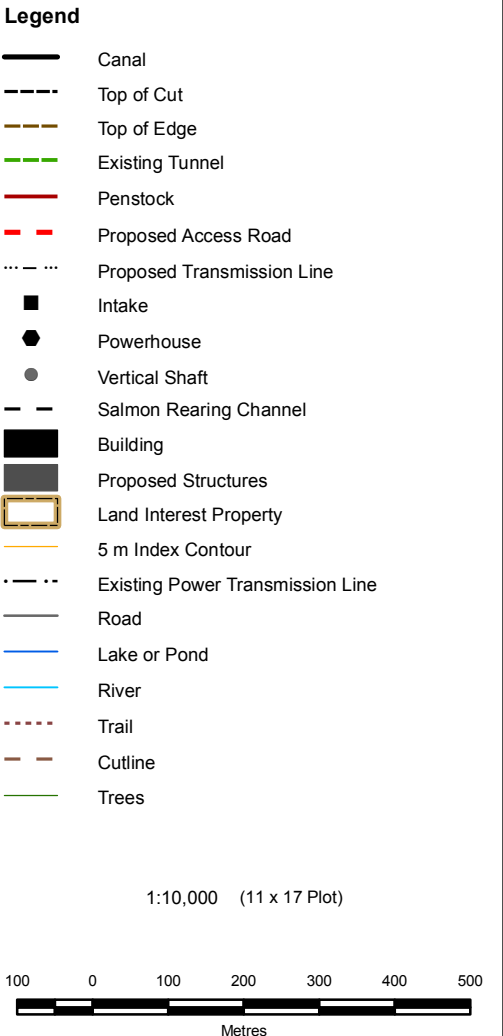
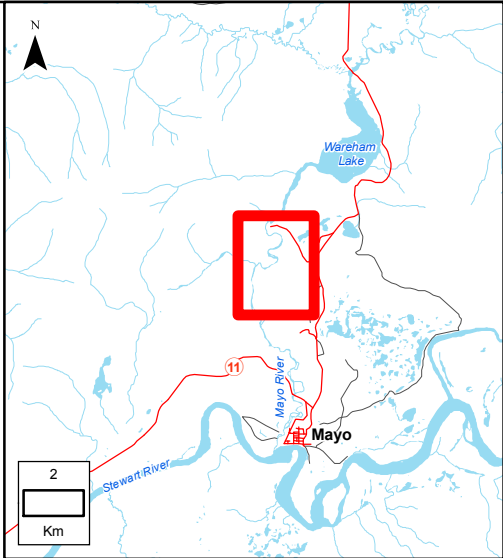
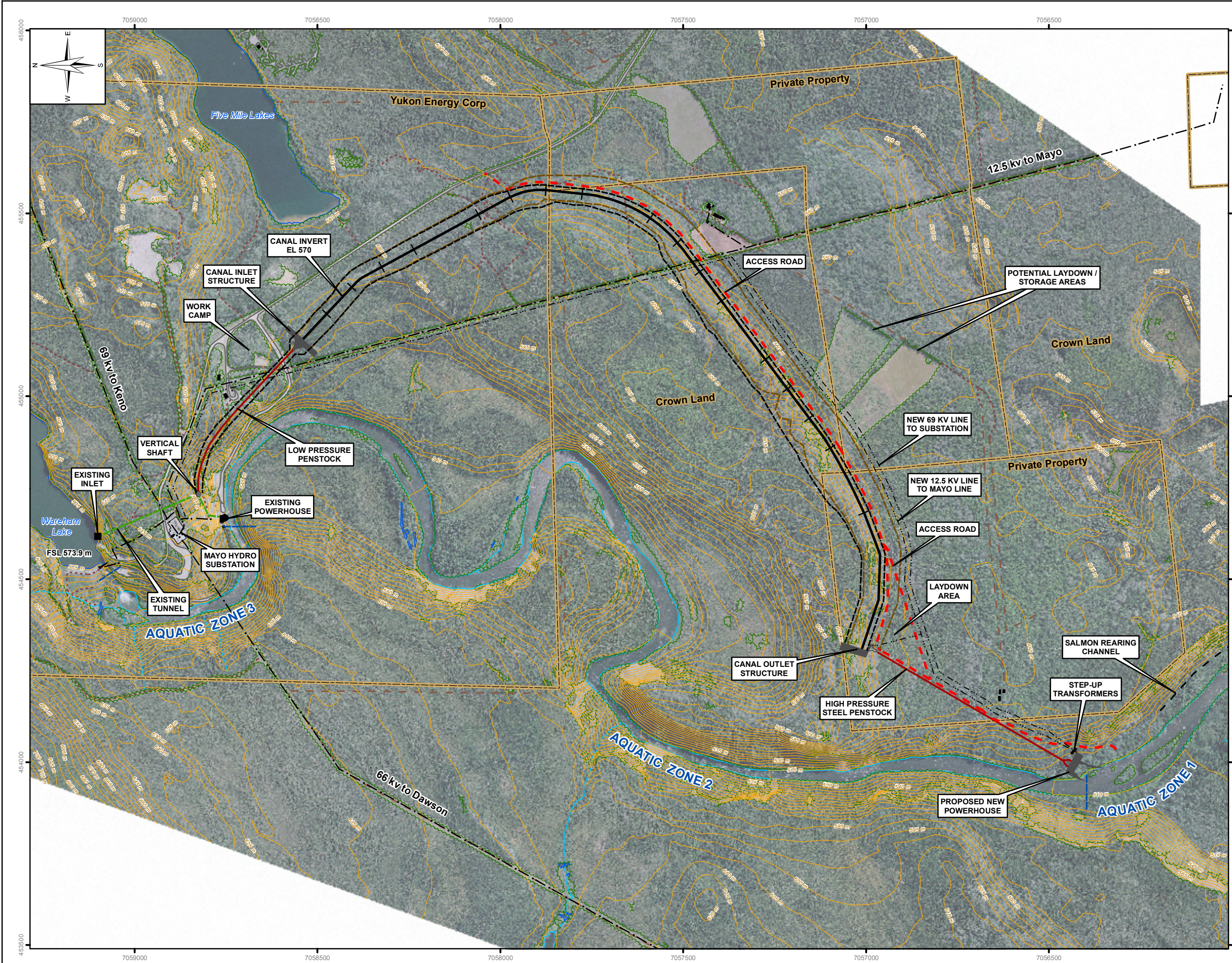
- approximately 4 metres. The dry slope of the ridges above and below the canal will be designed to maintain a 2:1 grade (one metre drop for every two metres of run). The wet banks inside the canal will have a 3:1 grade. The canal's benches will be designed to support vehicle traffic. Expected flow velocities in the canal will be 0.3 metres/second in open water season and slightly higher in the winter when flows will be beneath a stable ice cover.
- d) A concrete **intake gate structure** at the downstream end of the canal will control flow into a steel "downstream" high pressure penstock. This area will be fenced to prevent any unauthorized or accidental entry. The structure will incorporate a trash rack with bars spaced at approximately 150 mm (or less) apart to prevent any debris from entering the intake to the downstream penstock. Steel gates will be located in the penstock inlet structure that can be automatically closed in the event the turbine generator units trip offline. A pole-mounted step-down transformer, fed from the new 12.5 kV distribution line, will provide power to the gates. The gates can also be operated on location by the on-site plant operator, as required for maintenance or inspections.
 - e) The **downstream high pressure penstock** will carry water approximately 800 metres to the proposed powerhouse down a vertical drop of 64 metres. The downstream penstock has been designed as a steel pipe approximately 3.35 metres in diameter, to be constructed in 12 to 18 metre sections and welded together. A trench will be dug into the slope running to the powerhouse for the penstock, which will be buried by up to 4 metres of overburden. Three or four concrete thrustblock encasements may be constructed at locations where the penstock significantly changes direction. Each thrustblock encasement will be 6 metres long along each axis. Once in operation, these thrust blocks will resist the loads that arise as the flow changes direction inside the penstock. The penstock will divide into two smaller pipes during the final few metres before the powerhouse at a **bifurcation**, with a smaller penstock supplying flow to each turbine. Expected velocities inside the penstock will be 3 metres/second.
- 3. A **new all weather access road** of approximately 2.5 km, as required to access the new powerhouse.
 - 4. A new 12.5 kV **distribution line** to the new powerhouse will be installed for station service supply and communications. This line will be connected directly to the feeder transmission line from the Village of Mayo. This allows redundant sources of power supply for the station from both the existing Mayo hydro plant and the Village of Mayo's diesel plant if required. This line will also be used to provide construction power and fibre-optic communications during the new powerhouse construction activity phase.
 - 5. A new 69 kV **transmission line** of approximately 3.6 km in length will be constructed to connect the new powerhouse with the existing hydro plant substation.
 - 6. **Additional construction phase project components** include equipment lay-down areas, a site for a 50-75 person work camp, and a concrete batch plant.

All components of the existing facilities will remain in service, of particular note:

- The **existing intake structure** on Wareham Lake will not be modified, as it is adequate for the anticipated increase in flows to the new powerhouse as well as the existing powerhouse.
- The **existing generating station** will be retained to generate limited quantities of power by maintaining a 5 to 6 cms minimum flow through the plant on a near continuous basis.. The minimum flow levels have been identified as the flows necessary for ensuring the maintenance of optimum salmon habitat in the Mayo River between Wareham Lake and the proposed powerhouse, a section of river referred to as Zone 2. This minimum flow level requires only one of the existing powerhouse's two turbines to operate at any given time. Typical generation at the existing powerhouse will be reduced in most instances to approximately 2 MW. Both turbines will remain at the existing powerhouse, providing the full plant capacity for backup power and flow release as required, such as during scheduled and unscheduled maintenance of the new powerhouse.

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All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 8
Elevations are in metres above sea level (MSL)

KGS GROUP	YUKON ENERGY
MAYO B PROPOSED INFRASTRUCTURE	
CONCEPTUAL CONSTRUCTION FOOTPRINT AREA	
FEBRUARY 2009	REV: A

6.1.2 Key System Planning and Load Assumptions

The construction of the proposed Project is contemplated to occur concurrently with Stage Two of the Carmacks-Stewart Transmission Project (CSTP), a project previously reviewed by the Executive Committee of YESAB. CSTP will complete the 138 kV connection of the Mayo Dawson and WAF grids. Stage One of that project was completed in November 2008 and connected the Minto copper mine and Pelly Crossing to the WAF grid immediately displacing over 30 GWh per year of diesel generation with surplus hydro generation.

The planned Alexco silver mine development may potentially connect new industrial load to the Mayo Dawson grid as early as 2010. This new load will use surplus hydro and during certain times of the year it will also lead to a requirement for diesel generation if no new renewable power resource developments occur. Forecast further increases in the Alexco load expected for 2012 would increase such diesel requirements throughout most (if not all) of the year.

Potential new loads on the WAF system by 2012, including increased load at the Minto mine, the Carmacks Copper Mine development and new Faro site reclamation loads would also result in baseload diesel requirements on the WAF system if no new renewable power resource developments occur.

Overall, absent new renewable power resource developments, the above developments plus normal load growth could result in 50 to 100 GWh of annual baseload diesel generation requirements by 2015.

YEC is pursuing other potential renewable resource developments, including enhancements to the existing WAF hydro generation. All of these potential developments, as well as Mayo B, would be fully required to displace diesel if the above load developments materialize. Mayo B is the largest of the hydro enhancement projects potentially available to YEC for in-service by late 2011/early 2012.

6.2 ALTERNATIVES & CHOSEN APPROACH

As stated previously, the Project will provide long-term supplies of renewable power at stable costs, for electrical users on the Yukon's WAF and Mayo Dawson power grids, and help to offset pressures that would otherwise drive consumption of diesel fuel (either by Yukon Energy, or by large industrial loads that may otherwise not connect to the utility system and instead utilize on-site generation), which is costly and has associated environmental concerns.

6.2.1 Alternatives to the Project

A number of alternatives to the Mayo B project for providing new or enhanced renewable energy supply were evaluated by Yukon Energy before the Mayo B Project was advanced for further evaluation. For an in-depth discussion of these projects refer to the discussion in Section 1.4, Yukon Energy's 20 Year Resource Plan 2006-2025 overview document in Appendix 1A, and the Assessment of Potential Hydroelectric Sites – Concept Phase Study Executive Summary in Appendix 1B.

The priority near term (2010-2015) renewable generation options available to supply the potential loads reviewed under section 6.1.2 included Mayo B as well as three other smaller WAF hydro enhancements, all of which are forecast to be required. Mayo B is the largest of the priority near term enhancements.

Overall, the priority “alternatives to” Mayo B outside the Mayo area, if all developed on the same schedule as Mayo B, would still require diesel generation in the near term as well as long term that the Mayo B Project would otherwise displace.

As regards options on the Mayo Dawson grid and in the area of the Existing Facility, see Section 6.2.3.

6.2.2 Do not proceed with the Project or any other option

A decision to not proceed with the Project or any other renewable generation enhancement project in Yukon, would be expected to result in the following:

- The Yukon power systems will experience ongoing growth that cannot be served from existing renewable power sources. Consequently, given Yukon Energy's general obligation to serve customers who request service within its franchise area, the utility will be required to utilize non-renewable generation to service the loads, almost certainly diesel generation.
- Long-term power costs in Yukon will not benefit from the enhanced stability associated with capital intensive renewable power generation such as increased hydro (and that accordingly would occur with Mayo B). This would likely lead to materially higher power rates over time than would be the case with the Project, and separately may lead to more industrial customers electing to generate their own on-site power with fossil fuel generation rather than connect to the grid.
- Ongoing diesel generation in Yukon that arises, which could otherwise have been displaced by the Project, will generate approximately 700 tonnes of GHG emissions per GW.h of electricity generated.
- Economic development opportunities that could be realized from the project will not occur.

6.2.3 Project Development Concepts

Investigations of the Mayo B development concept date back to 1968 when the potential for a Mayo B project as an incremental addition to the existing Mayo generating station was reported on as part of a general survey of hydroelectric resources in the central Yukon. At the time the existing Mayo plant was owned and operated by the Northern Canada Power Commission (NCPC). Additional investigations of the potential to develop new hydro in Yukon noted the potential of a Mayo B project, including a 1989 review by the Yukon Electrical Company Limited (YECL) as manager for Yukon Energy.

The most recent investigation of the site prior to the current development planning was completed by BC Hydro in 2003 as part of a Small Hydro Assessment process for the Mayo-Dawson system, to consider potential future projects on or near the Mayo-Dawson transmission system. Six sites were investigated; Mayo B, Ethel Lake, a Reid Lakes and Lake Creek concept, the North Fork of the Klondike River, Rock Creek and the Chandindu River. The study concluded that Mayo B and the North Fork of the Klondike

River were by far the most attractive identified small hydro projects in the region, and that of the two the North Fork was not able to provide sufficient firm winter energy (which is critical to Yukon power generation). At the time, BC Hydro did not do any cost estimate updating, but only inflated earlier (1989) YECL values¹.

BC Hydro's study summarized the earlier work in respect of four significantly different project concepts:

- Scheme 1 Alternative 1 was a new 20 metre high dam 3.0 km downstream of the existing plant which would back up water to the existing plant, and a 1200m long tunnel to a 5 MW powerhouse.
- Scheme 1 Alternative 2 was a 30 metre high dam 4.2 km downstream of the existing plant to back up water to the existing plant, and a penstock to a 5 MW powerhouse.
- Scheme 2 was a new inlet on Wareham Lake with a tunnel, canal and penstock combination bypassing the existing plant to a new 10 MW powerhouse.
- Scheme 3 consisted of a 55 metre high dam 3.0 km downstream of the existing plant, flooding the existing plant location and feeding a 1200 metre long tunnel to a 15 MW powerhouse.

Only scheme 2 of the earlier studies did not involve a new dam, and each scheme effectively rendered the Mayo River downstream of the existing powerhouse to the approximate location of the proposed powerhouse inaccessible to fish as a river environment for most or all of the year, either due to dewatering or to inundation. The Scheme 2 concept was subjected to limited cost updating at the time Yukon Energy's 20 Year Resource Plan was prepared, resulting in a revised capital cost update of \$101 million in 2005\$, excluding transmission.

Upon initiation of the Concept Study Review by Yukon Energy in 2007, Mayo B project concepts of the type noted as Scheme 1 and Scheme 3 above (i.e., involving various scales of new dams and impoundments) were assessed and quickly discarded in the initial study screening as being unacceptable from both a cost and environmental impact perspective.

Compared to the earlier Scheme 2 concept, the current Project Proposal simplifies the Project development considerably by maintaining and reusing the existing intake at Wareham Lake. Not only does this aspect of the Project development reduce the number of components that are required to be constructed for the purposes of the Project, it also eliminates any need to undertake construction activities in Wareham Lake.

The approach adopted for each major component of the Project is reviewed below.

¹ Specifically, the study inflated earlier 1989\$ values to 2004\$ using the historical Non-Residential Building Construction Price Index from Stats Can (V7717859) for industrial buildings and the inflation rate calculated from the Consumer Price Index.

6.2.3.1 Location of the Powerhouse

Earlier stages in the Mayo B investigations considered alternative locations for the location of the powerhouse. The main notable alternative under consideration at the time was a concept noted as “Option C”, which would locate the powerhouse approximately 1.0 to 1.5 km upstream of the area now proposed for the Mayo B Powerhouse. This concept was investigated notwithstanding that it provides less power generation benefits (due to developing less head than the Proposed Mayo B Project), as it held the potential to permit a shorter conveyance potentially offering a lower overall project cost than Mayo B. Following review of geotechnical investigations and costing, the option was determined to be less economic than Mayo B.

In addition, the proposed powerhouse location (within an approximate range of 100 metres along the shoreline) may provide an opportunity to implement a salmon rearing channel directly adjacent to the powerhouse, focused on re-establishing and managing flows and conditions in an old (presently de-watered) side channel of the lower river. This same opportunity does not appear to exist at the Option C location.

6.2.3.2 Conveyance Options

During the Project development process, three conveyance options were extensively studied. Significant effort was expended on geotechnical investigations during the course of summer of 2008 (overburden auger drilling and bedrock core sampling) and fall of 2008 (**seismic refraction** surveys) in part to determine if there was sufficient quantity and quality of bedrock at depth to permit a tunnel to be used as the conveyance for most or all of the project route.

The geotechnical studies to date indicate that a tunnel from the existing Wareham Lake intake to the new powerhouse location would be very challenging due to the unexpectedly low depth of bedrock immediately downstream of the existing plant. At the same time, auger drilling confirmed appropriate overburden materials for surface conveyance construction and identified no permafrost in the vicinity of the surface conveyance. Given the technological challenges associated with tunnel projects, as well as the cost risk they entail, using a tunnel for the entire route was deemed to be eliminated from further consideration.

A second alternative to the Proposed Project was also considered that would see the flows from Wareham Lake conveyed to the new powerhouse through buried penstocks(s) with- no canal. Based on current estimated prices, this option proved significantly more costly than the canal scheme proposed.

6.2.3.3 Mayo Lake Operating Regime

The Mayo B concept studies reviewed the potential benefits from enhancements to the operating range of Mayo Lake of up to 2 metres of additional water level fluctuation to increase the amount of water retained in storage, including up to 1 metre of added top storage (raising the controlled maximum licensed lake level) combined with up to 1 metre of added bottom storage (lowering the minimum licenced elevation).

Flow releases from Mayo Lake Dam occur primarily through three low level gated 1.5 m diameter **sluices** that are opened or closed as downstream flows are required. When Mayo Lake water levels are above El. 665.73 m, then flow is also released from the dam by passing over a timber overflow spillway.

Early hydrological studies indicated insufficient inflows to Mayo Lake in most years to allow the 2 additional metres of extra storage to be fully utilized for energy generation. The long-term average energy enhancement benefits of this full added range were not significantly higher in comparison to the addition of only 1 metre of extra storage range.

Environmental and engineering investigations and scoping to date indicate potential complexities with respect to raising the upper lake levels that would not arise if the same storage enhancement was obtained by lowering the minimum licenced level by an equivalent amount (for example, see Appendix 6C regarding erosion). Concerns with increased upper storage (and water levels) included “toe of bluff” erosion, infrastructure concerns with respect to existing cabins and heritage structures close to the shoreline at current maximum elevation, as well as required modifications to the Mayo Lake dam structure.

This Project Proposal reflects a “modified” increased storage regime consisting of the following (as set out in section 6.8.1):

- Maintenance of the existing maximum controlled elevation for Mayo Lake;
- Reducing the controlled minimum elevation of Mayo Lake by 1 metre; and,
- Implement a water management regime to ensure that minimum spring elevations are not in excess of 2.59 metres below the lake elevation on the previous September 15 more than 2 years in a row (i.e., at least one year in three the drawdown from September 15 elevation, to the minimum elevation the following spring, shall be less than 2.59 metres).

6.2.4 Lower Mayo River Flow Regime

As part of the concept study reviews, Yukon Energy investigated various potential configurations and flow regimes to maximize the generation potential of the proposed project while ensuring good environmental conditions were maintained in the Mayo River. Ongoing environmental investigations indicated the potential for concerns regarding flows through Zone 2 (the stretch of the lower Mayo River between the existing powerhouse and the proposed new powerhouse) primarily in relation to salmon spawning and rearing habitat.

Three main options were considered with respect to flow regimes particularly in Zone 2:

- ***Option A – Maintain and fulfill existing licence conditions on a continuing basis:***
This concept recognizes and acknowledges the importance of the existing licence conditions as they relate to this portion of the river. Specifically, given that the requirements imposed on Yukon Energy by the existing Mayo Generating Station Water Licence require 2.8 cms minimum flow downstream of the existing plant at all times, establish a flow regime that is able to continue to meet this minimum flow year-round. This option was identified based on

particular attention to the fact that the current 2.8 cms minimum flow arises from conditions recommended by the Environment Canada Fisheries and Marine Service (the predecessor to the current Department of Fisheries and Oceans Canada) during the 1975 licencing of the facility, under the specific reference that observations on the river at that time indicated this flow rate was sufficient to ensure that most of the stream bed would remain wetted.

- **Option B – Seek to vary existing licence conditions and incorporate habitat compensation into the project proposal:** This concept involves maximizing flows through the new powerhouse at all times, such that the existing powerhouse and Zone 2 could be largely “de-watered” at times when there is no flow surplus to the needs of the new generating station. Habitat compensation for lost productive area in Zone 2 would be sought elsewhere on the river system or off-system.
- **Option C – In-situ mitigation:** Notwithstanding a licenced minimum flow of 2.8 cms, provide enhanced flow of 5 to 6 cms through the existing powerhouse and through the entire Zone 2 of the river to the extent possible throughout the year.

The studies completed to date reflect the obvious environmental benefits of pursuing development Option C (which reduces the extent of river that experiences reduced flows) notwithstanding the significant reduction to power production potential for the Mayo B plant. As noted in Chapter 7, the proposed minimum flows for Zone 2 serve to ensure maximum in-situ preservation and enhancement of spawning (and to some degree rearing) conditions. Consequently, the Project Proposal sets out Yukon Energy's intention to adopt a water management regime that sustains flows through Zone 2 (either through the existing powerhouse, the Wareham spillway, or the two combined) at a sustained level of not less than 5 to 6 cms year-round.

6.3 TECHNOLOGIES

The proposed Project will be built using conventional construction technologies following all applicable construction and design practices for works of this nature, including building and electrical codes and adhering to the best practices laid out in the relevant excerpts of Yukon Energy's Environmental Management System Manual (presented in Appendix 6-A). The technologies employed in the Project are industry standard in all material respects, and reflect consistency with a significant number of small hydro projects of similar configuration being constructed throughout Canada.

The Project will also adhere to all applicable national and territorial standards used in the design of all project components. The following list provides typical standards and associations with design manuals/guideline for the elements included in the Project:

- Canadian Dam Association (CDA) - Dam Safety Guidelines (2007).
Relevant for the powerhouse, canal inlet & outlet structures, and canal
- National Building Code of Canada (NBC)
Relevant for the powerhouse only
- Canada Standards Association (CSA) A23.3
Design of Concrete Structures

- American National Standards Institute (ANSI)
- Institute of Electrical and Electronic Engineers (IEEE)
- Alberta Electric Utility Code, 3rd Edition, 2007
- American Society for Testing and Materials (ASTM)
- Canadian Electrical Manufacturers Association (CEMA)
- National Electrical Manufacturers Association (NEMA)
- American Concrete Institute (ACI)
- American Water Works Association (AWWA)
Pipe Design and Installation
- Steel Plate Fabricators Association - Welded Steel Pipe
- American Society of Civil Engineers (ASCE)
Relevant for the penstock, canal inlet and outlet structures and canal
- U.S. Army Corps of Engineers (USACE)

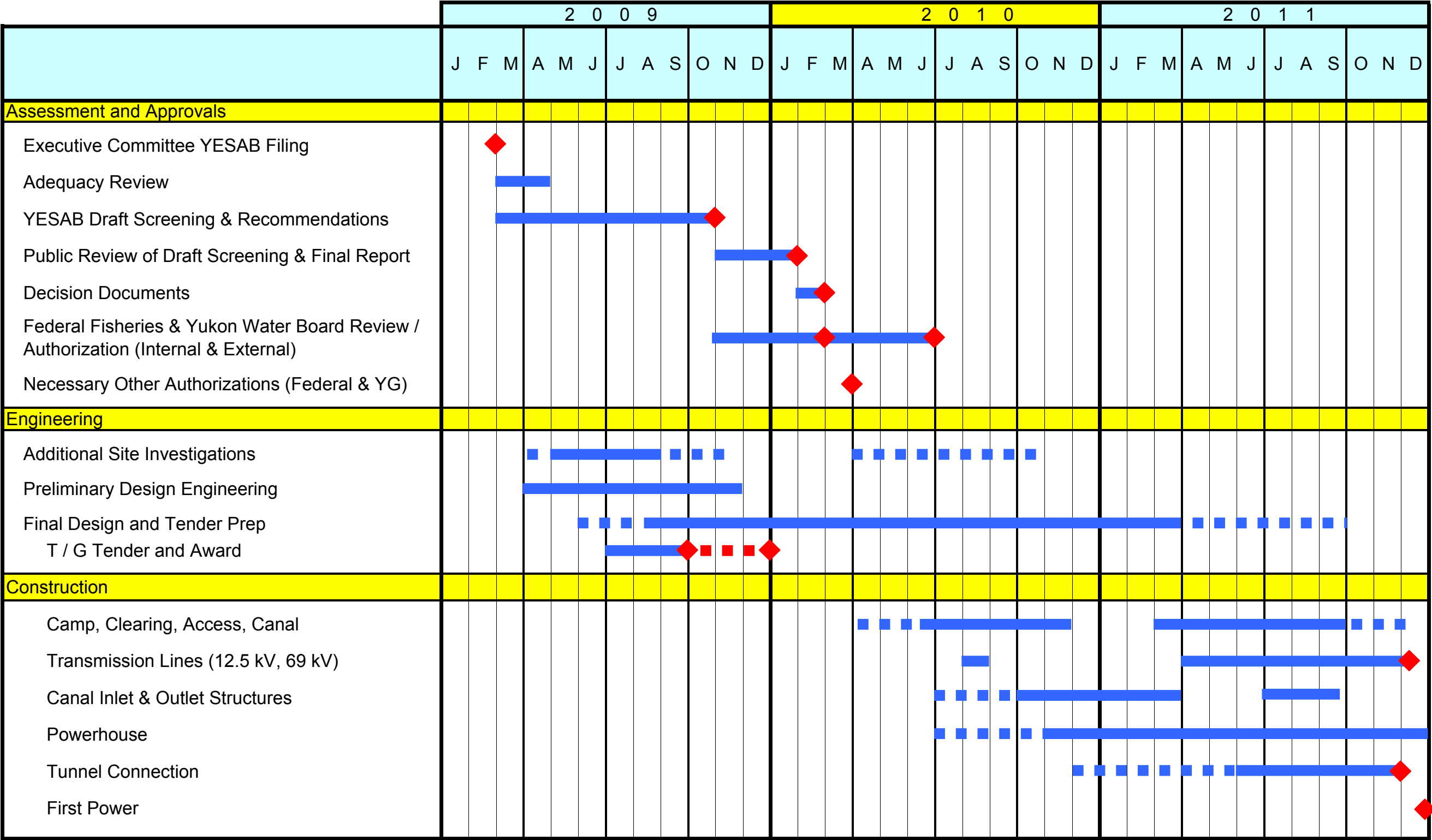
6.4 PROJECT CONSTRUCTION SCHEDULING

Construction of the proposed Project is currently scheduled over less than two full calendar years starting in 2010 with anticipated Project completion by year-end 2011. Construction will take place year-round, although activities will intensify during the spring, summer and fall.

6.4.1 Overall Construction Schedule and Sequence

Construction will take place in two phases, Early Site Preparation and Main Construction. Early Site Preparation will consist mainly of flagging, clearing and preparing the work site and providing access for vehicles. During the Main Construction phase, the powerhouse, penstock/pipe and canal will be built concurrently.

Early Site Preparation would begin construction in 2010 and be completed in the same year. Main Construction would also begin in 2010 on specific activities with anticipated Project completion by 2011. Figure 6-2 shows how the Project will progress.



Legend

■ ■ ■ Schedule flexibility

MAYO B HYDRO

2010 START & 2011 ISD

PROJECT SCHEDULE

6.4.1.1 Early Site Preparation Activities Timing

Early site preparation involves the following key activities:

- Survey and flag all required areas to be cleared
- Clear road access to the new powerhouse location
- Clear distribution line right of way
- Clear and prepare storage site for construction materials and equipment lay-down area
- Clear and prepare area for work camp
- Construct access road to new powerhouse
- Upgrade existing access road as required
- Prepare camp facilities for 50-75 people
- Construct 12.5 kV distribution line for construction power and communications to the powerhouse location, along new access road east to existing 12.5 kV distribution line ROW. The 12.5 kV distribution line will remain in use as a backup for station service power and powerhouse communications once project is complete.
- The anticipated schedule in Figure 6-2 incorporates flexibility related to physical and biophysical sensitivities (such as the potential need to recognize spring nesting season for certain bird species)

Flagging, clearing and construction of the required all-weather access road to the new powerhouse location, and all clearing and ground work of the distribution line, powerhouse site, work camp, equipment storage areas and the penstock-canal route is anticipated to occur between Q2 and Q3 of 2010, while ensuring avoidance of disturbance to nesting birds at sensitive sites during May and June. The new access road will be fenced and gated at the point of intersection with the existing Yukon Energy road. The Mayo hydro substation will remain fenced and gated.

6.4.1.2 Main Works Construction Timing

Main Works construction involves building and commissioning the new powerhouse, building the penstock and canal conveyance structure, constructing the concrete transition structures at the upper and lower ends of the canal, enlarging sections of the existing tunnel, constructing a new tunnel shaft from the existing tunnel and the upstream penstock, completing the tailrace and any salmon rearing channel, commissioning the distribution line, and site clean-up. The scheduled in-service date of 2011 would require the following key activities spread over two seasons:

Expected Duration - 1.5 to 2 Years**Powerhouse**

- *First Summer Season*
 - Excavate powerhouse sub-structure
 - Concrete formwork
 - Steel components will be fabricated off-site and trucked in
- *Second Summer Season*
 - Construct building envelope
 - o Steel building pre-engineered and hauled to site
 - Install electrical system components
 - o Turbine components, pumps, compressors and related items
 - Install turbine and generator
 - Attach smaller steel pipes to the new powerhouse, one for each turbine
 - Fit the smaller pipes into the main penstock

Penstock

- *First Summer Season*
 - Clear penstock corridor and construct access road
 - Excavate penstock trench and prepare foundation
 - Haul in bedding materials for the trench
- *Second Summer Season*
 - Fabricate steel penstock off-site and haul in
 - Lay pipe along trench and pack granular material around the pipe
 - Weld or couple pipe ends together
 - Re-spread overburden material over the pipe

Canal

- *First Summer Season*
 - Clear canal route and access road along entire length
 - Excavate surplus overburden
 - o Use some material for berms; haul remainder to suitable disposal location on site.
 - Haul in sand and granular bedding material
 - Spread sand along canal route
- *Second Summer Season*
 - Excavate remaining material
 - Lay geo-membrane liner over sand layer
 - Place granulated layer over the liner as ballast
 - Build concrete intake and outlet transition structures
 - o Canal entrance

- Construct concrete outlet structure at the upstream canal end to get the water from the upstream penstock into the canal.
- o Canal end
 - Construct an intake including gate for the downstream (steel) penstock.

69 kV Transmission Line

- *First or Second Summer Season*
 - Establish the pole foundations
 - Haul poles and insulators, hardware and reels of conductor to the ROW
 - Assemble and erect the structures and install anchors
 - Install insulators and string phase conductors and overhead ground wires

Tailrace

- *First Summer Season*
 - Excavate tailrace structure from powerhouse out to where rock/overburden plug between the powerhouse and the river will remain
- *Second Summer Season*
 - Excavate last portion of tailrace out to meet the river in the wet, outside of Salmon spawning season, using mitigation measures for sediment control

Site Clean Up

- *End of Second Season*
 - As project activities are completed

6.4.1.3 Access and Transportation Timing

Access to the Construction Footprint Area will be from Yukon Energy's existing access road off the Silver Trail Highway. Transportation related to the movement of labour, material and equipment for early site preparation will be traveling primarily from the Village of Mayo along the highway during Q2 into Q4 of 2010. In addition trailers and heavy equipment will be hauled up from Whitehorse (or outside the Yukon), traveling up the Klondike Highway, and Silver Trail Highway into the Construction Footprint Area.

Preliminary estimates indicate that materials delivery and worker traffic to the site will result in an additional 10 to 35 vehicles per day on the Silver Trail Highway 11 between Mayo and the power station's access road turnoff. The highest traffic counts will occur during the busiest construction months from June to September when the frost is off the ground. The remaining months will still see some construction-related activity occur, but this is expected to be about a third the amount that occurs during the summer.

6.5 PROJECT COSTING

The Project cost estimates to date reflect a period of study oriented to confirming the technical ability to construct the Project, and the timing and configuration of major Project components. The estimates reflect activities oriented towards a "Level 3 – Feasibility" stage of study, and are subject to design

refinement, and changing market conditions (including general economic conditions for construction in western Canada).

The cost of the Project is presently estimated at \$120 million (including escalation, interest during construction, and contingencies of 15% to 25% depending on the Project component). This estimate has been subjected to a preliminary third-party review. This review indicated that there may be a potential upward adjustment to the cost of up to 5%.

Similar to other hydro projects, a material component of the Project costing cannot be confirmed with reasonable certainty until the Project is tendered. The selection of a canal format (as opposed to a tunnel) likely reduces the degree of tender price risk, and future geotechnical ("ground condition") risk to Project costs, but this uncertainty cannot be eliminated prior to the tendering process being completed.

At \$120 million (and ignoring potential government infrastructure funding), the full assumed output of the plant of 38.4 GWh (under full long-term load conditions) yields a levelized cost of energy ("LCOE") for the capital cost of the project of \$0.142/kW.h. In the near-term under reasonably foreseeable load conditions, integration of the Project into Yukon power systems would be expected to yield a somewhat smaller net firm energy benefit, potentially as low as approximately 30 GW.h of firm energy (plus up to 10 GW.h of enhanced potential secondary energy should there be loads available to purchase this supply). In such a case the levelized cost of energy would approximate \$0.182/kW.h.

In order to enhance the opportunity for stakeholders to secure benefits from the Project including Canada, Yukon, ratepayers and NND, a variety of possible financing approaches are being considered. No further details on the precise form and source of financing are available at this time. However, in order to keep costs and risks to Yukon ratepayers within acceptable bounds (e.g., more in line with B.C green market power purchase costs of 8 to 10 cents/kW.h) it is anticipated that government infrastructure funding will be secured for a material portion of the project costs. Also there are ongoing discussions with NND relating to the possibility of NND investing in the Project.

6.6 PROJECT PLANNING AND PRELIMINARY DESIGN

As noted, the Project is an enhancement of existing infrastructure in a currently disturbed environment. The preliminary designs for key aspects of the Project have been completed to a stage sufficient to establish the general location of infrastructure within the Construction Footprint Area, to identify the key components that will make up that infrastructure, and to describe the general activities required to construct those components. As the Project planning is advanced, engineering and design would be ongoing during Q2 2009 to Q2 2010, with aspects of detailed design, including "issued for construction" drawings, being completed leading up to and in some cases during the construction process.

The main footprint of the Proposed Project stretches along a single corridor from the current water intake structure at Wareham Lake to the new powerhouse on the Mayo River. This corridor will be located on lands expected to be owned by Yukon Energy, and will be constructed within a 200-metre-wide zone as marked on Figure 6-1. The contractor will clear up to 150 metres of this corridor as determined by the needs of the Project. Any merchantable timber cleared from this corridor will be made available locally at the discretion of the contractor.

Construction of the powerhouse, canal, upstream and downstream penstocks, as well as substantial components of the access road, transmission line and distribution line will take place along this corridor. Other construction areas will include the access road oriented to descend to the powerhouse, the work camp area and the lay-down areas. Construction of all facilities along this corridor and across the site will adhere to Yukon Energy's Environmental Management System manual (Appendix 6A).

6.6.1 Access Road, Distribution Line and Ancillary Infrastructure Design

The construction designs for the access road, distribution line and other ancillary infrastructure are based on designs used successfully on projects in many jurisdictions with similar topography, climate and usage constraints.

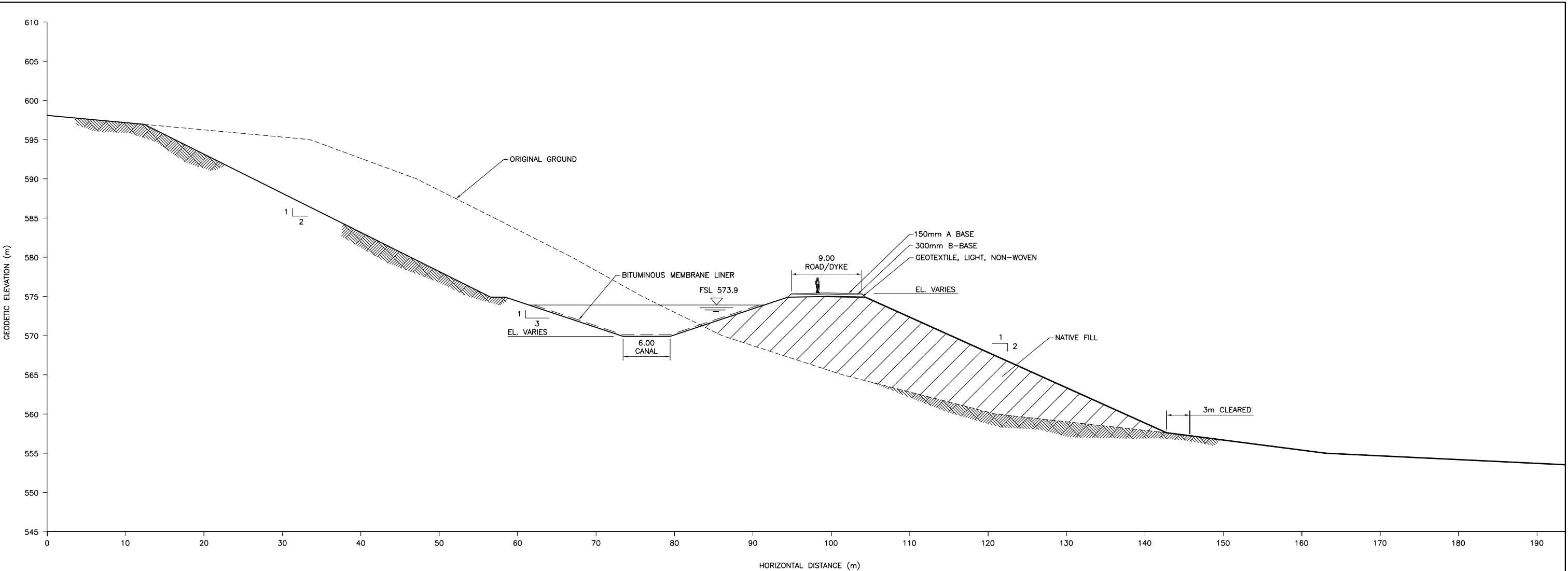
Access Road Design

A new access road is required to build, operate and maintain the proposed Mayo B power station and the penstock-canal water diversion system. The access road to the powerhouse will be one of the first projects undertaken. While this access road will become the final access road to the powerhouse once the Project is complete, it will also provide access to all portions of the site not accessible by current infrastructure during the construction phase.

The proposed road will be suitable for travel in all weather and will provide the primary route for delivering people and materials to the majority of the construction site. The road will start near the halfway point of the existing access road and will travel south approximately 2.5 kms until it meets the Mayo River. The road surface will be no more than 12 metres wide (likely 9 metres).. The road will run along the top of the berm on the downhill side of the canal, and then generally follow the downstream penstock to the powerhouse.

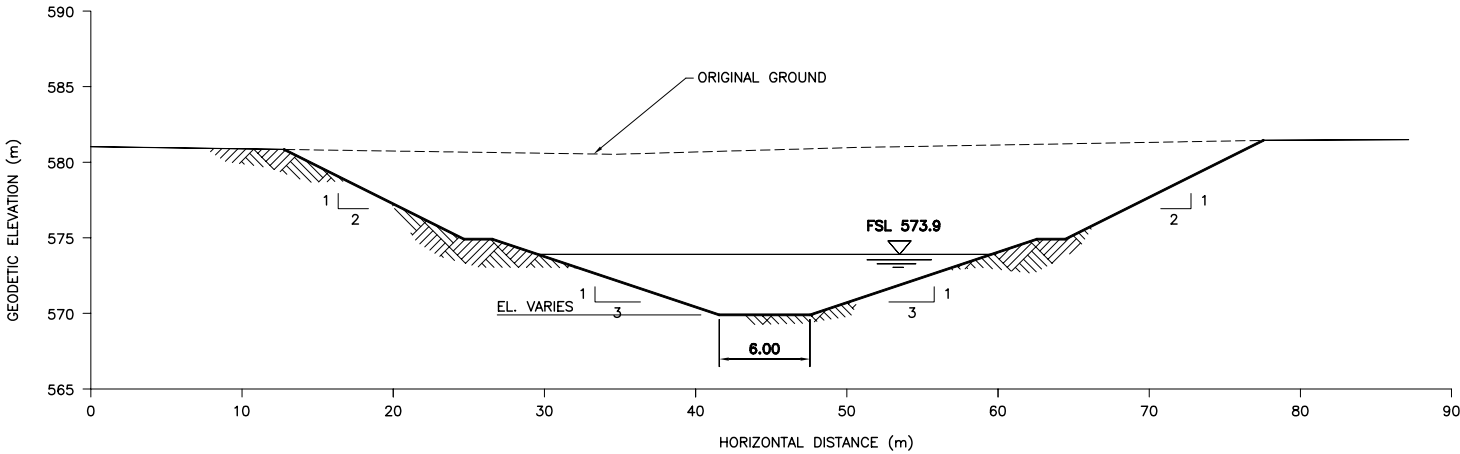
There are no streams or any observed surface drainage on the slope above the powerhouse or alongside the penstock where the access road will be built. Therefore no culverts will be installed for the new access road other than those required to maintain overall drainage from surface runoff. The access road along the portion of the slope above the powerhouse will be designed to minimize erosion and sediment mobilization down to the Mayo River. Figure 6-3 shows a typical access road design and how the access road will be built alongside the canal.

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24"x36"/PLOT SCALE: 1:2



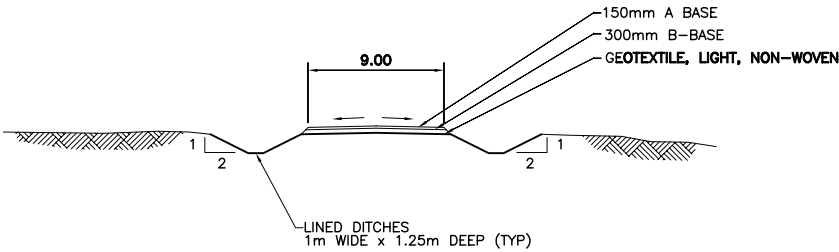
SECTION PERPENDICULAR TO CANAL ALONG RIDGE

SCALE: 1:500



SECTION PERPENDICULAR TO CANAL AT UPPER END

SCALE: 1:500



TYPICAL ACCESS ROAD CONSTRUCTION

SCALE: 1:500

KGS GROUP	YUKON ENERGY	
	MAYO B PROPOSED INFRASTRUCTURE	
	CANAL AND ACCESS ROAD TYPICAL SECTIONS	
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Transmission Line Design

The transmission line portion of the Project will require a new transmission route to be built in the vicinity of the penstock-canal corridor from the new powerhouse to Substation S249, near the existing powerhouse. The 69 kV transmission line will run from the proposed powerhouse to the existing Distribution line Right-of-Way (ROW) and continue along that ROW to Substation S249.

All transmission structures will use either a single pole and cross arm design, or multiple poles, such as the H-Frame design for longer spans. Figure 6.4 shows the typical transmission 69 kV transmission line.

Transmission structures will generally be between 12 metres and 17 metres high. The proposed powerhouse will be 3.6 km from the transmission line to the existing powerhouse. The proposed transmission lines will each be able to span 80-100 metres between poles, requiring an estimated 36 to 45 new transmission structures.

Guy wires will be installed on transmission structures where the transmission line changes direction or in areas with unstable or difficult terrain. Anchored guys will be used at dead-ends, deflections, and at unstable sites. The number of guys and the type of anchor will be selected as required for each site. Push braces will not be used unless there is no practical alternative. All guy wires will be equipped with guy guards for public safety, as per Yukon Energy's EMS Manual.

Structures will consist primarily of wood poles, with options for metal poles or towers where required. Final pole structure locations will be fixed on the basis of digitized mapping and will reflect assessment of engineering and economic factors with respect to line-length, clearing requirements, site-specific topographic and geo-technical considerations, in conjunction with environmental and socio-economic factors.

Subject to detailed engineering analysis, future pole locations can be modified to mitigate potential adverse environmental and aesthetic impacts should these issues arise during construction.

The foundations for the poles will be selected according to the site conditions. These will vary from simple augered holes to rock anchors or extensions such as piles or rock-filled barrels depending on the depth to bedrock and the type of covering soil.

Distribution Line Design

A 12.5 kV distribution line will be constructed from the site of the new powerhouse to the existing 12.5 kV distribution system in the vicinity of the Project. The 12.5 kV transmission line will supply power during the construction phase, station service power and communications during the operations and maintenance phase, and future operational redundant station service power for the hydro plant and the gate structure at the entrance to the steel penstock.

Construction of the distribution line will follow normal YEC distribution construction standards.

Figure 6-4
Example 69 kV Single Pole Structures



Equipment Storage Areas

A suitable laydown area near the canal will be established for material and equipment storage. Such an area will be made available to contractors as required, with space set aside for the concrete batch plant, aggregate processing site and for the steel penstock components. Contractors will prepare these sites as required to fit the specifications of their plants and processors, and by the materials to be stored.

A small laydown area may be required in closer proximity to the powerhouse location, and would require approximately 1 hectare of clearing adjacent to the powerhouse access road at the top of the ridge overlooking the river.

Work Camp

A flat, gravel landing will be prepared for the work camp north of the point where the upstream penstock meets the canal between existing service roads, adjacent to the existing cold storage buildings. This area is relatively flat and clear of large trees, and was reportedly the location of the work camp during construction of the original structures. This pad will need to be large enough to accommodate 50-75 people at peak construction times, likely requiring approximately 15-20 Atco-style accommodation trailers and up to 60 personal vehicles.

Potable water is anticipated to either come from a new well in the vicinity of the proposed work camp site or be trucked from facilities in Mayo, and would likely require minimal treatment. Grey water and sewage will be either be contained at the camp and trucked on a regular basis back to the existing treatment facility in Mayo, which has the necessary capacity, or disposed of via a permitted onsite ground treatment and disposal system.

6.6.2 Canal/Penstock Structure

The route for the penstock-canal corridor was designed to convey the required amounts of water to the top of the penstock without losing elevation or potential head. The critical feature of this corridor, therefore, is the canal, which has been planned along a route that requires no elevation change. The surface elevation in the canal will maintain the same surface elevation as Wareham Lake.

A geo-membrane will be used to line the canal to prevent leakage. The membrane is made from a polyester fibre impregnated with bitumen. This technology has been used for the past 35 years at other similar locations. It is designed to last a minimum of 35 years and in a freshwater environment such as Mayo B could potentially last up to 100 years or more. The liner would be covered by a granular layer to provide ballast and additional protection.

6.6.3 Existing Powerhouse

The existing powerhouse will not be physically altered. The existing powerhouse will primarily be used to generate power and release minimum flows into the Zone 2 area. This Project assumes a minimum flow through Zone 2 of 5 to 6 cms. Both existing turbines will be maintained to ensure a spare is always available for use during scheduled maintenance and in case of unscheduled break-downs. Since there is little salvage value for a used turbine, the back-up value of a second turbine far outweighs its scrap value.

6.6.4 New Powerhouse

The power station design will follow generally accepted and approved design standards established by the industry practice as well as Canadian Standards Association, the Institute of Electrical and Electronics Engineers Standards Association and the Alberta Electrical and Communication Utility Code, which are consistent with current industry practice. Other relevant codes and association manuals can be listed in section 6.3.

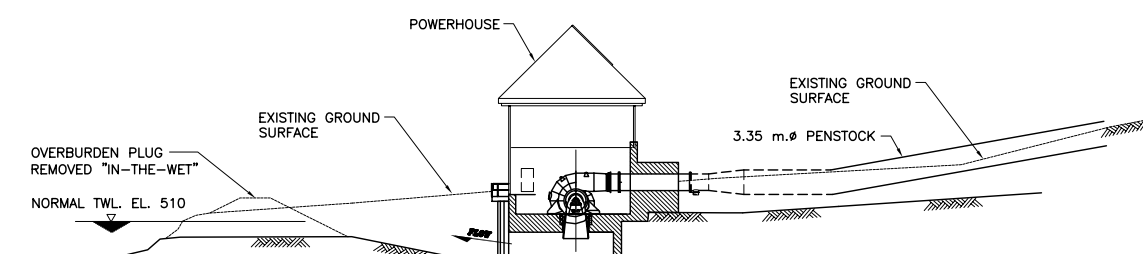
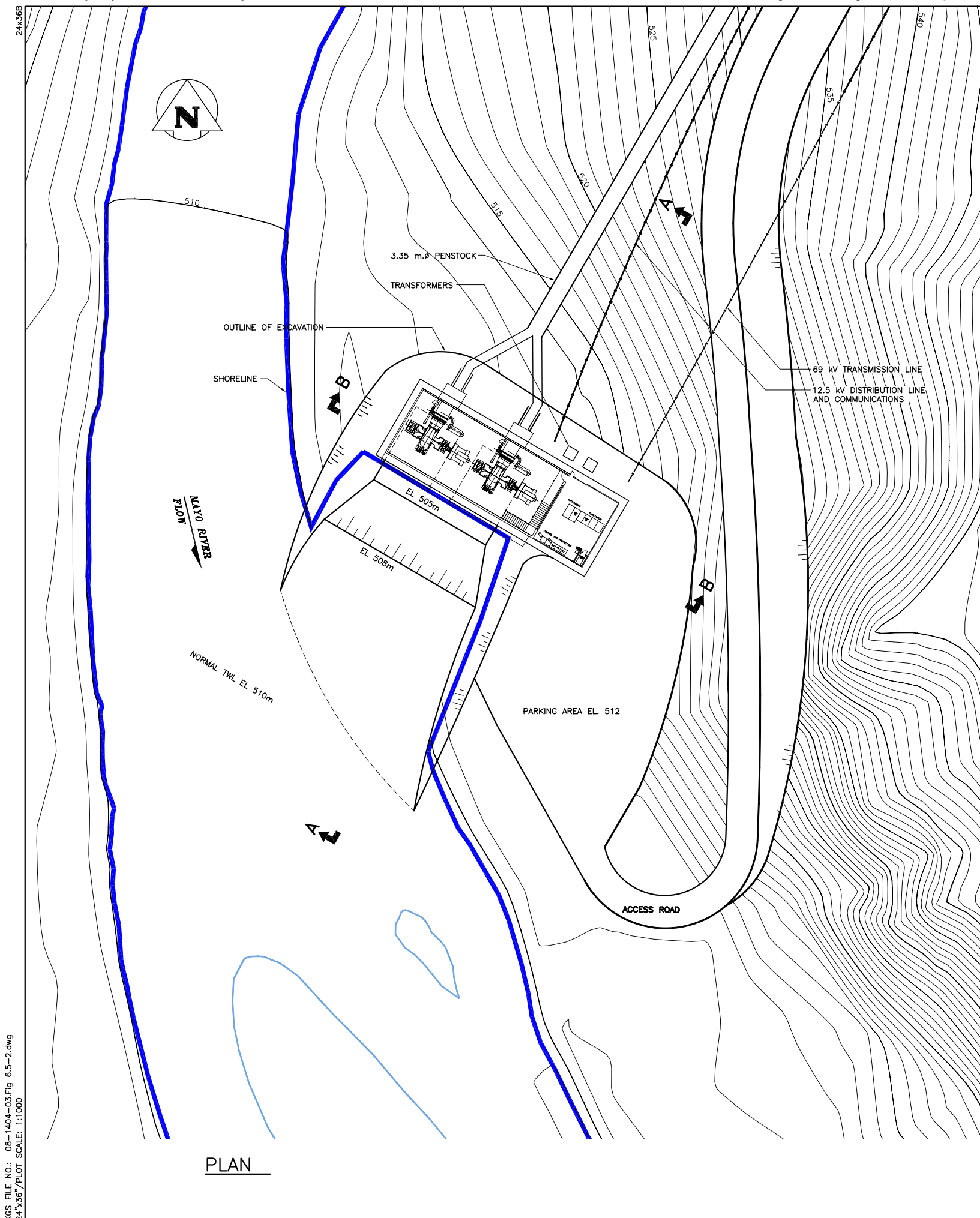
General Powerhouse Site Conditions

Further additional testing would be required through the remainder of 2009 to determine the exact location of the powerhouse and the associated bedrock elevations. Based on preliminary understanding, the powerhouse footprint would be approximately 50 metres x 20 metres, covering 1,000 square metres with an overall height of 15 to 20 metres.. An area of approximately 10,000 square metres around the powerhouse would be cleared, approximately 2,000 square metres of which would be gravelled.

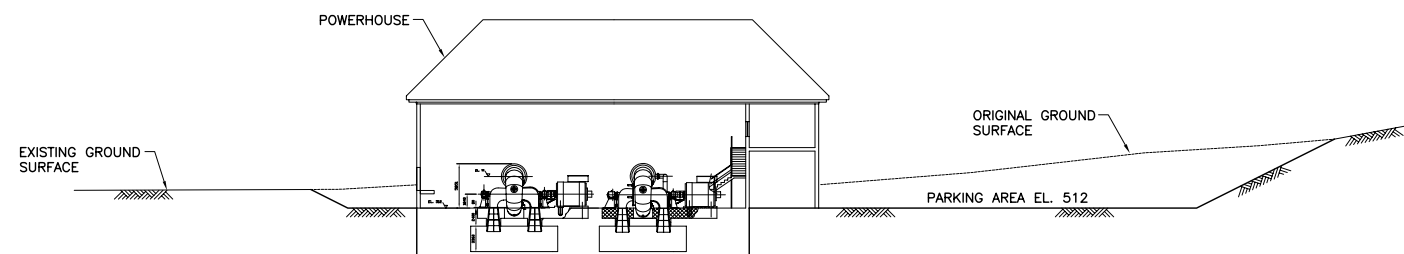
Up to 2,000 cubic metres of bedrock may need to be removed for powerhouse construction, although further drilling and testing and the final selected location could affect this volume. Regulatory authorization and special precautions will be needed for the required blasting in this area.

The generators inside the powerhouse will be roughly 3.5 metres square and 3 metres high. The Francis turbines will be 6 metres square and 3 metres high. Water enters the powerhouse through steel penstocks (one for each unit), passes through the blades of the turbine runners and then discharges down into a short concrete draft tube and into the excavated tailrace flowing into the Mayo River.

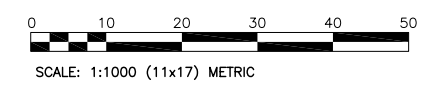
Two transformers will be located within a few metres of the powerhouse to step up the voltage for connection to the transmission grid. The transformers are located in a secured and fenced area. Station service power to the powerhouse will be supplied by a station service transformer. This will provide redundant power from either the existing hydro plant or from YEC's backup diesel power generators near the Village of Mayo. Figures 6-5 and 6-6 show diagrams of the proposed powerhouse facility.



SECTION A-A



SECTION B-B



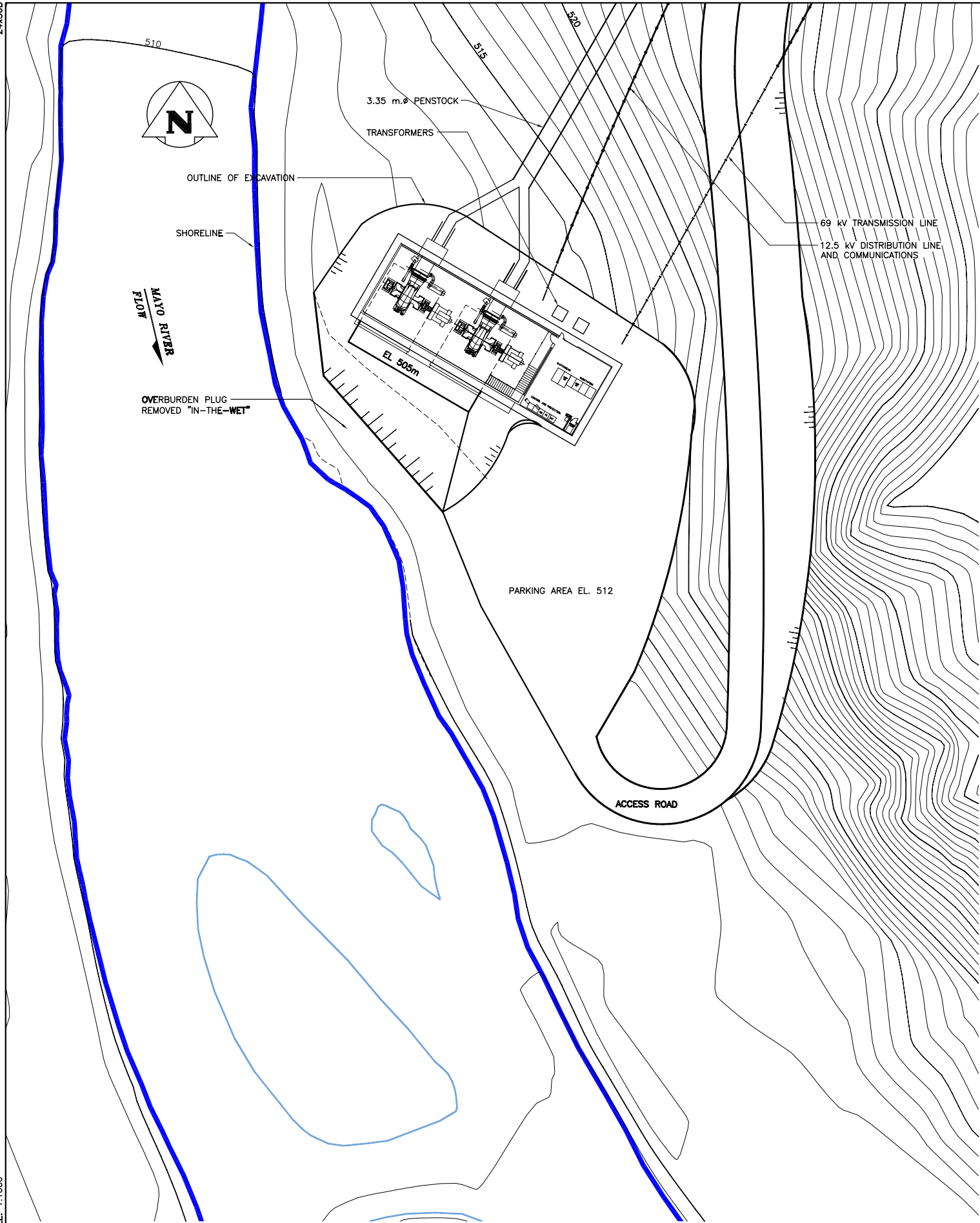
PLAN

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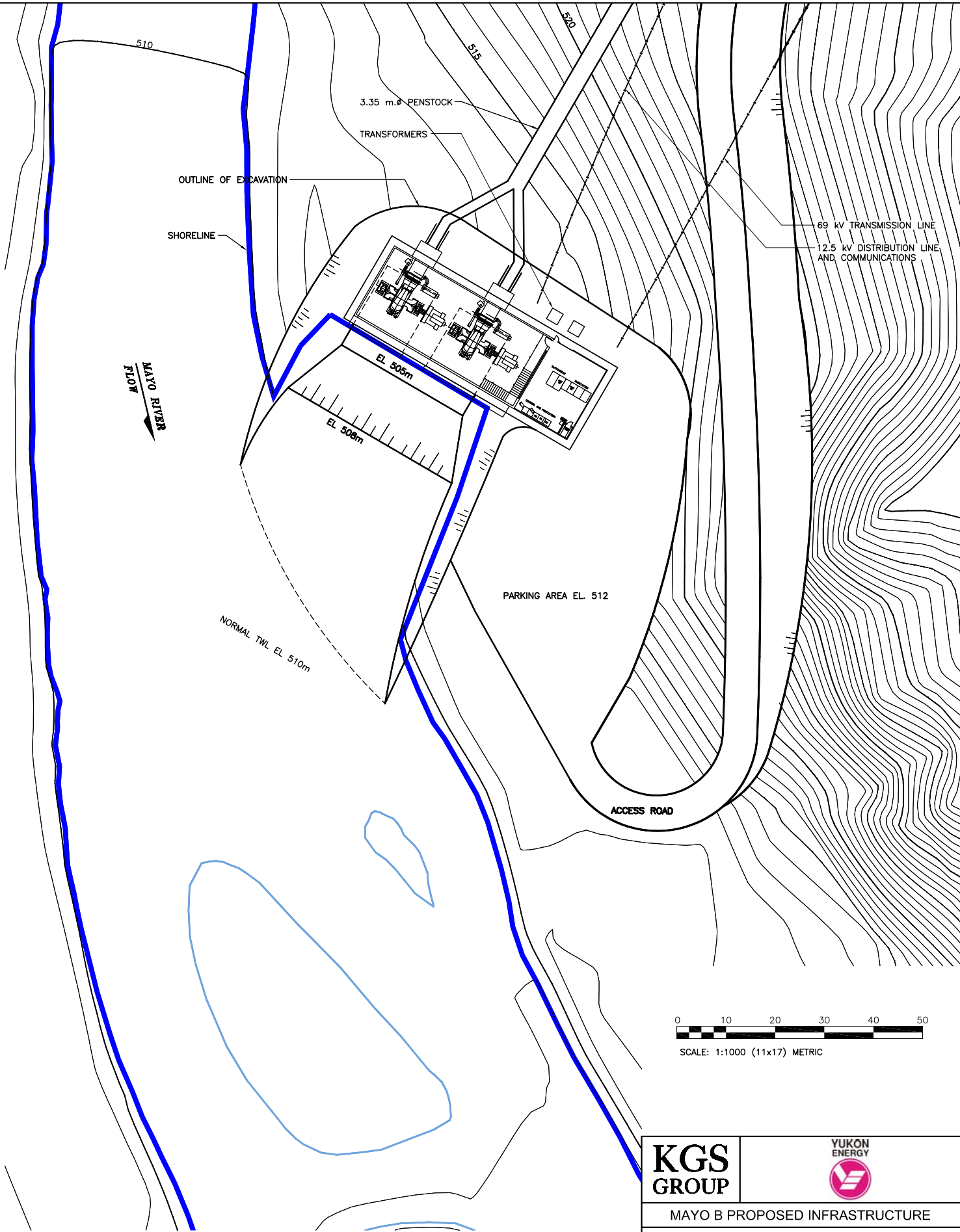
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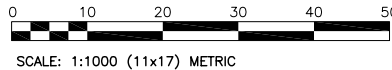
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24"x36" PLOT SCALE: 1:1000



PLAN — OVERBURDEN PLUG



PLAN — FINAL CONFIGURATION



KGS
GROUP



MAYO B PROPOSED INFRASTRUCTURE

POWERHOUSE
CONSTRUCTION PHASES

FEBRUARY 2009

REV: A

6.6.5 Salmon Rearing Channel

Yukon Energy's Project Proposal maintains provision for a salmon rearing channel, to be determined and detailed in conjunction with review by regulators, using an old river side channel immediately downstream of the tailrace of the new powerhouse. In this regard, an opportunity exists to create highly productive spawning and rearing habitat for Chinook salmon as required.

The purpose for creating channels of this type is to provide new fish habitat based on a stable flow of water, to create optimal habitat for juvenile Chinook rearing and possibly Chinook spawning. The construction of channels downstream of hydro project tailraces in order to provide fish habitat can be a ready means of providing for mitigation or enhancement related to hydroelectric developments.

Downstream of the proposed powerhouse, the area is well suited for a salmon rearing channel. There is a flat bench (approximately 70-100 wide) with a depression that is an abandoned side channel of the Mayo River. Preliminary reviews indicate that the channel has the same gradient as the river, and with appropriate design considerations can be gravity fed. The bench extends downstream a considerable distance and there are a series of options for the downstream transition to the main river channel. Specific determinations on any specific length of channel that may need to be developed have not been finalized, and will be addressed in consultation with regulators and government biologists as part of ongoing project review.

Development of any channel requires consideration by experts and regulators. A concept could revolve around a width of less than 10 m, such that there would be notable riparian influence. Water supplied to the channel could be supplied on a relatively consistent basis from the tailrace, through gravity flow.

The upstream portion of the old river channel is well vegetated within a mixed forest (Figure 6-7). The middle portion of the proposed channel has less developed vegetation (Figure 6-8). The lower portion has some active flows (when flows are high in the Mayo River).

Figure 6-7
Upstream Portion of Abandoned Side Channel
along Route of Proposed Channel



Figure 6-8
Middle Portion of Abandoned Side Channel
along the Route of Proposed Channel



6.7 CONSTRUCTION PHASE

The construction phase comprises a variety of tasks and activities, including site preparation, necessary blasting, sourcing of required materials, construction of supporting infrastructure as well as primary facilities, management of fuel and hazardous waste, and the management of necessary work crews. Each is addressed in the following sections.

There are no known cultural or environmentally sensitive sites along the proposed penstock-canal corridor or at the site of the new powerhouse. A heritage assessment of the finalized corridor will be undertaken prior to construction. Any standing heritage resources will be flagged in the field. Contractors will follow all permits and license conditions related to heritage resources, and will be briefed on the terms of all permits and relevant regulations, including heritage requirements, before initiating work on the project. If a newly discovered heritage resource is discovered, all construction activities will cease in the immediate vicinity of the site. The discovery will be reported to the appropriate authority under existing Yukon legislation, and to NND.

6.7.1 Excavated Materials

The Project's conveyance route will generally follow a natural ridge to the east of the Mayo River. The surface-run canal portion will be excavated using a cut and fill method along the ridge, using the majority of the materials from the excavation to shape the downslope side of the canal. Select portions of this excavated material will also be used to build up other features of the Project, such as the new access road, overburden required to bury the upstream and downstream penstock sections, and tailrace for the new powerhouse. Excavated materials may also be used to construct landings at the lay down area and to provide fill and/or finished grade materials for the work camp.

The excavation of the proposed canal will provide the bulk of the Project's excavated materials. Most of these materials are expected to be re-used to build the berms for the canal. Excess materials will also be used for landscaping around the upstream pipe leading to the canal, the downstream penstock leading to the powerhouse, the required access road along the side of the canal and to the new powerhouse. Larger select gravel, sifted with screens, may also be used to construct the proposed powerhouse's tailrace.

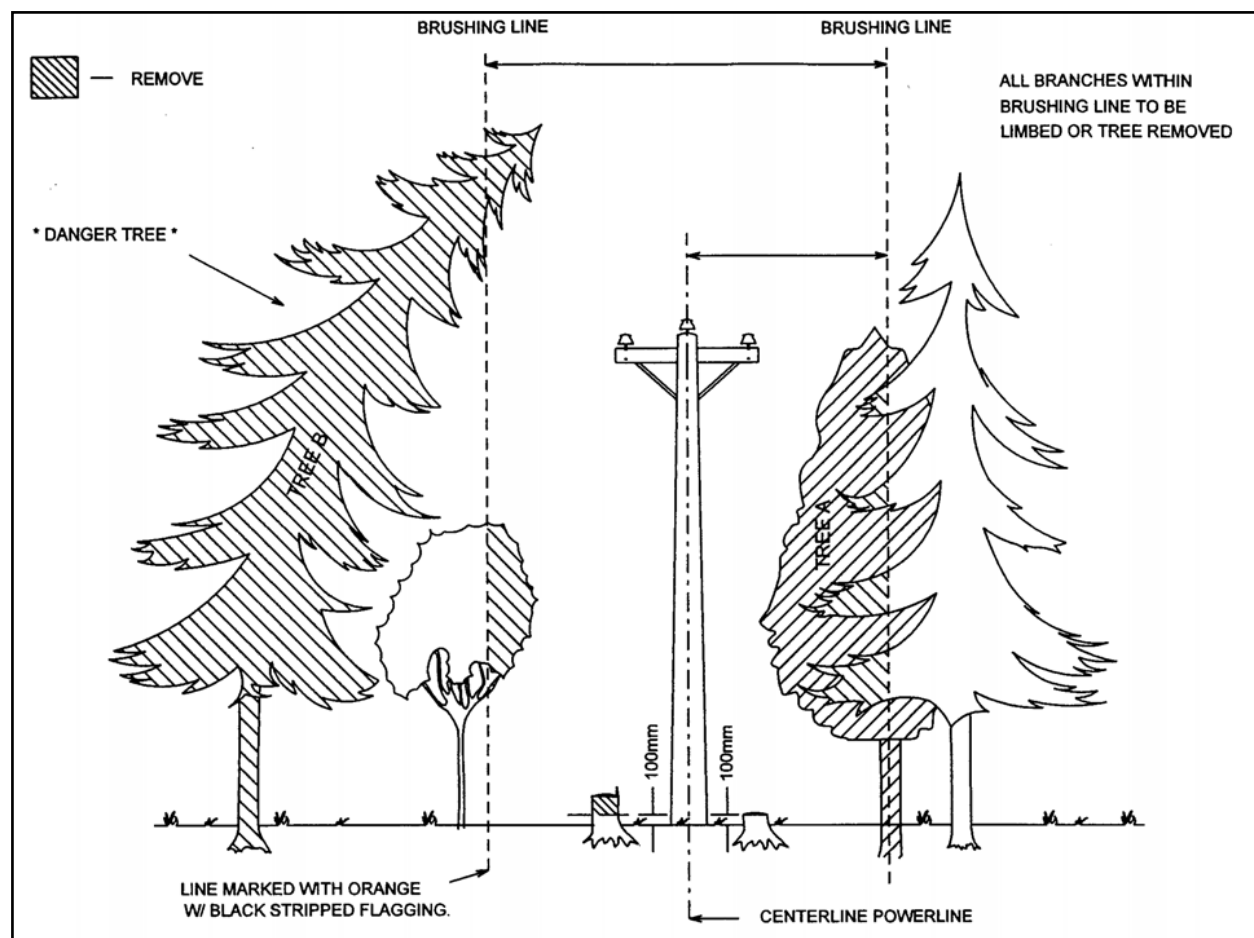
Any excess materials or materials that do not meet required construction specifications will be suitably disposed adjacent to the penstock-canal corridor, be distributed as overburden on top of the penstocks, or placed in a suitable waste area on YEC-owned property.

6.7.2 Site Preparation

The first step in the construction process will be for a survey crew to flag the new access road from the existing road to the location of the new powerhouse. This will be followed by clearing and grubbing the flagged areas, including the access road, distribution-line, powerhouse site, work camp area and preparing the construction materials and equipment lay-down areas. Once all these areas are prepared, the penstock-canal corridor from the Wareham Lake intake to the new powerhouse will also be flagged, cleared and grubbed.

Clearing and disposal of trees, including danger trees, on the established transmission ROW allows construction activities to proceed and is required for line operation safety and reliability. ROW brushing and clearing also aims to minimize the risk of wildfires. Brushing and clearing will be carried out in accordance with Yukon Energy EMS Manual best practices (see Appendix 6A). Figure 6-9 illustrates the EMS manual's guidelines for clearing and brushing danger trees.

Figure 6-9
Yukon Energy's EMS Manual Guidelines
for Brushing and Clearing of Danger Trees



ROW clearing will typically be done by mechanical methods. A mechanical feller-buncher is mounted on crawler tractors to cut tree growth up to approximately 8 inches in diameter. This method provides minimal ground disturbance. If mechanical feller-bunchers are not available, a combination of chainsaw and skidders to remove salvageable timber will be used in denser forest cover. Further clearing is expected to be done by bulldozers and excavators. Selective clearing methods (hand clearing with chain saws) are typically used in rugged terrain in the vicinity of all river and stream crossings and sensitive riparian areas.

Typical equipment for clearing may include:

- mechanical feller buncher
- excavators to pile waste wood in machine accessible areas
- tracked bulldozers for building access and some clearing
- grapple skidders to move merchantable timber
- propane fan burners
- fuel trucks (1 ton and 3 ton)
- crew trucks (1/2 ton and ¾ ton)
- chainsaws and brush saws
- Chippers
- spill kits

Trucks will be required to haul slash, overburden and select gravels from the site to disposal areas. Once the entire corridor is prepared, the final path for the penstock-canal corridor, access road and distribution line will be surveyed and marked. Steps will be taken to minimize the contamination of merchantable timber. Merchantable timber will be salvaged, if sufficient volumes are present. Merchantable timber will be hauled to one centralized location with good public road access. Smaller trees will be bucked, limbed and scattered along cleared areas. Otherwise, fuel wood salvage opportunities will be encouraged where safety, access and environmental concerns are manageable.

6.7.3 Blasting

In order to complete the preparations for the penstock-canal corridor, some blasting will also need to occur. The preliminary estimates for the blasting entail the following, from upstream to downstream

- Existing tunnel
 - Approx 1,100 cubic metres of rock excavation will be required to expand the tunnel from the intake structure to the proposed new vertical shaft. This will likely require blasting.
- New shaft from existing tunnel to the upper plastic penstock
 - Approximately 600 cubic metres of rock blasted.
- Upper penstock from the existing tunnel to the canal
 - Possibly some minor amounts of blasting may be required in the upper section in the vicinity of the existing surge tank. Due to the fractured nature of the bedrock in the area, bulldozers equipped with ripping attachments may be adequate for the removal of this material. No blasting is anticipated for the downstream penstock other than limited blasting of approximately 500 to 1000 cubic meters as the penstock approaches the powerhouse.
- Canal
 - Possibly some minor amounts in the upper section, within approximately 200m from the end of the plastic penstock. Due to the fractured nature of the bedrock in the area,

bulldozers equipped with ripping attachments may be adequate for the removal of this material.

- Canal inlet structure.
 - Possibly up to 600 cubic metres

All blasting will be conducted by qualified personnel in compliance with Yukon regulations, Yukon Energy environmental protection and safety procedures, and in accordance with any associated permit conditions.

6.7.4 Construction Material Sources

Considering the cost of transporting materials from larger industrial centres in the Yukon, and in order to stimulate the local and regional Yukon economy, local materials will be sought where practical. Sources for all materials will be investigated in 2009.

6.7.4.1 Materials for Access Road, Transmission Line and Conveyance Option

Most of the construction materials for the penstock-canal conveyance system, the access road and the adjacent transmission line corridor will be re-used from the excavation of the canal channel and potentially from blasting. The canal berms will be shaped using materials excavated from the channel and the overburden for the penstock and pipe will be supplied by the trench excavation.

All piping required for penstocks will be trucked in. These are expected to arrive in 12-18 metre sections and will be welded together in place.

Local gravel sources off site are currently being investigated for construction purposes such as concrete aggregate and access road surfacing, if suitable materials cannot be sourced on site.

An aggregate screening plant will also be erected in the project area to crush, stockpile and screen aggregate as required.

Transmission and distribution materials will be sourced as appropriate for this scale of project with a combined total of only 5.3 km of power lines required.

6.7.4.2 Materials for Powerhouse

A concrete batch plant will be located at suitable location on site in order to produce the concrete required to build the proposed powerhouse. Local sand and gravel will be required by the concrete batch plant to produce concrete for the new powerhouse, canal transition structures, and penstock thrust blocks.

The Francis turbines, powerhouse generators, step up and step down transformers, and power lines will all be trucked in using tractor trailer units at appropriate times.

6.7.4.3 Materials for Disposal Areas

Some of the excavated materials will be transported to the staging areas to lay down the pipe and other materials. An area will be set aside nearby for temporary storage, sorting and screening of excavated materials.

6.7.5 Construction of Supporting Infrastructure

Construction power will be obtained for the new powerhouse site from existing 12.5 kV distribution, thereby eliminating the need for on-site diesel fuel generators during the construction phase at the powerhouse location.

Contractors will develop and maintain the concrete batch plant and the aggregate processing area. Contractors will have discretion whether the best solution is to build or transport the required facilities to the site based on market forces and competitive bids.

6.7.5.1 Access Road Construction

The access road will be the first feature constructed after the 150-metre-wide penstock-canal corridor is prepared. The road will be constructed primarily from aggregate processed from blasted materials and from gravels located beneath the overburden in the canal excavation area. Usable material from the excavation area will be compacted along the surveyed roadway to form the base of the access road. Once the overburden is removed and set aside for final grading, temporary storage of materials for the road will take place in the canal excavation area to avoid excess loading and traffic within the construction site. If the required materials cannot be located, materials will be transported to the site from external gravel pits.

6.7.5.2 Transmission and Distribution Construction

Construction of distribution for construction and permanent power will begin once the penstock-canal corridor is grubbed and the access road is completed. Construction of transmission is also slated for 2009.

Construction of all distribution and transmission facilities will be carried out by experienced contractors, subject to Yukon Energy's EMS Manual, and subject to conditions specified in the Land Use Permit. Yukon Energy will have construction inspectors on site throughout the construction process to ensure conformity to specifications and specific mitigation measures.

Transmission and Distribution Line Construction

Line construction consists of the following basic activities: establishing the pole foundations, hauling the poles and insulators, hardware and reels of conductor to the ROW; assembling and erecting the structures and installing anchors; installing insulators and stringing of the phase conductors and overhead ground wires; and clean-up. Line construction is generally a specialized skill and will likely require line crews coming from outside the region. Line construction also involves the use of heavy equipment and local labour.

Generally, poles are hauled from a marshalling area to identified locations on the ROW. The structures are then assembled ready for installation into the ground. A digger with an earth auger excavates a hole to the proper depth. The structure is placed into the hole and properly aligned. Backfill is then compacted around the pole to hold it in place. Anchors for the deflection and dead-end structures are then installed and randomly tested to ensure suitable holding capacity.

The stringing operation begins by attaching large diameter pulleys (“dollies”) onto the insulators. The reels of conductor are then loaded onto a trailer that secures the reels as the conductor is pulled out. The wire is fed through the dollies and pulled out for a length of up to 3,200 m. After the conductor is fed off the reels, it is pulled up to the design tension. After the wire is tensioned, it is put into the clamps at the bottom of each insulator. A clean-up crew then moves through to ensure all debris has been cleaned up and the line is ready to be energized.

Typical equipment for line construction could include the following:

- Pickups and crew cabs for transportation of crews and small tools
- Highway trucks and picker trucks for hauling of material from the delivery point to site
- Tandem axle trucks and trailers for hauling of poles
- Tandem flat decks with hiab, preferably 6 x 6 for ROW access trails
- Crawler tractor for access construction
- Rubber tired (4 x 4) or skidder backhoes and small tracked excavator
- Auger truck
- Compressor and hand drills for rock work
- Tandem flat line truck with truck mounted crane of required capacity
- ROW access trails
- Fork lift (15T)
- Stringing equipment, single drum or bull wheel puller, bull wheel tensioner, rope machine
- Baby puller, correctly rated for conductor and installation tensions of conductor, reel stands
- For conductor reel size, 100T press and compressor
- Line truck with manlift, preferably 6 x 6 for ROW access trails.
- Nodwells (tracked)
- Helicopter
- Spill kits

6.7.5.3 Construction of Work Camp

Since the work camp will be constructed before the penstock-canal corridor is excavated, gravel will need to be sourced to construct the pad on which the work camp will be located. This pad will need to be large enough to accommodate between 50-75 people at peak construction times, likely requiring approximately 15-20 Atco-style accommodations trailers and up to 60 personal vehicles.

Potable water is anticipated to come from a new well in the vicinity of the proposed work camp site or sourced from local supplies, and would likely require minimal treatment. Grey water and sewage will be contained at the camp and trucked away on a regular basis back to the existing treatment facility in Mayo, which has the necessary capacity, or disposed of via a permitted onsite ground treatment and disposal system. Figure 6-10 shows an example of the kind of work camp that will be required at Mayo B.

Figure 6-10
Sample Work Camp Layout



6.7.5.4 Contractors' Work Areas

The contractors' work areas will consist primarily of the concrete batch plant, aggregate processing area, and material lay down area. The penstock-canal corridor work area will also provide a large area for contractors to work in and store equipment and materials when not in use.

A small laydown area may be required in closer proximity to the powerhouse location, and would require approximately 1 hectare of clearing adjacent to the powerhouse access road at the top of the ridge overlooking the river.

6.7.6 Construction of Primary Structures

6.7.6.1 Penstock-Canal

Construction of the three sections along the penstock-canal conveyance system will take place concurrently. Construction of the downstream penstock will consist of excavating a trench from the intake location to the powerhouse. A short distance will be left between the end of the large pipe from the penstock to the powerhouse to allow for the diversion into two smaller pipes and the final attachment to

the turbines within the powerhouse. The powerhouse will be constructed during this same period but will not be attached to the penstock until both structures are completed or nearing completion.

Once the trench is excavated, gravels will be laid along the bottom of the trench to support the penstock and prevent it from shifting. The 12- 18 metre sections of steel penstock will then be laid into the trench starting at the bottom of the slope and welded together where they meet. Once the entire penstock is in place, the forms for the concrete thrust blocks will be built and the block poured. Once the concrete has set, compacted granular material will be placed around and on top of the penstock. Overburden will be placed on top, leaving a slight rise on the surface of the ground to indicate the penstock's location.

Canal construction will consist primarily of excavating the gravel and overburden from the canal route path and sorting those materials for use in building the berms. The berms will be built using coarser gravels as the core materials, with finer gravels used to cover the top and sides. The polyester fibre geo-membrane will be laid over the entire inside of the canal, with finer gravels placed on top to hold it in place.

Construction of the upstream penstock will be very similar to construction of the downstream penstock, requiring a trench to be built from the new tunnel extension to the upstream end of the canal. Granular material will be laid in the base of the trench to support the penstock. Once all the pieces are welded together, more gravel will be laid around the penstock. Following welding of the joint, additional bedding material will be compacted around the penstock until it is completely covered, with compacted native overburden material placed on top. Some blasting may be required to complete the trench for the upstream portion of the penstock. The tunnel extension will be blasted into the bedrock, but this will not be constructed until near the end of the construction process, since it will be necessary to shut down the existing plant to tap into and enlarge the existing intake tunnel.

Linking the canal with the upstream and downstream penstocks, the inlet and outlet structures will be constructed from formed concrete, with sloping funnel-like transitions from the higher flow velocity in the upstream penstock into the lower velocity canal, and then from the lower velocity in the canal back to the higher velocity in the downstream penstock.

6.7.6.2 Existing Powerhouse

No new construction will take place at the existing powerhouse.

6.7.6.3 New Powerhouse, Tailrace & Salmon Channel Enhancement

Powerhouse

The main function of the powerhouse will be to house the turbines, generators, power-related electrical components and principal control functions and to protect them from the elements. Besides providing the principal means for generating power, the powerhouse will also provide the main control centre for the operation of the Project enhancements.

The powerhouse will be constructed primarily as a large open room housing the turbine and generator equipment, with a small, enclosed control room designed to protect the electrical and electronic controls and other sensitive equipment. An overhead crane will be installed to facilitate the installation of the

major equipment, and will be used to assist maintenance work on the equipment over the life of the Project.

Once the area for the foundation is blasted and prepared, concrete forms will be built to pour the roughly 50 m by 20 m foundation with the draft tubes and supports for the turbines and generators. Pre-fabricated, insulated steel walls will be anchored to this foundation to enclose the powerhouse, with a steel roof and trusses built 10 to 15 metres above.

Tailrace

The tailrace from the powerhouse back into the Mayo River will be constructed almost entirely in the dry. Before construction begins, sediment controls will be placed around the construction area adjacent to the Mayo River to prevent sediment and other contaminants from entering the river. Once the powerhouse is complete, the remaining land, or plug, between the excavated tailrace area and the Mayo River will then be excavated to allow water from the new plant to flow freely into the Mayo River. The potential salmon rearing channel will be scheduled to be completed prior to the Chinook spawning period in the final year.

In total, an area approximately 2,000 square metres will be excavated downstream of the powerhouse for the tailrace. Select gravels and riprap will be used to line the excavated area to ensure the force of the water leaving the turbines does not erode the tailrace area. Provisions will be made to divert a portion of the turbine flows from the tailrace into the proposed salmon enhancement channel immediately downstream of the new powerhouse.

Salmon Rearing Channel

The potential salmon enhancement channel requires a determination of detailed design elements, likely in consultation with regulators. Potential design elements could include the following:

- A gravity-fed channel could be constructed by excavating portions of the abandoned channel bed in varying amounts to create a riffle-pool morphology.
- Any channel excavation construction work will be completed 'in the dry' to prevent sedimentation of the Mayo River. Initial channel flows would require sedimentation control methods, such as perhaps a gradual introduction of water to rinse the channel (with recovered water pumped to an adjacent vegetated area to settle) until the flows run relatively clean. This type of activity would likely need to be scheduled to occur outside Chinook spawning periods. Any construction would be expected to be completed in a manner that will retain as much riparian cover as possible. In-stream cover in the form of woody debris and boulders could be incorporated throughout the channel to optimize rearing conditions.
- Although any channel would be anticipated to be developed most notably for rearing, suitable spawning gravels (loosely piled cobbles near pool-riffle transitions) could be placed near the upstream end of the channel (due to the close proximity to the water source, with relatively warm water temperatures during the winter) to provide optimal egg incubation conditions for Chinook salmon.

A side channel restoration project completed in 2004 to improve juvenile Chinook habitat by NND provides strong evidence that such a rearing channel can be a success. The NND channel has been heavily used by juveniles throughout the majority of the year, and valuable lessons were learned. Pictures of this rearing channel are shown in Figure 6-11.

Figure 6-11
Photos of a Restored Side Channel



*Photos of a restored side channel on the lower Mayo River
constructed to increase rearing habitat for juvenile Chinook salmon (shown at low flow).*

The amount of water flow being discharged into the new channel is a very important variable which will likely have to be determined as a key design criteria. Establishing a stable flow in channels of this type, to the extent possible, is an important characteristic influencing the quality of new habitat created. While efforts should be made to maintain this flow stability, variations in flow may be required at times to flush the channel (i.e. to clean spawning bed materials).

6.7.7 Fuel & Hazardous Material Management

During construction, up to 10,000 gallons of petroleum will be stored in a dedicated staging area near the work camp, complete with appropriate spill-proof equipment (including secondary containment) and documentation. A spill response plan will be kept in the engineering office, at the existing powerhouse and with emergency response personnel.

6.7.8 Work Force Requirements

Specific work force estimates are difficult to estimate for hydro-electric projects of this size prior to the award of construction contracts. To achieve accurate results, planning estimates must be verified with contractor estimates to ensure estimates reflect current market forces. The following outline is a rough indication of approximately which trades and skills will be required.

6.7.8.1 Access Road Clearing & Site Prep

- Heavy equipment operators, trucks, excavators and related skills
 - Similar to road construction work

6.7.8.2 Work Camp

- Heavy equipment operators, trucks, excavators and related skills
 - Similar to road construction work

6.7.8.3 Transmission Line

The line construction workforce generally requires a higher level of skill sets, qualifications and experience than other aspects of the construction process. Transmission line crews are generally contracted from outside the kinds of remote regions where transmission lines are usually located.

The first stage in constructing a transmission line is to stake the exact locations for each pole structure. Full transmission line crews can stake 20 structures per day. For a project of this limited size, contractors may employ a reduced crew. The second stage in constructing a transmission line includes framing the structure, setting the structure and stringing line onto the structure. Framing, setting and stringing the structures takes roughly three times as long as staking. Final determination of workforce requirements will be made by the construction contractor hired to complete the work.

The following lists outline the skills, qualifications and experience required for each of the main activities involved in transmission line construction:

Table 6-1
Transmission Line Workforce Requirements

Activity	Skills, Qualifications and Experience
Material handling	• Long haul truck drivers • Truck drivers experienced at driving on primitive roads in rough terrain and experienced at operating hiabs and handling poles. Must be experienced in the placing of material to the advantage of the installation crews with minimal supervision • General labourers as helpers, experienced in line hardware
Access & site preparation	• Surveyor, acting as sub-foreman, familiar with soils, transmission line structure staking and general line construction requirements • Heavy equipment operator, experienced in the requirements for providing access on a linear project • General labourer
Wood pole structure framing	• Lineman Supervisor, Journeyman • Lineman, Journeyman • Lineman, Apprentice • Equipment operator (backhoe, auger, crane, etc.) • General labourers
Wood pole and guy anchor installation	• Equipment operator (backhoe, auger, crane, etc.) • General labourers
Wood pole setting/structure erection	• Lineman Supervisor, Journeyman • Lineman, Journeyman • Lineman, Apprentice • Equipment operator (backhoe, auger, crane, etc.) • General labourers
Conductor installation	• Lineman Supervisor, Journeyman • Lineman, Journeyman • Lineman, Apprentice • Equipment operator (backhoe, crane, etc.) • General labourers
Clean-up	• Equipment operator (backhoe or crawler tractor) • General labourer
Testing and commissioning	• Lineman, Journeyman • Technicians

6.7.8.4 Penstock-Canal and Powerhouse

The following lists outline the skills and equipment required for each of the main components of the Penstock-Canal:

Table 6-2
Penstock-Canal and Powerhouse Workforce Requirements

Activity	Skills, Qualifications and Experience
Penstock	<i>First Summer Season</i> - Heavy equipment operators, trucks, excavators and related skills - Similar to road construction work <i>Second Summer Season</i> - Heavy equipment operators, trucks, excavators and related skills - Welders
Canal	<i>First Summer Season</i> - Heavy equipment operators, trucks, excavators and related skills - Similar to road construction work <i>Second Summer Season</i> - Heavy equipment operators, trucks, excavators and related skills - Similar to road construction work
Powerhouse	<i>Concrete Formwork</i> 80% journeymen and 20% unskilled labour - Includes journeymen carpenters and re-bar expertise. <i>Install electrical components, turbine components, pumps, compressors and related jobs</i> - Majority skilled trades <i>Install turbine and generator</i> - Skilled trades plus electrical and mechanical engineers - Equipment imported from outside Yukon <i>Tailrace</i> - Excavators experienced working in the wet <i>Commissioning of plant</i> - Engineers

6.8 OPERATION & MAINTENANCE PHASE

The Project incorporates specific water regime alterations compared to the situation with the existing plant and licence.

6.8.1 Water Management Parameters

The overall water management concept and objectives for the system will not change with development of the Project. Notably, Yukon Energy's use of water storage will remain focused on ensuring peak summer flows are used to fill Mayo Lake, within the bounds of the licence and other operational constraints. Water stored at Mayo Lake will be released during winter periods to provide for the

maximum generation that can be used to serve firm power loads, and, where possible, secondary power loads, the same as under the situation today or in the future absent a Mayo B project.

While the objectives for the system will remain the same under the proposed Project as without the Project, two material revisions to the parameters within which Yukon Energy manages water on the system are included in the proposed Project:

1. **Mayo Lake:** The Project incorporates a revision to the range within which Yukon Energy is permitted to manage Mayo Lake. As noted in Chapter 5, the present licence permits unconstrained operation over 2.59 metres (from a FSL of 665.84 metres, to a LSL of 663.25 metres). The project includes a revised LSL to a level of 662.25 metres, for a total controlled operating range of 3.59 metres. In conjunction with this revision to the LSL, Yukon Energy will incorporate into its water management practices a required periodic constraint on maximum lake drawdown over the key period of interest to fall spawning fish (most notably lake trout). Specifically:
 - a) Yukon Energy will track the **winter drawdown**, defined as the change in average daily lake elevation from September 15 of each year, to the minimum lake elevation reached during the period to the subsequent May 31. For example, the difference in elevation from (a) the level at September 15, 2012, to (b) the lowest level reached during the period from September 16, 2012 to May 31, 2013.
 - b) Yukon Energy will ensure that, in the event winter drawdown exceeds 2.59 metres for two years in a row, the subsequent year's winter drawdown will be equal to or less than 2.59 metres. In short, Yukon Energy will ensure that the winter drawdown does not exceed 2.59 metres each year for more than two years in a row.
2. **Lower Mayo River:** Presently a minimum flow is required to be maintained downstream of the Wareham Lake powerhouse of 2.8 cms. The proposed Project incorporates a minimum flow through this zone of 5 to 6 cms at all times.

All other components of the existing licence and operating practices are incorporated into the proposed Project unchanged.

6.8.2 Representative Modelled Water Flows

During the operation and maintenance phase of the Project, with the adoption of the above water management parameters, the water levels and flows on the system from time to time may vary from what would have been the case had the Project not been undertaken. Modelling of this water regime is important to understanding both the feasibility of the Project (as it relates to power production) and the implications for environmental and socio-economic conditions.

Yukon Energy has completed modelling of the above water management parameters using a period of historic inflows (1987-2007 inclusive, or a period of 21 years) and representative load conditions that could reasonably be expected to occur during the operations phase of the Project (notably a consolidated power system load assuming CSTP Stage II is in-service of 468 GW.h, which could reasonably be

expected to occur within the first 10 years of the Project consistent with: (a) retail and wholesale Yukon loads based on current conditions and projections over this period; and (b) industrial loads totalling 107 GW.h).

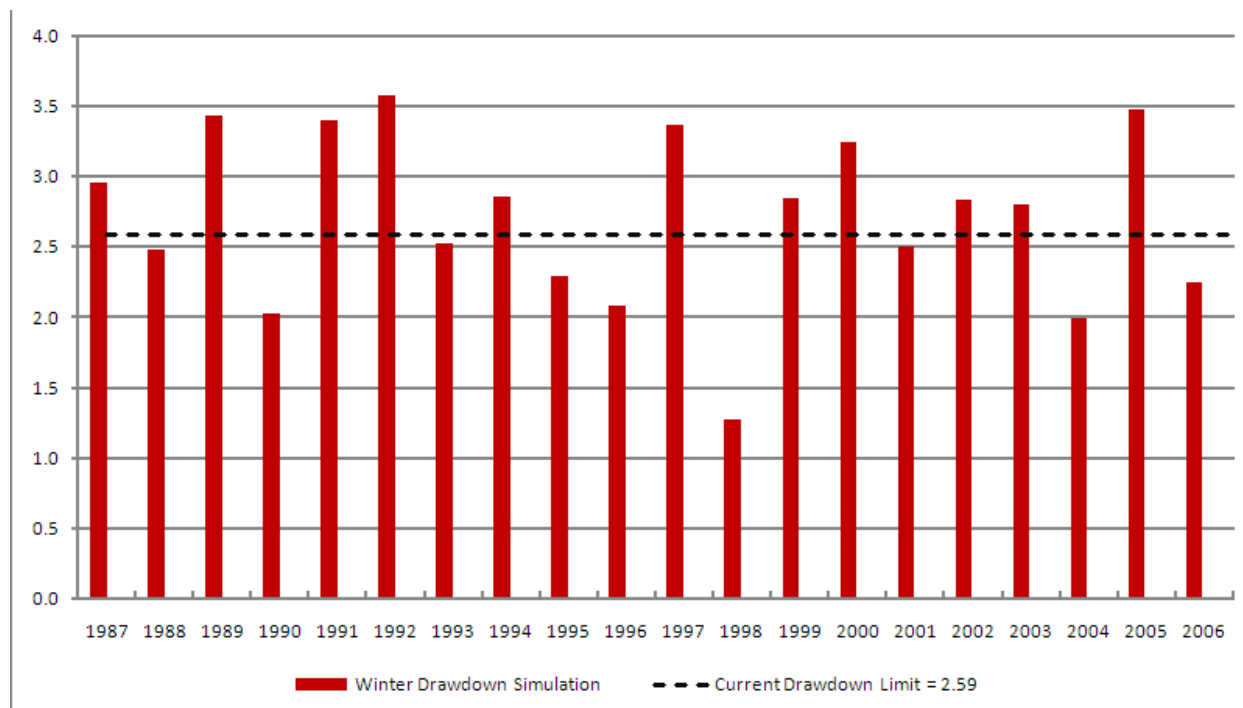
The results of this modelling scenario with respect to water flows in the Lower Mayo River (Zones 2 and 1) and the water levels at Mayo Lake are set out in Appendix 6D. The modelling incorporates the full 21 calendar years of output. With respect to the above two water management parameters, the following results of the modelling work are noted:

1. **Mayo Lake levels:** Implementation of the enhanced storage range and winter drawdown limitations noted above results in a sample of 20 “water years”² of data (the last calendar year in the sequence cannot be used as a data point, as September 15th elevation cannot be compared to the water levels the following spring, as the following spring levels are outside the modelling range). The results of the analysis are shown in Figure 6-12 below. Results of note are as follows:
 - a) In 9 of the 20 years (45% of the time) the drawdown is less than the 2.59 metres permitted in the existing licence terms.
 - b) In a further 5 of the 20 years (25% of the time) drawdown exceeds 2.59 metres, but in each case for only a one year event, with the years immediately preceding and following the year in question exhibiting winter drawdowns less than 2.59 metres (in most cases substantially less).
 - c) A two-year-in-a-row sequence of winter drawdowns in excess of 2.59 metres occurs only 3 times in the 20 year horizon.
 - d) Only one year exhibits a winter drawdown at or near the maximum permitted (3.573 metres of the 3.59 metre range is utilized).

² With respect to Mayo Lake, the parameters are based on a water year linked to the annual cycle of fall spawning fish; further detail is provided in Appendix 7A.

Figure 6-12
Mayo Lake –Winter Drawdown Simulation-Proposed Project

Bars indicate the results of system modelling. The height of each bar is the difference between the Sept. 15 water level of the noted year minus the minimum level realized during the period to the following May 31.



2. **Lower Mayo River Flows:** Development of the Project with the above noted minimum flow requirements (5 to 6 cms) on the Mayo River downstream of the existing powerhouse will result in two notable water regime changes. First, minimum or “base” flows under the proposed Project parameters will exceed the type of low base flow events that are permitted under the licenced flow regime. Second, the installation of an approximately 19 cms new plant combined with a 5 to 6 cms flow through the existing plant will maintain combined winter generation flows (i.e., Zone 1) in most years at a sustained level higher than could be achieved with solely the existing plant in service. The net effect of these two factors is set out in the flow scenario data in Appendix 6D (note that Appendix 6D indicates the results of modelling assuming a 6 cms minimum flow and a 19 cms design flow for the existing plant – at a minimum flow of 5 cms and within the potential variability related to precisely optimizing the plant design flow the results are directionally very similar in respect of the metrics applied below). Two aspects of the flow regime (as modelled) that are characteristic of the Project were measured from the data:

- a) **Minimum, or base, flows:** Minimum flows through each Zone were targeted to be maintained at a level that represents a relatively high percentage of the average flows in the Zone (i.e., avoid low flow events) during the same water year³. Specifically, two

³ In the case of Lower Mayo River Flows, the relevant water year is from July 1 of each year to June 30 of the following year, to reflect salmon life cycle characteristics.

thresholds were applied, minimum flows at 25% of average (good conditions) and minimum flows 50% of average (excellent conditions), based on fisheries literature (as noted in Chapter 7 and Appendix 7A). The Project modelling indicates that over the 20 water years the following arises:

- i. **Zone 2:** In the key zone downstream of the existing powerhouse but upstream of the new powerhouse, base (or minimum) flows are maintained above 50% of average flows for every year in the sequence. The worst year in the sequence is at 52% and the best at 98%, with the median at 85%. In short, each year is in the “excellent” range.
 - ii. **Zone 1:** The base flows in Zone 1 exceeded 50% of average flows in one year of the sequence, and exceeded 25% in every year of the sequence. The median value is 35%. Consequently, the period exhibits 19 years of “good” conditions and 1 year of “excellent” conditions.
- b) **Peak flows:** The peak flows that occur in most years reflect uncontrolled spills arising from freshet flows that cannot be stored. Values that are on the order of 2.5 (i.e., peak flows that are determined to be in the range of 2.5 times as large as the annual flows for that same water year) were noted as being optimal.
- i. **Zone 2:** The management of flows in Zone 2 results in a ratio of peak flows in relation to average flows that vary from 1.39 to 4.99. The median value is 2.76.
 - ii. **Zone 1:** In zone 1, the distribution of peak flows, as a percentage of annual average flows, varies from 1.47 to 3.17, with a median of 1.85.

6.8.2.1 Operations Under Abnormal Conditions

In very high inflow years, water that cannot be practically stored within the water license constraints will be spilled via the overflow spillway at the Mayo Lake control structure, and where necessary, through the Wareham Dam spillway gates. In very low inflow years Mayo Lake will not refill to its maximum and no water will be spilled through either spillway structure (all releases will be managed using either the generating station units, or the Mayo Lake control structure). In the event of a complete hydro plant outage, which results in no water passed through the turbines, Wareham spillway flows will be adjusted, where possible, to meet minimum flow requirements and targets, and licensed lake level constraints.

6.8.3 Inspection & Maintenance of Facilities

Dam facilities are currently inspected monthly, annually and on a five-year cycle. On-site operations and engineering staff also perform ongoing, informal visual inspections as part of their normal routine. Monthly visual inspections are recorded at the same time instrument readings are taken. Formal annual inspections are made by qualified Yukon Energy staff. Independent contractors are hired to perform the five-year safety reviews.

6.8.3.1 Access Road & Transmission Line Maintenance

Present contracts to clear and maintain the existing access road network will be expanded to include the new access road to the proposed powerhouse.

Like the dam facilities, transmission lines are visually inspected on an ongoing basis by operations and engineering staff. Formal inspections of both the 12.5 kV line and the 69 kV line will be made annually by staff. Routine maintenance of the transmission line hardware and brushing of the area will be added to the existing maintenance activities by YEC staff and contractors.

6.8.3.2 Conveyance Maintenance

The entire conveyance corridor will also be visually inspected on an ongoing basis by operations and engineering staff. Annual inspections will be made of the penstock overburden cover and of the canal berms. The transmission corridors and the berms over the penstock and pipe will be brushed every five years to prevent larger trees from taking root in the area above or close beside the penstock. Maintenance of the canal berms to maintain the appropriate slope and address any natural erosion or road surface repairs will be done on an as required basis based on the results of the annual inspections.

6.8.3.3 Powerhouse Maintenance

Powerhouse maintenance will likely take place annually during the early spring or late summer. The new powerhouse will be designed so that one turbine can be taken offline at a time for maintenance.

6.8.4 Operation Work Force Requirements

The operational workforce requirements will remain consistent with present requirements. Only one full-time plant operator will be required with additional staff required only for special projects such as maintenance and monitoring procedures.

6.8.5 Fuel & Hazardous Material Management

During normal operations, 500-1,000 gallons of petroleum will be stored in the proposed powerhouse, complete with appropriate secondary containment, leak detection and recovery systems. A spill response plan and equipment will be kept at the existing powerhouse and with Mayo emergency response crews.

6.8.6 Emergencies, Accidents & Malfunctions

As indicated for the construction phase, emergency response capabilities will be coordinated with the Village of Mayo's volunteer fire and ambulance services department. There is a community nursing station in Mayo with a doctor and three nurses. Air support for more critical injuries is provided out of Whitehorse.

6.9 DECOMMISSIONING & RECLAMATION PHASE

There is currently no timetable or plan for final disposition or decommissioning of the main Project facilities (i.e., powerhouse, canal/penstock structure, access road and distribution line). It will be 50 to 100 years before these facilities will require substantial refurbishment. This is far into the future such that

it is not feasible today, based on available information and agreements, to provide meaningful assessment of likely plans or their effects for rehabilitating the operational components and related infrastructure of the Project at the end of its operational life. When such plans need to be developed, Yukon Energy will submit these plans as then required for regulatory review and approval prior to implementation. Accordingly, this Project proposal does not provide any further assessment for its final disposition.

The following section discusses decommissioning and reclamation of construction-related sites such as the work camp and hayfield equipment storage area.

6.9.1 Decommissioning/Reclamation of Construction related sites

The work camp and lay down area(s) are the two main areas to be reclaimed once construction of the Project is complete. The main goal for reclamation will be to return the areas to the state they were in before the Project began.

The following measures will be used as required:

- Grading, disking and plowing may be used to remove ruts caused by rubber-tired and tracked vehicles.
- Where any grading, disking or plowing is required, the disturbed area may be reseeded with vegetation similar to what was previously there.
- Noxious weeds along a ROW in agricultural land may be ploughed or sprayed.
- Where appropriate, the unused land may be allowed to re-vegetate naturally. Specific areas subject to erosion may be re-seeded manually.

6.10 GENERAL ENVIRONMENTAL AND SOCIO-ECONOMIC ELEMENTS OF THE PROJECT

The project concept for the construction phase and the operations and maintenance phase comprises a number of elements incorporated into the design based on environmental and socio-economic considerations, which are pervasive to the activities and plans set out in the remainder of this chapter. These relate to oil spill prevention and containment, slope protection and site drainage, access and safety, and security and emergency response.

6.10.1 Oil Spill Prevention & Containment

Wherever possible, permanent equipment will be specified to be oil free. Alternatively, equipment will be designed to minimize the volume of oil it contains. Permanent equipment which must be filled with oil will be equipped with a containment system or provided with secondary containment.

The powerhouse design will also incorporate a permanent oil-containment system, including an oil water separator system designed to guard against the possible contamination of the waterway in the event of an accidental spill of oil or other petroleum-based liquids within the powerhouse.

6.10.2 Slope Protection & Site Drainage

All of the slopes adjacent to the canal system and all of the overburden areas covering the new pipe and penstock will be designed with suitable erosion protection, including specified gravels and/or vegetation cover. In particular, there will be drainage features along both sides of the penstock-canal system to direct surface runoff away from slopes and other structural areas and provide a low point for water to collect and move downhill. These drainage channels will also be designed to allow for maximum absorption into the ground. When runoff volumes are large enough that water does reach the base of the hill, it will be directed in a controlled manner to the river. Armouring (the placement of non-erodible material) of critical areas of ditches, settling ponds and silt fences will be provided, if required, to prevent silt from entering the waterway.

6.10.3 Access & Safety

There is currently access available to most of the proposed Construction Footprint Area from roads and trails currently located at the site. An access road will be built along the length of the canal and down to the proposed powerhouse.

Yukon Energy Corporation recognizes the responsibilities for employee health and safety are shared and accepts the responsibility of leadership of the health and safety program, for its effectiveness and improvement and for providing the safeguards required to ensure safe operations. In fulfilling this commitment to protect both people and property, management will provide and maintain a safe and healthy work environment in accordance with industry standards and in compliance with legislative requirements. Yukon Energy will strive to eliminate any foreseeable hazards that may result in property damage, accidents, and/or personal injury/illness.

On every project, all workers are given the necessary instruction and training to complete the tasks. Workers are adequately supervised while taking into account the nature of the work and the abilities of the workers.

The Corporation's internal responsibility system for health and safety is naturally extended to contractors and consultants. Yukon Energy Corporation expects contractors and consultants to accept their responsibility to ensure that project work is performed in a safe manner, and that it is in compliance with the Yukon's Occupational Health and Safety Act, the Yukon's Health and Safety Regulations and any other applicable territorial and/or federal laws or any other industry-specific requirements that may apply.

Pre-Contract controls include the requirement for contractors to submit a copy of their Health and Safety Program and a letter confirming they are in good standing with the Yukon Workers' Compensation Health and Safety Board. Contract start-up controls include a requirement for contractor employees to undergo orientation to Yukon Energy Health, Safety, and Environmental policies, programs, and procedures, as well as any special orientation required for special projects (e.g., familiarization with project permits, licences, and special considerations).

Workplace safety is not only the responsibility of Yukon Energy Corporation management or safety department personnel; all workers and contractors are responsible for their own safety and the safety of

others in the work area, as per “Duties in Respect of Health & Safety”, Occupational Health and Safety Act (4b).

During the construction phase, access will be limited to Project construction workers and regulatory authorities only. During the operational phase, access roads will have security gates but past experience shows unauthorized visitors may still enter the site. Once the Project is completed and all equipment and materials have been removed, there will be few new hazards to unauthorized visitors created as a result of the Project.

One potential new hazard will be located at the entrance to the downstream penstock at the lower end of the canal, which draws water on an enclosed path to the powerhouse turbines. The trash rack bars, spaced approximately six inches apart and located at the mouth of the penstock, will prevent both people and wildlife from entering the penstock should they happen to fall into the canal at this location. The area will also be fenced to deter people from entering the area. In a worst-case scenario, the velocity of the water at the trash racks will be slow enough that most people would easily be able to move away, even from the centre of the current.

Another potential hazard will be at the concrete structure where the upstream penstock transitions into the canal, as the water slows from 3 to 0.3 cubic metres per second at this location. Again, this area will be fenced to prevent unauthorized or unintentional entrance into the area. Even if people or wildlife enter this area and fall into the canal, the water velocity will be slow enough for most people and animals to maintain control and move to safety, and the direction of flow is away from the structure.

The only remaining apparent safety issue is along the banks of the canal itself. The 3:1 grade on the inside bank is regular and relatively gradual, making it safer than most sections of the Mayo River. Therefore, this area will not be fenced as the expense required is not warranted by the apparent danger. Warning signs will be posted prohibiting unauthorized access. During fall freeze up, there is also the danger that someone may fall through the ice before it becomes thick enough to support people. Again, this danger is common to all waterways in the area. The canal will be well marked. The slow velocity and regular movement of the water in the canal will make it much safer and more predictable during this period than the surrounding natural water features.

6.10.4 Security & Emergency Response

As a small, remote facility located adjacent to a small urbanized centre, the primary security issues facing the Mayo system involve any public access to the site, including any small-scale theft and vandalism. The two primary deterrents to public access, theft and vandalism during the construction phase will be the site's location on a road with few other purposes than to access the Mayo hydro system and the work camp. Formal access to the construction site will be limited to authorized personnel only, making visitors easily identifiable. Road access will be gated and fenced and monitoring measures will be implemented as deemed necessary by the Contractor.

As an expansion to an Existing Facility, the changes proposed in this Project create few new ongoing security issues during the operational phase. Existing security protocols, implemented presently by the plant operator, will therefore be applied to all new facilities.

Emergency preparedness planning with respect to dam safety will be thoroughly addressed to the extremely high standard maintained by hydro utility companies. This includes continuation of Yukon Energy's comprehensive Emergency Preparedness Plan which is a continuing component of Yukon Energy's dam safety program and review.

For construction site and operations phase on-site emergency response, these services will primarily be addressed by the Village of Mayo's volunteer fire and ambulance services department. There is a community nursing station in Mayo with three nurses and a doctor who divides his time between Mayo, Pelly Crossing, and Carmacks. Mayo acts as the medical evacuation point from Pelly Crossing to Elsa, and each community has its own ambulance. Policing is provided by the RCMP. There is a volunteer fire department with two fire trucks.

7.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS ASSESSMENT

Chapter 7 provides an assessment of the effects of the Project, focusing on the following:

- Overview of Approach;
- Identification of Valued Components;
- Assessment of Environmental and Socio-Economic Effects; and
- Other Effects.

7.1 OVERVIEW OF APPROACH

This chapter provides an assessment of the environmental and socio-economic effects of the Project to determine whether, after the implementation of mitigation measures, the Project is likely to result in significant adverse residual effects (including significant adverse cumulative effects) on identified VCs. The effects assessment builds on the framework established in earlier chapters, including:

- the assessment approach as reviewed in Chapter 3;
- the public consultation and involvement program (PIP) as described in Chapter 4;
- the results of an environmental and socio-economic scan provided in Chapter 5; and,
- the Project Description as discussed in Chapter 6.

More detailed information related to the environmental and socio-economic setting in the Project Study Region is provided in appendices to this Chapter, as follows:

- Appendix 7A - Fisheries and Aquatic Resources Report
- Appendix 7B: Terrestrial Resources Report
- Appendix 7C: Socio-Economic Setting
- Appendix 7D: Heritage Resources Impact Assessment
- Appendix 7E: Preliminary Assessment of Potential Erosion Impacts Associated with Two Water Level Simulations for Mayo Lake
- Appendix 7F: Further Heritage Resources Site Investigations
- Appendix 7G: Comparison of Historical Ariel Photography at Roop Lakes

There are three main pathways for effects from the Project on VCs:

- **Project-related direct and indirect changes to the aquatic and terrestrial environment:** Changes to the aquatic and terrestrial VCs (including associated wildlife and aquatic life) result from Project-related activities such as construction, operation and maintenance. Environmental changes can also be linked indirectly to subsequent socio-economic effects (e.g., resource use, economic and social change).

- **Project-related direct socio-economic effects:** Effects on people and communities can accumulate directly from the Project (i.e., direct local employment and training opportunities and local business expenditures during Project construction, operation and maintenance; and supply of lower cost grid electricity to displace diesel electricity generation during Project operation).
- **Overall effects on people and communities:** All of the specific socio-economic effects from the Project through different pathways accumulate on the affected people and communities. The results can be described overall as resource use effects, economic effects and social effects.

Residual environmental and socio-economic effects are examined for phases of the Project's life-cycle from construction to operation and maintenance. The closure and decommissioning phase has been excluded from the assessment due to the long operational horizon for the project (50-100 years). Both beneficial and adverse environmental and socio-economic effects are considered, where appropriate, along with the potential effects of the environment on the Project, and the potential effects of accidents and malfunctions.

The assessment focuses on effects of the Project that are considered "likely" to occur. Based on the approach set out in Chapter 3, the expected effects of Project activities are assessed for each environmental and socio-economic VC, focusing initially on the expected geographic extent, duration and magnitude of each effect.

The Project effects for any environmental or socio-economic VC may fall within three distinct geographic areas and for the purpose of assessment their significance may be measured as low, medium or high, based on the described geographic ranges:

- **Construction Footprint Area: Low Geographic Extent:** This describes the footprint areas needed for the Project construction, operation and maintenance. Most of the Project effects during construction are confined to the Construction Footprint Area and stem from the actual physical work performed during construction and maintenance, as well as the physical presence of the Project infrastructure.
- **Project Study Region: Moderate Geographic Extent:** This describes the broader Project Study Region for examining environmental and socio-economic effects occurring throughout the region, and is defined as the portion of the Northern Tutchone Planning Region between and including the Village of Mayo and Mayo Lake that is generally in the vicinity of the Mayo River, Mayo Lake and Mayo Lake Access road. The maximum geographic extent of most potential environmental and socio-economic effects is expected to be included in this region, including the effects of changing water levels and flows at Mayo Lake and along the upper Mayo River.
- **Beyond the Project Study Region: High Geographic Extent:** This is the area beyond the Project Study Region that covers the entire Yukon Territory. It is anticipated that no likely adverse environmental or socio-economic effects of the Project will impact on this broader region outside of the Project Study Region. However, some positive socio-economic effects are expected to extend to this broader region.

Three broad categories are considered for the duration of effects related to Project activities for the purpose of assessing significance of effects within any of the above three geographic areas:

- **Short-term effects (low duration)** tend to last not much longer than the specific construction or maintenance activities undertaken. These effects are related to the construction activities in each portion of the Construction Footprint Area (clearing, excavating, construction of new facilities), and the subsequent infrequent brief maintenance activities (mainly clearing and brushing maintenance along the transmission line routes and along the canal).
- **Medium-Term effects (moderate duration)** tend to be related to secondary effects of the new facilities and operating regime, where these changes induce a period of adaptation or reestablishment of ecosystem components.
- **Long-term effects (high duration)** tend to be related to the on-going existence of new Project components in the Construction Footprint Areas, and to the operation of the Project components as it relates to ongoing water levels and flows. For the purposes of assessing significance of effects, long-term effects are considered to be of high duration.

Within the context of the above geographic area and duration categories, three categories for the magnitude of effects (level of detectability or acceptability) are considered for the purposes of assessing the significance of effects related to Project activities:

- **Low magnitude effects** are unlikely to be detectable or measurable, or are below established thresholds of acceptable change;
- **Moderate magnitude effects** could be detectable within the normal range of variation with a well designed monitoring program, or are below established thresholds or acceptable change; and
- **High magnitude effects** would be readily detectable without a monitoring program and outside the normal range of variation, or exceed established thresholds of acceptable change.

Significance for the Project's effects on any VC is determined using the approach and criteria set out in Chapter 3 based on scientific analysis of ecosystem effects including traditional and local knowledge, socio-economic research and professional judgment. Noted deficiencies in the information base about potential effects on VCs are addressed further in Chapter 8 Monitoring and Follow-Up Programs.

7.2 IDENTIFICATION OF VALUED COMPONENTS

As discussed in Chapter 3, a VC based approach is intended to ensure that potential significant adverse effects to important environmental and social components will be detected and mitigated through the assessment process. The YESAB Guides provide considerable guidance for scoping for VCs. Consistent with the YESAB Guides, VCs for this assessment were identified based on the following considerations:

- Focal species and habitat (e.g. defining landscape attributes required to meet the needs of biota, and also the management regimes that should be applied to them);

- Socio-economic context (e.g. a socio-economic component recognized as being important because of its integral connection to, or reflection of, the socio-economic system; its commercial or economic value; and/or its role in maintaining quality of life in a community);
- Representation (i.e. seeking to maintain an appropriate representation of ecosystem networks and populations on the landscape over time, while recognizing and managing for natural temporal fluctuations in composition that occur);
- Special elements (for example rare or under-represented ecosystems, rare and/or threatened flora or fauna species, important harvested species, and unique landforms);
- Ecological processes (processes of social or environmental importance); and
- First Nation/Resident/Community values or concerns.

The selection of VCs helped to focus the assessment on components deemed to be of particular importance or of special interest to residents or to the ecosystem. The VC selection process also helped to define and describe effects pathways, and to identify temporal and spatial boundaries for the assessment of Project effects.

In this assessment, the analysis focuses on those environmental and socio-economic components that may potentially be affected by the Project. As such, the VCs selected for this assessment must be valued in environmental or socio-economic terms, and have some connection to or overlap with the Project that could create a pathway for effects to occur. VCs were identified through:

- Consultation with interested parties (as described in Chapter 4);
- Consideration of the environmental and socio-economic setting (as discussed in Chapter 5 as well as appendices to this Chapter). This includes field studies undertaken within the terrestrial and aquatic environments; heritage resources field studies; socio-economic fieldwork and data collection; a consideration of TK and local knowledge and plans and policies applicable to the Project Study Region; and
- Consideration of the Project Description (as described in Chapter 6) and likely pathways of effect on the environmental and socio-economic setting.

As set out in the YESAA legislation, the assessment focuses primarily on potentially negative or adverse effects of the Project. However, there are two key benefit streams related to the Project that are also addressed via selection and assessment of VCs. The first benefit stream includes positive socio-economic effects related to renewable energy development, electrical system reliability, economic development and the development and strengthening of local infrastructure. The second potential benefit stream relates to the opportunity to improve the existing limiting conditions with respect to habitat for Chinook salmon. Other ancillary positive effects are not described and VCs were not defined to capture those potential positive effects. For example, erosion effects of the Project were initially considered as a potential pathway of adverse effect from the Project. However, further study, as summarised in Appendix 7E, indicated that potential erosion-related effects of the Project in relation to the baseline condition (as described in Chapter 3) would be positive. As a result no VC was selected to specifically address potential erosion-related effects of the Project.

During the consultation process, certain issues were identified that are of social or environmental importance related to the existing environment, but that do not have pathways of effect flowing from the Project. These topics are discussed in Chapter 4 (Dam Safety related to the Wareham Dam; Fish passage at the Wareham Dam; Icing and Inland Water Inundation around the Village of Mayo and Wareham Lake levels near the Minto Bridge). The proposed Project is not anticipated to have effects related to these existing environmental concerns and as such no VCs have been defined related to these concerns for the current assessment.

Consistent with *Environment Canada's Environmental Assessment Best Practice Guide for Wildlife at Risk in Canada* (Lynch Stewart, 2004), all species at risk (that are either listed federally under the Species at Risk Act, or by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)) that may be present in the proposed Project Study Region were initially considered in the environmental VC scoping. Those species at risk that could potentially interact with the Project and that are included in the impact effects assessment include grizzly bear, wolverine, Common Nighthawk, Olive-sided Flycatcher and Rusty Blackbird. During the initial environmental studies, it was determined that Woodland Caribou occurrence within the zone of influence of the Project is unlikely. Nesting of Peregrine Falcons in the terrestrial study area is also unlikely and even if nesting did occur, effects of the Project on Peregrine Falcons or their habitat are extremely unlikely. As such Woodland Caribou and Peregrine Falcons, which are species at risk, are not considered as VCs for the purposes of this assessment. Similarly, although the environmental surveys included a survey of raptor nests to determine their relative abundance and distribution in the Project Study Region, nest trees were located above the waterline in taller trees that are not expected to be affected by the Project. Therefore raptors are not considered a VC for this assessment.

Similarly, berry picking and the collection of medicinal plants was identified by NND as an important socio-economic consideration. However, during the scoping review, it was determined that the Construction Footprint Area falls outside any areas identified as prime areas for berry picking or the collection of medicinal plants or similar activities. Therefore there is no pathway of effect from the Project to these activities, and plant and berry collection has not been included as a socio-economic VC in this assessment.

Finally, well chosen VCs can provide a representative measure of the Project's effects on the non-selected environmental and socio-economic components. Further, measures designed to mitigate adverse effects on VCs also serve to minimize the likelihood of adverse impacts on other environmental and social components. For example, in this assessment two key aquatic environmental VCs were identified: Chinook salmon and lake trout. While there are other aquatic species that may potentially be affected by the Project, the assessment related to these two VCs substantially addresses potential pathways of effect of the Project on other aquatic species. The Mayo Lake population of lake trout was selected as a VC as they appear to be more sensitive to increased drawdown changes and measures to protect or evaluate impacts for these species would also cover any shallow lake spawning by lake whitefish. It is anticipated that mitigation measures adopted relative to potential effects on these VCs will also be effective for other aquatic species.

The following sections summarize and characterize the VCs considered in this assessment.

7.2.1 Environmental Valued Components

This section provides a description of the environmental VCs considered in the effects assessment. Environmental VCs include both aquatic environment VCs and terrestrial environment VCs that are of particular concern in the Project Study Region and that may potentially be affected by the Project. Table 7-1 summarizes the Environmental VCs, the characterization of potential effects on the VC and the parties who identified the VC as a potential concern.

Table 7-1
Environmental Valued Components
Considered for the Assessment of the Mayo B Project

Key Interests	Valued Component (VC)	Identified by¹:	Characterization of Potential Effect
Salmon	Chinook Salmon	NND, OP, OG	Reducing water flows in Zone 2 could result in reduced spawning and rearing habitat availability. Modified flow regimes in Zone 1 could alter the quantity of habitat.
Spawning Freshwater Fish	Lake Trout	NND, OP, OG	Increase in winter draw-down range of Mayo Lake may result in exposure of lake trout spawning areas, resulting in loss of eggs from freezing or de-watering.
Wetlands	Wetlands	NND, OP, OG	Increase in winter draw-down range of Mayo Lake may alter wetland habitat in the Roop Lakes area, and at the end of the Nelson Arm. Wetlands are also important habitat for Waterfowl and waterbirds. Increased winter draw-down range may affect waterfowl breeding and staging areas in the wetland areas at the end of Roop Arm and Nelson Arm. There are also potential effects on habitat for Rusty Blackbird.
Aquatic Mammals	Aquatic Furbearers - Beaver	NND, OG	Increased winter draw-down of Mayo Lake water levels may directly affect habitat, leading to effects on populations, for example, of beaver & muskrat.
Vegetation	Rare and Listed Plants Habitat	OG	The project will have direct effects on terrestrial habitats in the Construction Footprint Area and potential indirect effects on surrounding habitats.

¹ NND = Government and Citizens of the First Nation of Nacho Nyak Dun; OP = Other Interested Persons; and OG = Federal, Territorial, or Municipal, Government

Key Interests	Valued Component (VC)	Identified by ¹ :	Characterization of Potential Effect
Wildlife	Moose	NND, OG	Construction and maintenance of Project works may directly affect habitat and movement. Enduring access may indirectly increase potential hunting.
	Other Species of Concern including Grizzly Bear, Wolverine, Common Nighthawk and Olive-sided Flycatcher	OG	Construction and operation of the project may overlap with habitat for Species at Risk not captured by the Wetlands VC.

7.2.2 Socio-economic Valued Components

This section provides a description of the Socio-economic VCs considered in the effects assessment. Socio-economic VCs include components related to resource use (including traditional, domestic and commercial resource use); heritage resources; local and regional economy; and social context that are of particular concern to individuals and communities in the region and that may potentially be affected by the Project. Table 7-2 summarizes the Socio-economic VCs, the characterization of potential effects on the VC and the parties who identified the VC as a potential concern.

Table 7-2
Socio-Economic Valued Components
Considered for the Assessment of the Mayo B Project

Key Interests	Valued Component (VC)	Identified by:	Characterization of Potential Effect
Traditional & Domestic Resource Use	Hunting	NND, OG	<u>Construction Phase:</u> Noise, air emissions (e.g. fugitive dust, vehicle exhaust), and traffic from construction may cause wildlife to avoid the Construction Footprint Area temporarily during construction. An influx of workers at the Work Camp may result in increased harvesting pressure on wildlife resources <u>Operations & Maintenance Phase:</u> Presence and maintenance of the new powerhouse and associated infrastructure may result in certain species of wildlife avoiding the immediate area.
	Fishing	NND, OG	<u>Construction Phase:</u> Direct effect of access limitations for people who fish in the lower Mayo River adjacent to the Construction Footprint Area An influx of construction workers may result in fishing during non-working hours, increasing harvesting pressure on fish resources. <u>Operations & Maintenance Phase:</u> Restricted access to the Construction Footprint Area may create challenges to fishing in the Mayo River in the area. Changes in flows in the lower Mayo River may impact fishing success.

Key Interests	Valued Component (VC)	Identified by:	Characterization of Potential Effect
Traditional & Domestic Resource Use	Trapping	NND, OG	<u>Construction Phase:</u> Construction activities will limit the ability of community members to access a small portion of RTC 407 (a community concession area encircling the Village of Mayo). Noise, air emissions, and traffic from construction may cause wildlife to avoid the Construction Footprint Area temporarily during construction. <u>Operations & Maintenance Phase:</u> The long-term presence of the access road, powerhouse, and surface-run canal will permanently modify an area as small furbearing mammal habitat. The distribution line ROW may increase habitat for small furbearing species that prefer open, low vegetation environments.
Other Resource Use	Tourism, Outfitting and Outdoor Recreation	NND, OP	<u>Construction Phase:</u> Increased traffic and noise from construction activities may prevent some tourists from deciding to travel the Silver Trail. Increased traffic and noise from construction activities may be audible at the campgrounds. <u>Operations & Maintenance Phase:</u> Increased winter flows may affect snowmobiling and access to trails along the Mayo River Zone 4 if suspended ice occurs in late winter/early spring. Increased draw-down of Mayo Lake may affect timing and ability to use beach and boat launch at west end of Mayo Lake. Decreased flows in Zone 2 may affect recreational boating.
	Placer Mining	OP	<u>Operations & Maintenance Phase:</u> Project effects within the Project Study Region in relation to accessing placer claims by barge during the early portion of the season when the lake will be at its lowest elevation.

Key Interests	Valued Component (VC)	Identified by:	Characterization of Potential Effect
Other Resource Use	Private & Commercial Land Use	OP, OG	<u>Operations & Maintenance Phase:</u> Increasing the bottom storage range of Mayo Lake may affect water access to commercial and private lease-holders and property owners at Mayo Lake. Increased winter flows from Mayo Lake to Wareham Lake may potentially affect the property owner near Minto Bridge.
Heritage Resources	Heritage Resources	NND, OP, OG	<u>Construction Phase:</u> Activities in the Project Construction Footprint Area may result in the discovery of unknown heritage sites. Known valued sites will be avoided or recorded.
Local Economy	Local Employment and Training	NND, OP, OG	<u>Construction Phase:</u> Workforce estimates suggest that there will be opportunities for residents of the area to benefit from employment and possible training.
Local Economy	Local Business	NND, OP, OG	<u>Construction Phase:</u> Construction activities will result in opportunities for local business (including NND businesses) to provide services (e.g., fuel hauling, camp services, clearing, heavy equipment operations etc.) An influx of workers may be beneficial to businesses in Mayo as the customer base will increase over the two-year construction phase.

Key Interests	Valued Component (VC)	Identified by:	Characterization of Potential Effect
Regional Economy	Government Fiscal Flows	NND, OG	<u>Construction Phase:</u> There may be direct expenditures incurred, and increases in direct and indirect tax and/or royalty revenue. <u>Operations & Maintenance Phase:</u> YEC is presently in the process of discussing opportunities for NND to participate in the Project through investment. If a mutually acceptable agreement can be arranged, there could be material benefits to NND in the form of financial returns commensurate with their investment.
	Utility Ratepayers	NND, OP, OG	<u>Operations & Maintenance Phase:</u> Improved system capability and reliability through new renewable power generation at stable costs, and reduced diesel fuel generation costs to service future load growth.
Social Context	Community and Family Life	NND, OP, OG	<u>Construction Phase:</u> Construction of the Project will require a work camp (max. peak capacity of 50-75 persons) on YEC property. An influx of workers has social implications for the community such as increased alcohol related incidents.
	Community Infrastructure & Services	OG	<u>Construction Phase:</u> Construction activities over a two year period will impact local community infrastructure and services. This could include increased reliance and stress on local infrastructure and social services (i.e., waste removal, water supply, wear & tear on road infrastructure etc).
	Traffic	NND, OP, OG	<u>Construction Phase:</u> Increased traffic during construction phase may result in a potential increase in traffic accidents, and increased wear and tear on highway and local road infrastructure.
	Worker Health and Safety	OG	<u>Construction Phase:</u> Potential concerns with health and safety of workers during construction activities. This could include increased reliance on local health services such as ambulance and nursing station services.

7.3 ASSESSMENT OF EFFECTS

As reviewed in Chapter 3 (Section 3.3.1), Project effects on baseline conditions are predicted separately for each environmental and socio-economic VC by comparing (a) “what would be expected without the Project” (the baseline), and (b) “what would be expected with the Project”.

7.3.1 Assessment of Effects on Environmental Valued Components

Section 7.3.1 provides assessment of Project effects and mitigation measures with regard to the following environmental VCs:

- Chinook salmon;
- Lake trout;
- Wetlands (waterfowl and waterbirds; and Rusty Blackbird);
- Aquatic Mammals – Beaver;
- Other Species of Concern (Common Nighthawk, Olive-sided Flycatcher, Wolverine, Grizzly Bear);
- Moose;
- Vegetation-Rare and Listed Plants Habitat.

With respect to cumulative effects, the effects assessment considers several existing environment activities, including fishing and recreation, and sediment related to various existing activities in the Project Study region. No specific future changes to these baseline conditions are identified based on other projects known to be occurring in the future.

Table 7-3 summarises the effects assessment for each of the environmental VCs. More detail on certain specific effects on environmental VCs is provided below.

Table 7-3 Summary of Project Effects and Significance on Aquatic and Terrestrial Environment

Description / Nature of Project Effect	Mitigation	Cumulative Effects Assessment	Residual Effects after Mitigation	Determination of Significance	Monitoring / Follow-Up
Chinook Salmon					
<u>Construction Phase:</u> Indirect effects related to sediment mobilization affecting rearing/spawning habitat.	Appropriate erosion and sediment control measures to be in place during construction period.	None identified (i.e., the baseline condition includes a degree of sediment related to various factors. No specific future changes to these baseline conditions are predicted based on other projects known to be occurring in the future).	Potentially adverse effects related to sediment mobilization.	Low magnitude; Moderate geographic extent; Low duration. Low (-) Not Significant	Construction compliance monitoring.
<u>Operations & Maintenance Phase: Modified flow regime in Zone 1</u> Potential for effects on habitat as a result of modified flow regime.	None required.	None identified.	Potential effects on habitat may be positive or negative but on balance expected to be neutral.	Low Magnitude; Moderate Geographic Extent; High Duration. Neutral Not Significant	
<u>Operations & Maintenance Phase: Modified flow regime with average lower flows in Zone 2.</u> Potential effects on habitat as a result of lower average flows.	Yukon Energy has committed to maintain a minimum flow of 5-6 cms downstream of the existing powerhouse.¹	None identified.	There are positive and negative effects, however the net habitat productivity should be maintained by providing a higher minimum flow than previous conditions during critical over-wintering periods	Low magnitude, moderate geographic extent, High duration. Low (neutral) Not Significant.	Spawning and rearing habitat use evaluation.

¹ The current limiting factor in regards tomortality of overwintering eggs in this stretch of river is low flow levels that can occur during incubation of Chinook eggs. Refer to Chapter 7, Aquatic Report: Appendix E for examples of past flow regimes where flows went down to 3-4 cms (in entire lower river; current license limit of 2.8 cms) for periods in the fall and winter following high flows during the Chinook spawning period. Such occurrences are not optimal for incubation success. The proposed project includes a minimum flow of 5-6 cms in Zone 2 and as such incubation success for Chinook salmon will be enhanced. The US Fish and Wildlife Service Habitat Suitability Index Model indicates that where Average annual base flow during the late summer to winter low-flow period is 50% or higher of the average annual daily flow, that the Suitability Index is 1.0 or excellent for this variable. (US Fish and Wildlife Service. 1986).

Description / Nature of Project Effect	Mitigation	Cumulative Effects Assessment	Residual Effects after Mitigation	Determination of Significance	Monitoring / Follow-Up
<u>Operations & Maintenance Phase: Implementation of the Tailrace Rearing Channel:</u> Creation of high quality rearing habitat as needed to address any residual effects of modified flow regime in Zones 2 and 1, related to the productive capacity of the river and no net habitat loss.	None (proposed as a potential mitigative activity)	None identified.	Positive effects related to high quality rearing habitat, as needed.	Low Magnitude; Low geographic extent; High duration. Low (+) Not Significant.	Monitoring to evaluate physical and biological success.
<u>Operations & Maintenance Phase: Modified flow regime throughout lower River (reduced peak flows) in all Zones.</u> Potential long-term changes in river morphology.	If necessary, planned flood events could be induced.	None identified.	Changes to Flow regime.²	Low magnitude; Moderate geographic extent; High duration. Low (-) Not Significant	Monitoring of long-term changes to geomorphology, as required.
<u>Operations & Maintenance Phase: More frequent dewatering in Zone 3</u> Potential adverse effect related to habitat loss and fish stranding.	- Ramping rules are currently in place during spawning season. - If necessary, salvaging fish from plunge pool during sustained events.	None identified.	Potential adverse effects related to residual fish habitat loss and stranding.	Low magnitude; Low Geographic Extent; High duration.³ Low (-) Not Significant	Continued use of ramping rules and monitoring for fish stranding.
Lake Trout					
<u>Operations & Maintenance Phase:</u> Increased drawdown at Mayo Lake may have a direct effect on egg incubation success due to dewatering or freezing in spawning areas. Uncertainty exists with respect to the potential effects on Lake Trout.	- The Project includes a revised water management regime including winter drawdown provisions, as set out in Chapter 6. - Progressive mitigation options are also available, in the event this measure alone is not effective.	None identified.	In years with winter drawdowns that exceed levels experienced under baseline conditions, may have adverse effects on lake trout spawning.	- Moderate magnitude, moderate geographic extent, high duration. - Frequency of the effect is moderate (occurring occasionally but not every year). - Reversibility potential is high, due to the fact that Lake Trout are a long lived species and that there are numerous other mitigation options available. Considering the suite of potential mitigation options, including ultimately altering the operating conditions of the Project if necessary, the magnitude of the effects on Lake Trout can be considered low in the long-term. Low (-) Not Significant.	Monitoring to ensure health of population. Construction or cleaning of alternative spawning sites, if determined to be required based on monitoring results, along with other potential progressive staged mitigation measures.

² The new flow regime in Zone 1 will be more stable with low flow events being notably higher than previous conditions. In Zone 1, the amount of fish habitat available is directly related to flow levels. As this section is unconfined, has a low gradient and many side/back channels, the lower the flows, the less wetted habitat available for fish (including valuable juvenile Chinook rearing habitat). When flows go down in this section the main channel width may decrease and the number of wetted/charged side channels may be reduced. These changes, if they occurred, would be gradual over time. Planned flood events could help to alleviate these effects if necessary.

³ Zone 3 has 3 per cent of the habitat area available to Chinook Salmon in the lower Mayo River (Zones 1-3).

Description / Nature of Project Effect	Mitigation	Cumulative Effects Assessment	Residual Effects after Mitigation	Determination of Significance	Monitoring / Follow-Up
Species of Concern					
<u>Construction Phase:</u> Direct effects on Common Nighthawk and Olive-sided Flycatcher nest habitat and Wolverine and Grizzly Bear seasonal habitat. Indirect Effects on Common Nighthawk, Olive-sided Flycatcher, Wolverine and Grizzly Bear due to construction disturbance and avoidance.	Clearing will take place outside of breeding season for Common Nighthawk and Olive-sided Flycatcher.	None identified.	- Potential for adverse effects on nesting habitat for Common Nighthawk and Olive-sided Flycatcher and seasonal habitat for Wolverine and Grizzly Bear. - Potential for avoidance of the area due to construction disturbance.	- Low magnitude, low geographic extent, high duration. - Effect on nesting habitat may be negative (if nests are present) or neutral (if no nests present). Low (- /neutral) Not Significant.	Pre-construction nest survey.⁴
Wetlands (including waterfowl and water birds)					
<u>Operations & Maintenance Phase: Rusty Blackbird</u> - Lower water levels may affect vegetation characteristics of nest habitats. - There is uncertainty as to the possible presence of Rusty Blackbird in potentially affected wetlands, and their nesting and foraging ecology in the region.		None identified.	Potential for adverse effects related to reduced local productivity.	- Low magnitude, moderate geographic area, high duration. - Although effects on local Rusty Blackbird nesting in the Study Region may remain, in any event the Project would affect only a very small proportion (less than 1%) of available nesting habitat such that the effects from a species or regional perspective will not be significant. Low (-) Not Significant	Nest surveys during the breeding season are suggested to determine presence in the Project Study Region.
<u>Operations & Maintenance Phase: Waterfowl and Waterbirds</u> - Lower water levels in affected wetlands at start of nesting season could result in reduced local productivity for waterfowl by flooding of nests established early in nesting season before water levels stabilize. - There is an incomplete understanding of effects of new water level management on potentially affected wetlands (mainly Roops Lake) and presence/density of shoreline nesting waterfowl in the area potentially affected by the Project.		None identified.	Potential for adverse effects related to reduced local productivity for waterfowl.	- Low magnitude, moderate extent, high duration. - Although effects on local waterfowl nesting in the Study Region may remain, in any event there are many other wetlands where waterfowl and waterbirds are known to nest in the Mayo region such that the effects from a species or regional perspective will not be significant. Low (-) Not Significant.	Pre-construction shoreline nesting waterfowl survey; Post construction monitoring of water levels in key nesting wetland areas to establish early-season effects are recommended.

⁴ Given the large range of wolverine and grizzly bear, and the small footprint of the project (<1% of either species' home range), the operation of the project in a previously and actively human-disturbed area, monitoring and follow-up for wolverine and grizzly bear response to the Project is not warranted.

Description / Nature of Project Effect	Mitigation	Cumulative Effects Assessment	Residual Effects after Mitigation	Determination of Significance	Monitoring / Follow-Up
Aquatic Furbearing Mammals					
<u>Operations & Maintenance Phase: Aquatic Mammals</u> - Reduced water levels in late winter on Mayo Lake and associated wetlands may which may force aquatic mammals out of their lodges to create chip nests to remain closer to water and food caches underneath the ice. This behavior may expose them to predation. - There is uncertainty both with respect to the frequency of maximum drawdown (which may occur either occasionally or at regular intervals) and on food cache size and depth, lodge entrance characteristics and historical behavior of aquatic mammals at late winter low water levels. Effects will be either negative (aquatic mammals will not adapt to changing water levels) or neutral (aquatic mammals will adapt to changing water levels).		None identified.	Potential for adverse effects on aquatic furbearers due to reduced water levels in winter.	- Low magnitude, moderate extent, high duration. - Although effects on local aquatic furbearers in the Study Region may remain, in any event there are substantial populations and habitat for aquatic furbearers throughout the Stewart River watershed such that the effects from a species or regional perspective will not be significant. Low (-) Not Significant.	Pre-construction surveys of food caches and lodges on Mayo Lake and areas in Roop Lake influenced by Mayo water levels; and Post-construction observation of animal responses to late winter low water levels are recommended.
Moose					
<u>Construction Phase:</u> Direct effects on seasonal habitat during clearing. Indirect effects related to seasonal habitat avoidance due to construction disturbance.	- Project design minimizes construction footprint to the extent feasible. For example this includes bundling of rights of way for the canal, road and transmission lines. - Where feasible, reduce significant construction activities (e.g. blasting) when moose are known to be within 500 m of construction activity.	None identified.	- Direct adverse effects on seasonal habitat due to construction clearing. - Indirect effects related to construction noise and disturbance.	Low magnitude, low geographic extent, high duration. Low (-) Not Significant.	None.
<u>Operations Phase:</u> Seasonal habitat avoidance due to road/site maintenance activities.	Operational activities will be limited to regular maintenance/adjustment at control structures at Mayo and Wareham Lakes; indoor activities at the new and old powerhouses and travel along access roads.	None identified.	Potential for seasonal habitat avoidance during disturbances related to ongoing operational or maintenance activities.	Low magnitude, low geographic extent, high duration. Low (-) Not Significant.	None.

Description / Nature of Project Effect	Mitigation	Cumulative Effects Assessment	Residual Effects after Mitigation	Determination of Significance	Monitoring / Follow-Up
Rare and Listed Plant Habitat					
<u>Construction Phase:</u> Direct effects on vegetation including wildlife habitat within the construction footprint. Indirect Effects may include dust accumulation inhibiting growth.	- Project design minimizes construction footprint to the extent feasible. For example this includes bundling of rights of way for the canal, road and transmission lines. - Avoidance of sensitive areas to the extent feasible, consistent with the construction environmental management plans.	None identified.	Clearing during construction will result in direct effects including loss of vegetation within the construction footprint and potentially rare/listed plant species mortality.	Effects will be Moderate magnitude, low geographic extent, high duration (once cleared the areas will remain altered from their existing state). Relative abundance of similar habitats in the region and small project footprint (i.e. relative habitat loss << 1%). Low (-) Not Significant.	One-time evaluation of total wildlife and rare plant habitat lost. Reclaim sites to allow re-vegetation where possible.
<u>Operation Phase:</u> Direct and indirect effects related to road and site/maintenance.	- Maintenance activities (e.g. snow clearing, grading, etc) will be limited to the cleared ROW. - Rare plant sites will be delineated and where possible maintenance activities will be limited.	None identified.	Maintenance activities will result in direct effects on vegetation and wildlife habitat, particularly in the cleared ROW.	Effects will be low magnitude, low geographic extent and low duration. Low (-) Not Significant.	None.

Chinook Salmon

Chinook salmon is a valuable species that is harvested by First Nations and for commercial and recreational purposes both in the Yukon and Alaska. Notable numbers of adult Chinook return to the Mayo River each summer and spawn within zones 1 and 2. Juveniles are found throughout the lower Mayo River and use a wide range of habitats. Changes in flow regimes in Zones 1-3 have the potential to impact this important species. Chinook salmon can also serve as a representative species to evaluate how changing environmental conditions expected to arise as a result of the Project may affect other species in the lower Mayo. Of the fish species in the lower Mayo River, Chinook were found to be the most widespread, and likely the most sensitive to changes in flow regimes. Egg incubation occurs in the fall/winter, a particularly harsh time in terms of flow levels and ice conditions. Chinook depend on the Mayo River for spawning, incubation, and juvenile rearing and overwintering for a year before migrating to the ocean. Unlike the other species in the Mayo River, they only spawn once during their life cycle. The Project is anticipated to have different effects on Chinook in different Zones.

In Zone 1, the revised water management regime will modify flows compared to baseline conditions. The amount of fish habitat available is directly related to flow levels. As this section of the river is unconfined, has a low gradient and many side/back channels, the lower the flows, the less wetted habitat available for fish (including valuable juvenile Chinook rearing habitat). When flows decrease in this section the main channel width decreases (more than Zone 2 and 3) and the number of wetted/charged side channels is reduced.² The new flow regime is expected to have both positive and negative impacts on habitat quantity and quality in Zone 1, with the total effect being neutral.

In Zone 2, the limiting factor to fish production is low flow levels that can occur during incubation of Chinook eggs.³ The proposed project includes a minimum flow of 5 to 6 cms in Zone 2, compared to a current baseline minimum licenced flow of 2.8 cms. The US Fish and Wildlife Service Habitat Suitability Index Model indicates that where average annual base flow during the late summer to winter low-flow period is 50% or more of the average annual daily flow, that the Suitability Index is 1.0 or excellent for this variable (US Fish and Wildlife Service. 1986). Results of Project modeling indicated that in Zone 2, flows are maintained above 50% of average flows for every year in the sequence. The worst year in the sequence is 52% with the median being 82%.⁴ While there are positive and negative effects, the net impact on Chinook habitat is expected to be positive, since the minimum flow in Zone 2 will be higher than the current condition (5-6 cms compared to 2.8 cms for the current license as described in Section 6.8.1). Monitoring studies are recommended to confirm this assessment and are described in more detail in Chapter 8.

In Zone 3, more sustained dewatering conditions are expected to occur as a result of the Project. Absent appropriate operating procedures, this could lead to fish stranding. However, Zone 3 has only 3 percent of the habitat area available to Chinook salmon in the lower Mayo River (Zones 1-3) and Yukon Energy has ramping procedures for this spillway (see Appendix 5-D). Therefore effects are not expected to be

² Refer to Aquatics Report, Appendix 7A for more information.

³ Refer to Aquatics Report, Appendix 7A for more information for examples of past flow regimes where flows went down to 3-4 cms (in entire lower river; the current license limit is 2.8 cms).

⁴ Refer to section 6.8.2 for more information.

significant. Follow-up programs related to fish stranding, where appropriate, are a component of Yukon Energy's ramping procedures.

In all zones there will be a modified flow regime which could lead to long-term effects related to changes in river morphology and associated habitat. There are potentially positive and negative effects expected. In Zones 2 and 3 a narrower channel will likely develop over several decades with riparian vegetation creeping in. Such a change will likely have positive impacts in terms of riparian influence on the wetted channel. In Zone 1, there is potential that the channel may become less complex over time. Such changes will have to be evaluated over the long term to determine if the changes are having positive and/or negative effects. Mitigation (a planned flood event) could alleviate such processes if needed. Follow-up programs consistent with YEC's on-going efforts to review environmental changes in the water systems are recommended. More details with respect to this follow-up program are provided in Chapter 8.

Implementation of a Tailrace Rearing Channel is described in Section 6.6.5 and Section 6.7.6.3. The purpose of such a channel is to provide new fish habitat where determined to be required using a stable flow regime, to create optimal habitat for juvenile Chinook rearing and possibly adult Chinook spawning. The construction of channels downstream of hydro project tailraces, in order to provide fish habitat can be a ready means of providing for mitigation for hydroelectric developments. The Tailrace Rearing Channel is expected to have positive effects on Chinook salmon by creating high quality rearing habitat. Monitoring is required to ensure that the anticipated effects emerge as predicted by this assessment. Further detail on this monitoring program is provided in Chapter 8.

In summary, there are different effects expected to impact Chinook salmon habitat in each Zone (1 through 3); however the net effects of the Project on Chinook salmon are expected to be positive. With the mitigation proposed, the Project will meet or exceed DFO's No Net Loss policy. Actual quantification of habitat quantities and qualities will be completed to demonstrate this in a manner acceptable to DFO.

Lake Trout

No Project effects on lake trout in the Construction Phase were identified.

The proposed drawdown may impact egg survival for lake trout in Mayo Lake on a regularly reoccurring basis. Ripe lake trout were captured to depths of 7m at the one known spawning location during the spawning period; however, it is not known at what precise depths egg deposition actually occurs. Lake trout are a long-lived species and as such are somewhat resilient to variable year to year spawning success. They are also known to be able to adapt to changing conditions.⁵ Existing sources of data for the lake indicate that there are normal distributions of age and size ranges of lake trout in Mayo Lake from the period of time predating 1988.

Maintaining the existing maximum water level drawdown (as described in Section 6.8.1) in at least one out of a three year period should, at a minimum, allow for successful spawning and incubation in these years. However, there is sufficient uncertainty with respect to the total impact on the long-term viability of the Mayo Lake population, that adverse effects could potentially be significant if this mitigation alone is

⁵ Refer to Aquatic Report Section 5.1.2, Appendix 7A.

not effective. Therefore, monitoring is required to ensure that the Project effects are consistent with the analysis in this assessment. As set out in Chapter 8, in the event that the monitoring program identifies concerns with respect to age class distribution, and key measures regarding the stock health are determined to be below a reasonably expected range in relation to the observed potential for Mayo Lake, a series of sequenced mitigation measures will be implemented. Progressive, or staged response, mitigation measures are considered appropriate, despite the stated uncertainty, due to the fact that the effects of the Project on fish populations are reversible. Details on these mitigation measures are discussed further in Chapter 8.

In summary, considering the fact that Lake Trout are a long lived species and that there are considerable further mitigation options available, reversibility potential is high. As a result, considering the suite of potential mitigation options, including ultimately altering the operating conditions of the Project if necessary, the magnitude of the effects on Lake Trout can be considered low in the long-term. Therefore the residual effects of the Project following mitigation are determined to be not significant with respect to Lake Trout.

Species of Concern

There is potential breeding habitat for Common Nighthawk and Olive-sided Flycatcher within the construction footprint. However, the overall effects on available habitat within the breeding range of these species are < 1%, and effects of this Project on overall species' habitat are not significant. Wolverine and grizzly bear have large home ranges, and the habitat represented by the construction footprint is <1% of that for individuals of either species. The project is occurring in a previously and continuously disturbed area. Effects of this development are considered not significant for wolverine and grizzly bear.

No Project effects on species of concern in the Operations and Maintenance Phase were identified.

Wetlands (Including Waterfowl and Waterbirds)

No Project effects on wetlands in the Construction Phase were identified.

Key wetland areas for waterfowl in the Project Study Region include the wetland area at the upper end of Wareham Lake by the Minto Bridge; aquatic studies reach 11 on the upper Mayo River, and the Roop Lake wetlands. There is an incomplete understanding of the influence of Mayo Lake water levels on the Roop Lakes wetlands areas. Aerial photography from 1948, 1996 and 2008 indicates that the Roop Lakes wetlands complex has existed for several decades, including before the Mayo Lake dam was originally constructed in the 1950s (see Appendix 7G). Over time, the lower portion of the wetlands has increased in size, commensurate with the higher water levels in the reservoir post-flooding. The majority of the Roop Lakes complex does not exhibit notable increases in wetted extent over the period covered by the photos notwithstanding the raising of Mayo Lake in the 1950s. While aerial photography cannot precisely indicate other changes, such as potential changes to the depths of the various water bodies, it is apparent that wetland habitat is an enduring feature of this area under each Mayo Lake regime, including the natural regime when lake elevations were well below the levels anticipated to occur under the proposed licence revision. Consequently, it is anticipated that the revised water management regime for the Project will not drain or "cut-off" the Roop Lakes wetlands.

There may be effects of this Project on waterfowl nesting in the Mayo Lake/Mayo River area. However, there are many other wetlands where waterfowl and waterbirds are known to nest in the Mayo region (refer to Terrestrial Studies report and chapter 7), and thus the overall effects of this project on regional waterfowl productivity is expected to be not significant.

Rusty Blackbird may breed in shoreline/wetland areas that may be affected by changes to water level management and probable reduced water levels at the start of the nesting season. However, the overall effect on available habitat within the breeding range of all species is < 1%, and effects of this Project on overall species habitat are not significant.

Aquatic Mammals

No Project effects on aquatic mammals in the Construction Phase were identified.

Aquatic mammals, in particular beaver, activity was observed throughout the aquatic portions of the study area. Beaver food caches were observed on Mayo Lake, and beaver use occurs in the Roop Lake wetlands in areas that may be affected by the revised water management regime on Mayo Lake. In particular, water levels in late winter that are lower than the baseline condition may force aquatic mammals out of their lodges where they may create “chip nests” to remain closer to water and food caches underneath the ice. This behaviour may expose them to predation.

In respect of aquatic mammals, there may be effects on the individuals using Mayo Lake and those wetlands that may be affected by the revised Mayo Lake water management regime. Further studies would be required in order to confirm the specific effects related to the Project on these individuals. A program of follow-up studies as noted in Chapter 8 could provide this information.

Relative to the aquatic mammal population of the Stewart River watershed, effects of the Project will not be significant.

Moose

Moose are found in the Project area, in particular use was noted in the burn area adjacent to the upper Mayo River area, and Roop Lakes area.⁶ The Construction Footprint was not an area noted as an area of regular use by moose, but moose tracks were noted along the shoreline of the Mayo River below Wareham Lake. The habitat that will be removed within the Construction Footprint Area does not appear to provide significant thermal cover or forage habitat, and does not appear to provide a critical component of moose habitat in the Mayo region. The potential effects of low water levels in later winter/early spring in the Roop Lake area will not have any predictable effect on the use of the area by moose. Construction activity will disturb moose in the immediate area, but the effects are short term and limited in area. Overall the Project will have no measurable effect on regional moose populations. Therefore, adverse Project effects on moose during the Construction and Operation and Maintenance Phases are expected to be low and not significant.

⁶ Refer to the Terrestrial Studies Report, Appendix 7B.

Rare and Listed Plant Habitat

The Project will have localised effects during the Construction Phase on rare and listed plant habitat that is generally available throughout the region. No one habitat type will be significantly affected because there are no unique habitats within the Construction Footprint or within the area that may be affected by indirect effects related to construction and operation activities. Some localised sites that may provide habitat for rare plants will require site investigation prior to construction, and mitigation (e.g., site-specific protection) may be considered as appropriate. The adverse Project effects during Construction and Operations will be low and not significant.

7.3.2 Assessment of Effects on Socio-Economic Valued Components

This section generally focuses on those VCs of the socio-economic environment that are of particular concern in the Project Study Region and that may be potentially affected by the Project based on the above noted pathways. For the socio-economic components, potential Project effects of construction, operation and maintenance often extend beyond the Construction Footprint Area and the areas in close proximity to this footprint, reflecting the mobility of people to engage in, for example resource use and employment opportunities. Some effects of the Project can extend beyond the Project Study Region (e.g., construction expenditure effects and utility ratepayer effects) to affect the overall Yukon economy in particular. Figure 7-1 illustrates the pathways of effects on people and communities.

Section 7.3.2 provides assessment of Project effects and mitigation measures with regard to the following socio-economic VCs:

- Hunting;
- Fishing;
- Trapping;
- Tourism, Outfitting and Outdoor Recreation;
- Placer mining;
- Private & Commercial Land Use;
- Heritage Resources;
- Local Employment and Training;
- Local Business;
- Government Fiscal Flows;
- Utility Ratepayers;
- Community and Family Life;
- Community Infrastructure & Services;
- Traffic; and
- Worker Health and Safety.

Figure 7-1
Socio-Economic Pathways of Effects

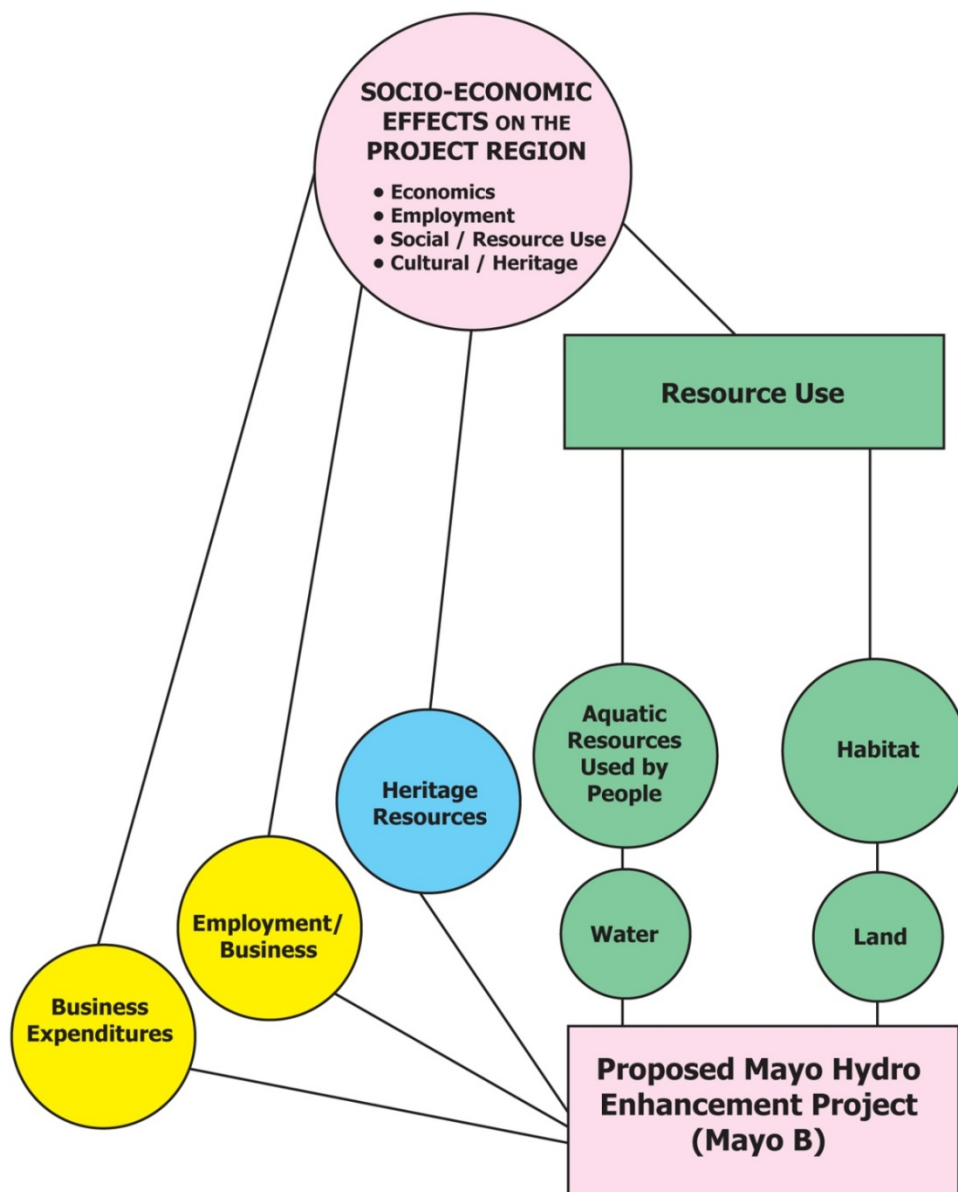


Table 7-4 provides the effects assessment for each of the above socio-economic VCs.

Table 7-4 Summary of Project Effects and Significance on the Socio-Economic Environment

Description / Nature of Project Effect	Mitigation	Cumulative Effects Assessment	Residual Effects after Mitigation	Determination of Significance	Monitoring / Follow-Up
Traditional and Domestic Resource Use					
<i>Hunting</i>					
<u>Construction Phase:</u> Direct adverse effects on the people who hunt in the immediate Construction Footprint Area: - Noise, fumes and traffic from construction equipment may cause wildlife to avoid the Construction Footprint Area temporarily during construction. <i>However, public consultation has noted that very little hunting occurs in this area.</i> <i>YG Hunting Regulations prevents hunting within 1km of a residence without permission from the resident</i> Indirect effects on hunting in the Project Study Region: - The influx of workers at the Work Camp may result in increased pressure on wildlife resources (peak numbers are expected to be between 50 and 75 workers) <i>Hunting typically occurs along the Mayo River between the Mayo dam and Wareham dam; as well as at Mayo Lake.</i>	- Avoidance of critical wildlife areas - A “no firearms policy” will be enforced within the Construction Footprint Area for safety concerns; and to inconvenience workers wishing to hunt during off-work hours - Yukon Energy designated liaison person to triage any concerns that may arise during construction - Community notification of construction activities and timing.	Information gathered during the public consultation process indicated there is increased hunting pressure from southern recreational hunters coming to the Mayo region Information gathered during the public consultation process indicated that the voluntary no hunting request at McQuesten Lake has resulted in increased pressure on Mayo Lake resources Future development of the Bellkeno Mine project could result in a temporal overlap of construction workforces for the two projects of about two years.	- Ability to hunt in the Construction Footprint Area will be affected during construction (includes restrictions due to safety concerns for construction & maintenance crews). - Wildlife may temporarily avoid the area.	Direct effects will be Short-term, Low Magnitude, Small geographic extent (portions of Construction Footprint Area). Low (-) Not Significant Indirect effects will be Short-term, Low Magnitude, Project Study Region Low (-) Not Significant	Yukon Energy designated liaison person to triage any concerns that may arise during construction.
<u>Operations & Maintenance Phase:</u> Presence and maintenance activities for the new powerhouse and associated infrastructure may result in wildlife avoiding portions of the immediate area. Operations of the Project, including fluctuations in water levels of Mayo Lake and Mayo River is not anticipated to affect access to hunting in the Project Study Region	None required – very little hunting occurs in the Construction Footprint Area.	None.	Ability to hunt in the Construction Footprint Area will be directly affected during long-term operations (gated and fenced access) Wildlife may avoid portions of the area (i.e., access road, powerhouse)	Presence and maintenance activities effects will be Long-term, Low Magnitude, Small geographic extent (portions of Construction Footprint Area) Negligible Not Significant Water level fluctuations for Mayo Lake and Mayo River will be Short-term, Low Magnitude, Project Study Region Low (-) Not Significant	None.

Description / Nature of Project Effect	Mitigation	Cumulative Effects Assessment	Residual Effects after Mitigation	Determination of Significance	Monitoring / Follow-Up
Fishing					
<u>Construction Phase:</u> Direct adverse effects on the local people who fish in the lower Mayo River adjacent to the Construction Footprint Area (according to the public consultation process, numbers are small) - Restricted access to the east side of the lower Mayo River within the Construction Footprint Area (Yukon Energy is acquiring all property for the construction of Project infrastructure) <i>Most Chinook salmon fishing is on the Stewart River; limited recreational fishing is generally south of the Construction Footprint Area</i> Indirect adverse effects on fishing in the Project Study Region: - An influx of construction workers may wish to fish in their non-working hours	- Work with Mayo RRC, NND and the Village to identify alternate fishing locations for camp workers to avoid potential competition with local community members - Yukon Energy designated liaison person	None	Ability to fish will be restricted on the east side of the lower Mayo River. Competition for fishing locations from camp workers.	Direct effects will be Short-term, Low Magnitude, Small geographic extent (Construction Footprint Area) Low (-) Not Significant Indirect effects will be Short-term, Low Magnitude, Project Study Region Negligible Not Significant	Yukon Energy designated liaison person to triage any concerns that may arise during construction
<u>Operation & Maintenance Phase:</u> Long-term direct effects due to restricted access to Yukon Energy property (Construction Footprint Area) Long-term indirect effects on fishing in the Project Study Region <i>Abundant and more favourable fishing lakes in the vicinity of Mayo, including Janet & Ethel Lakes</i> <i>No Project effects on the ability to fish or access to fishing at Mayo Lake or along the upper Mayo River (Zone 4)</i>	None required – almost all fishing occurs outside the Construction Footprint Area The Project includes a revised water management regime including winter drawdown provisions as set out in Chapter 6.	None	Continued restricted access to Yukon Energy property and portions of the lower Mayo River	Long-term, Low Magnitude, Project Study Region Low (-) Not Significant	
Trapping					
<u>Construction Phase:</u> Short-term direct effects on the ability of community members to access small portion of Community Trapline 407. <i>Small number of community members use this trapline on an annual basis (approximately 5 Assistant Licenses are allotted on an annual basis)</i> <i>Decreased opportunities within small portion of RTC 407 for educational activities associated with elders teaching youth about trapping</i> Noise, fumes and traffic from construction equipment may cause wildlife to avoid the Construction Footprint Area temporarily during construction.	- Avoidance of critical wildlife habitat - Local notification of work schedule - Trapper compensation for construction period (if required)	None	Ability to trap within portions of RTC 407 in the Construction Footprint Area during the construction period Wildlife may temporarily avoid the area	Short-term, Low Magnitude, portions of Construction Footprint Area Low (-) Not Significant	

Description / Nature of Project Effect	Mitigation	Cumulative Effects Assessment	Residual Effects after Mitigation	Determination of Significance	Monitoring / Follow-Up
<u>Operation & Maintenance Phase:</u> Long-term presence of the access road, powerhouse and surface-run canal will permanently remove these areas as small furbearing habitat within the Construction Footprint Area. The transmission line ROWs may increase habitat for small furbearing species that prefer open, low-vegetation environments. <i>Approximately 3% of RTC 407 will be removed from the community trapline. This is in a previously disturbed environment.</i> Project Study Region: Access to trapping activities at Mayo Lake will not be adversely affected. Water levels of Mayo Lake will see gradual drawdowns over the winter months potentially resulting in adverse effects on beaver's ability to access their food caches.	Yukon Energy's EMS best practices for ROW maintenance and access The Project includes a revised water management regime including winter drawdown provisions as set out in Chapter 6.	None	Long-term reduction in ability to trap portions of RTC 407 Improved access along transmission line ROW and access road	Long-term, Low Magnitude, Construction Footprint Area Low (-) Not Significant	
Other Resource Use					
<i>Placer Mining</i>					
<u>Operation & Maintenance Phase:</u> Direct Project effects within the Project Study Region in relation to accessing placer claims by barge during the early portion of the season when the lake will be at its lowest elevation. <i>Short-term Project effects in late May/early June will affect placer miners using barge access – access likely delayed approximately two weeks.</i> <i>Other forms of access include truck/snowmobile in winter</i>	None required	None	Long-term effect on use of barge to access placer claims during late May/early June	Long Term, Low Magnitude, Project Study Region Low (-) Not Significant	
<i>Tourism, Outfitting and Recreation</i>					
<u>Construction Phase:</u> The Village of Mayo is a staging and jumping off point for many activities related to tourism, outfitting and recreation. Most of these activities occur outside the Construction Footprint Area; and outfitting activities beyond the Project Study Region. Recreation activities are generally outside the Construction Footprint Area, but within the Project Study Region, including: picnicking, hiking, canoeing, camping, cross-country skiing and snowmobiling. McIntyre Park and Five Mile Lake Campground are within the Project Study Region. Indirect short-term effects during the construction phase relate to noise, fumes and traffic overlapping with tourism season.	Confined location of Project infrastructure within an already disturbed environment, outside the Village of Mayo boundaries. Construction Footprint Area avoids both McIntyre Park and Five Mile Lake campground. Notification of construction activities will be posted in the community.	None	Noise, fumes and traffic may potentially cause temporary displacement of some tourist activity during July and August of the two construction seasons.	Short-term, Low Magnitude, Project Study Region Low (-) Not Significant	

Description / Nature of Project Effect	Mitigation	Cumulative Effects Assessment	Residual Effects after Mitigation	Determination of Significance	Monitoring / Follow-Up
<u>Operation & Maintenance Phase:</u> Increased winter flows may affect snowmobiling and access to trails along the Mayo River Zone 4 if suspended ice occurs in late winter/early spring. Increased drawdown of Mayo Lake may affect timing and ability to use beach and boat launch at west end of Mayo Lake. Decreased flows in Zone 2 may affect recreational boating.	None required	None	Changes in winter flows may affect snowmobiling and access to trails along Zone 4. Increased drawdown may affect timing and use of boat launch and beach at west end of Mayo Lake over short window in spring. Decreased flows in Zone 2 may affect recreational boating	Long-term, Low Magnitude, Project Study Region Low (-) Not Significant	
Private and Commercial Land Use					
<u>Construction Phase:</u> Land not presently owned by Yukon Energy is required for the Project, including Crown lands adjacent to the existing YEC parcel and two privately-owned parcels. No additional Project effects on private or commercial land within the Construction Footprint Area or the Project Study Region.	Yukon Energy will initiate specific negotiations with the landowner towards acquisition of the lands, if and to the extent necessary, in advance of construction	None	None	Long-Term, Construction Footprint Area Negligible (-) Not Significant	
<u>Operation & Maintenance Phase:</u> Increasing the bottom storage range of Mayo Lake may potentially affect water access to commercial and private lease-holders and property owners along the shores of Mayo Lake, including Gull and Peggy's Island. <i>This affect will occur prior to spring freshet when Mayo Lake starts to refill, and will be short-lived.</i> Increased winter flows from Mayo Lake to Wareham Lake may potentially affect the property owner near Minto Bridge.	None	None	Potential effects related to changes in water levels for commercial and private lease-holders and property owners.	Long-term, moderate frequency, low magnitude, Project Study Region Low (-) Not Significant	

Description / Nature of Project Effect	Mitigation	Cumulative Effects Assessment	Residual Effects after Mitigation	Determination of Significance	Monitoring / Follow-Up
Heritage Resources					
<u>Construction Phase:</u> Short-term construction activities may impact known or unknown heritage resources within the Construction Footprint Area.	- Known heritage resources will be avoided by either a 15 m or 30 m buffer (depending on the type of resource) if feasible; otherwise additional data recovery after consultation with Heritage Branch and NND - YEC's EMS best practices for Heritage Site Investigation and Avoidance will be followed - Additional heritage investigations along the final canal route, transmission line route and powerhouse location will be conducted prior to construction.	None	Potential inadvertent discovery of unknown heritage sites along the access road, canal, transmission line corridor(s) and powerhouse location.	Short-term, Construction Footprint Area, Low Magnitude Low (-) Not Significant	Additional Heritage Site Investigations prior to construction (Appendix 7-F).
Local Economy					
Local Employment & Training					
<u>Construction Phase:</u> Employment and training opportunities will exist over the course of the two year construction phase. Employment opportunities will include a variety of skill sets including general labour, heavy equipment operators, trucking, camp catering, linemen, carpenters and other skilled trades.	No mitigation is required.	Future development of the Bellkeno Mine project could result in a temporal overlap of construction workforces for the two projects of about two years. This could result in competition for local labour.	Job skills acquired through employment and training may be applied to other employment opportunities.	Short-term, Construction Footprint Area, Low Magnitude Low (+) (increased employment) and (-) (potential for labour competition) Not Significant	
<u>Operation & Maintenance Phase:</u> Yukon Energy does not anticipate any additional need for additional operational staff.	No mitigation is required.	None	Employment of local people for maintenance activities associated with the transmission line corridor.	Short-term, Construction Footprint Area, Low Magnitude Low (+) Not Significant	
Local Business					
<u>Construction Phase:</u> Local contractors will have an opportunity to bid on various components of the construction activities, including clearing and grubbing various Project areas, building the access road, excavating the canal etc. Project workers will likely utilize Village businesses such as the grocery/hardware store, gas bar, restaurant etc.	No mitigation is required. Yukon Energy is committed to employing local contractors wherever possible.	Future development of the Bellkeno Mine project, as well as other local projects could result in a temporal overlap. This could result in a shortage of available local contractors.	Local contractors will benefit from the opportunity to participate on the Project. Local businesses will benefit from spending by the construction workforce within the Mayo community.	Short-term, Project Study Region, Moderate (+) Magnitude Low (+) Positive Significance	

Description / Nature of Project Effect	Mitigation	Cumulative Effects Assessment	Residual Effects after Mitigation	Determination of Significance	Monitoring / Follow-Up
<u>Operation & Maintenance Phase:</u> Local contractors may have the opportunity to provide maintenance services for the transmission line routes and access road.	No mitigation is required.		Local contractors may benefit from infrequent maintenance activities.	Short-term, Project Study Region, Low Magnitude Low (+) (increased employment) and (-) (potential for labour competition) Not Significant	
Regional Economy					
<i>Government Fiscal Flows</i>					
<u>Construction Phase:</u> The Territorial Government or Federal Government may incur expenditures (related to contributions to project funding). The Territorial government and/or Federal government may experience increases in direct and indirect tax or royalty revenues.	None.	None.	Potentially expenditures related to Project funding and increases in tax and/or royalty revenues.	Short-term, effects could extend beyond the Project Study Region, low magnitude. Low (+) Not Significant	
<u>Operation & Maintenance Phase:</u> YEC is currently engaged in a process of determining potential opportunities for NND to participate in the Project by way of investment or ownership interest.	None	None	Potentially participation in the Project by NND including financial returns commensurate with their investment.	Long-term, Project Study Region, Moderate magnitude. Moderate to High (+) Potentially Significant.	
<i>Utility Ratepayers</i>					
<u>Operation & Maintenance Phase:</u> Operation of the Project will benefit ratepayers by providing a cost-effective source of renewable energy and improving grid reliability.	None.	None.	Lower cost (relative to alternative sources of supply), renewable energy and enhanced system reliability.	Long-term, effects extend beyond the Project Study Region, moderate magnitude. Moderate to High (+) Potentially Significant	
Social Context					
<i>Community and Family Life</i>					
<u>Construction Phase:</u> The Project includes a work camp located outside the municipal boundaries, with peaks of 50-75 workers during portions of the two year construction schedule. - Possible adverse effects include social implications such as an increase in alcohol-related incidents from an influx of workers into town. - Potential positive effects include participation of construction workers in the recreation programs offered through the Village's community centre (e.g., badminton, soccer, curling etc.)	- Yukon Energy designated liaison person to triage any concerns that may arise during construction - Yukon Energy will establish a "drug and alcohol" policy for the camp. Such a policy could include, among other elements, a "zero tolerance" policy for construction workers who cause alcohol related disturbances in town.	Future development of the Bellkeno Mine project could result in a temporal overlap of construction workforces coming into the Village of Mayo for recreation or other purposes.	Potential increase in alcohol related incidents in the community. Potential increase in social mixing through participation in recreational programs	Short-term, Project Study Region, Moderate Magnitude Low (-) / (+) Not Significant	Yukon Energy designated liaison person to triage any concerns that may arise during construction

Description / Nature of Project Effect	Mitigation	Cumulative Effects Assessment	Residual Effects after Mitigation	Determination of Significance	Monitoring / Follow-Up
Community Infrastructure & Services					
<u>Construction Phase:</u> Construction activities could result in increased reliance and stress on local infrastructure and social services (i.e., waste removal, water supply, wear & tear on road infrastructure etc). Construction workforce may potentially use the Village’s recreational facilities. Job-site related accidents may increase the pressure on local community health, police and emergency response services.	- Yukon Energy will consult with the Village to determine an appropriate fee for use of the sewage lagoon and landfill. - Construction materials will be re-cycled/re-used on site as much as is practicable to reduce the amount of construction waste. - All special and hazardous wastes generated at the project site will be recycled or disposed of in an approved manner. - Adherence to Workplace Health & Safety regulations; and job safety training.	Future development of the Bellkeno Mine project could result in a temporal overlap of construction workforces coming into the Village of Mayo for recreation or other purposes such as the health centre.	Yukon College may have increased enrolment from community workers seeking training opportunities in anticipation of employment. Increased stress on community health centers.	Short-term, Project Study Region, Low/Moderate Magnitude Low (-) / (+) Not Significant	Follow up discussions on sewage lagoon user fee and landfill user fee.
Traffic					
<u>Construction Phase:</u> In order for the Project to proceed, equipment, materials and personnel will be transported into the job site over the course of the two year period. This will result in an increase in traffic over the Klondike and Silver Trail Highways <i>Current traffic capacity of the Silver Trail Hwy. is 10% and the Klondike Hwy. less than 20%. Bridges are in good repair.</i>	YG highways will be made aware of the Project, and its anticipated use of the Silver Trail Highway for hauling of equipment and materials.	Future development of the Bellkeno Mine project could result in a temporal overlap of traffic use of the Silver Trail Highway, resulting in a potential increase in accidents and increased wear and tear on local road infrastructure.	Increased traffic may result in a potential increase in traffic accidents and wear and tear on road infrastructure.	Short-term, within and beyond the Project Study Region, Low Magnitude Low(-) Not Significant	
Worker Health & Safety					
<u>Construction Phase:</u> Construction activities could result in job-related accidents. This could result in increased reliance on local health services such as ambulance and nursing station services.	Adherence to the Occupational Health and Safety Act and the Yukon Health & Safety regulations; and job safety training.	None	Safety concerns over job-related accidents may continue for the short-term.	Short-term, Construction Footprint Area, Low Magnitude Low(-) Not Significant	
<u>Operation & Maintenance Phase:</u> Operations and maintenance of the Project will follow the same worker health and safety policies and practices currently in place.	- Yukon Energy's EMS manual on transmission and powerhouse infrastructure. - Access to YEC's property will be fenced and gated at the access road. - Intersections of the canal and penstock will be fenced. - Safety signage.	None	Safety concerns over new infrastructure may continue for the short-term as the local community adjusts.	Long-term, Construction Footprint Area, Low Magnitude Low(-) Not Significant	

Traditional and Domestic Resource Use

There is very little hunting, fishing and trapping within the Construction Footprint Area. Most fishing by NND members occurs at Fraser Falls on the Stewart River – a long-standing traditional fishing camp – or at other locations. The majority of moose hunting occurs along the Mayo River between Mayo Lake and Wareham Lake, as well as the area around Mayo Lake and to some extent Roop Lakes. Community members generally put in their boats downstream of the Mayo Lake control structure and float downstream to the Minto Bridge area, calling for moose from boats; conversely the Mayo Lake access road provides access to moose hunting areas adjacent to the road and river. The Community Trapping Concession is a five kilometre radius around the Village of Mayo that is available for elders and potentially youth an opportunity to go out on the land and experience and/or learn about trapping.

To address community concerns identified by NND and the Mayo District RRC, Yukon Energy will designate a Project Liaison Contact person if this Project proceeds. If issues arise due to increased resource use pressure from camp workers, the Project Liaison Contact person will work with NND and the Mayo RRC to address these concerns.

Project residual effects on the resource use VCs within the Construction Footprint Area are expected to be short-term and low in magnitude due to current levels of use, and not significant. Hunting, fishing and the ability to trap within approximately 3% of RTC 407 will be restricted due to safety concerns for crews and community members.

Potential long-term socio-economic effects relating to the existence of permanent structures, maintenance of the transmission line and canal corridor, and operation of facilities regarding water levels and flows include:

- Portions of the Construction Footprint Area will continue to be fenced and gated, thus removing these areas from local hunting and access to the east side of the Mayo River.
- Approximately 3% of RTC will be permanently removed from the community trapping concession.
- Indirect effects on fishing at Mayo Lake relate to healthy fish stock populations. There are no Project effects on the ability to fish, or access to fishing, at Mayo Lake.

Long-term adverse Project effects on resource use due to the presence of Project infrastructure and the revised water management parameters will be either low or negligible due to current levels of use, and abundant and more favourable opportunities for fishing and hunting within the Project Study Region

It is expected that residual adverse long-term effects on resource use VCs within the Project Study Region will be low in magnitude and not significant.

Other Resource Use

Placer mining activity occurs at Mayo Lake, outside the Construction Footprint Area. Therefore there are no Project effects on placer mining during the construction phase. Operation and management of Mayo Lake water levels pursuant to the revised water management regime will result in a short-term affect on those placer miners accessing their claims by barge. The barges are used to haul heavy equipment, fuel

drums and supplies out to placer claims, leaving from the west end of the lake. Mayo Lake must refill sufficiently to enable the barges to float off the mud-flats and subsequently get close enough to the placer claim property to off-load the equipment and supplies on site. Under the proposed management regime, the lowest lake levels will occur at the end of winter/early spring after the lake has been drawn-down to match load requirements. This will typically occur in early May, just prior to spring freshet in May/early June and prior to the normal ice free season on the lake. The net result will be a delay of roughly two weeks in the ability of placer miners to use their barges to access their claims – which is understood to be within the range of acceptability to those most active on the lake.

The long-term residual adverse effects on placer mining activity within the Project Study Region are expected to be low in magnitude and not significant.

The Village of Mayo, within the Project Study Region, is used as a starting/stopping point for several activities related to tourism, outfitting and recreation. Outfitting activities occur beyond the Project Study Region and will not be affected by this Project. Recreational activities in and around the Village of Mayo do not overlap with the Construction Footprint Area where the Project infrastructure is proposed. In addition, the Project has avoided both McIntyre Park and Five Mile Lake campground – areas currently used for picnicking, camping and cross-country skiing. Concern over noise, air emissions (e.g. fugitive dust, construction vehicle exhaust) and traffic as possible deterrents to tourism activity will be limited in extent and short-term (July and August for the two construction seasons).

The residual adverse short-term Project effects on tourism, outfitting and recreation are expected to be low in magnitude, within the Project Study Region and not significant.

During operations of the Project there will be increased winter flows which may affect crossings of the Mayo River Zone 4 if suspended ice occurs in late winter/early spring. The area adjacent to and surrounding the Mayo River and Mayo Lake access road provide abundant and suitable areas for snowmobiling, without concerns for late winter/early spring ice conditions. Requirements to cross the River will likely only require more care and attention by users and is not considered a significant potential effect.

In addition, an increased draw-down of Mayo Lake may affect timing and ability to use the beach and boat launch at the west end of the Mayo Lake. The lowest levels are anticipated to occur in early May, just prior to spring freshet in May/early June, which generally results in an increase in the lake elevation over a short time period. The potential affect on timing and ability to use the beach and the boat launch is expected to be short-term.

Decreased flows in Zone 2 may affect recreational boating. Currently, water levels and flows fluctuate during the summer season depending on inflows and precipitation. Although recreational canoeing does occur between the existing powerhouse and the Village, it is not considered “high use”. The lower Mayo River (Zone 1) and the upper Mayo River will remain available as alternate recreational canoeing and boating areas for community residents.

The residual adverse Project effects on outdoor recreational activities within the Project Study Region are expected to be long-term, low in magnitude and not significant.

It is unlikely that there will be any discernable Project effects on private or commercial land use within the Construction Footprint Area as Yukon Energy will initiate specific negotiations with the landowner towards acquisition of the lands, if and to the extent necessary, in advance of construction. No additional Project effects on private or commercial land within the Construction Footprint Area or the Project Study Region are expected.

Operation and management of Mayo Lake under the revised water management regime may potentially affect water access to commercial and private lease-holders and property owners along the shores of Mayo Lake. The timing of affected access will at most be a short window prior to the spring freshet. The majority of property owners and lease-holders are at the west end of the lake near the mouth lake, and have existing road access.

The residual long-term adverse Project effects on private and commercial land owners in the Project Study Region are low in magnitude, moderate in frequency and not significant.

Heritage Resources

A heritage resources impact assessment was conducted early in the field season within the Construction Footprint Area. Field investigations along the original conveyance options and transmission line were conducted to identify archaeological and historic sites. A shoreline survey was conducted along Mayo Lake to assess potential impacts to heritage resources if the lake level was increased up to an additional meter in elevation (an option since dropped from consideration). Several historic resources were found within the Construction Footprint Area and these have been documented and filed with the Heritage Resources Branch. Project mitigation includes avoiding these historic sites by a 15-30 buffer (depending on the type and size of resource) if feasible; otherwise data recovery and documentation will be undertaken, after consultation with the Heritage Branch and NND.

Yukon Energy has further committed to undertake a heritage resources inventory, prior to construction, of the final canal route (i.e., shovel testing along the ridge), transmission line and powerhouse location for possible unknown heritage resources (as per the Heritage Resources Impact Assessment report and direction from Heritage Resources Branch).

Mitigation measures related to the potential inadvertent discovery of unknown heritage sites during construction activities includes adherence to Yukon Energy's EMS best practices for Heritage Site Investigations, as well as flagging of any newly discovered sites. Upon discovery of any new heritage site, construction activity in proximity to the site will cease until the Lands Inspector indicates work can proceed.

The residual adverse Project effects on heritage resources are expected to be short-term, within the Construction Footprint Area, low in magnitude and not significant.

There will be no Project effects on heritage resources by operation of the Project.

Local Economy

The construction phase of the Project will provide several opportunities for local employment, and potentially training for various aspects of the construction; as well as local businesses contracted for

portions of the work. Clearing and grubbing of the road access, canal and transmission line corridors, along with the work camp, equipment lay-down areas and powerhouse site will be the first types of activities in the construction schedule, and represent a substantial amount of the early construction activity. It is anticipated that the following types of skills will be required:

- General labourers;
- Truck drivers and heavy equipment operators; and
- Camp caterers.

The construction workforce for the canal/penstock, powerhouse and transmission line will require a more skilled labour force, including:

- Journeymen carpenters, linemen and technicians, and those experienced in concrete form-work; and
- Skilled trades (i.e., electrical and mechanical engineers).

Depending on the successful contractor(s) on the Project, Yukon Energy anticipates that several components of the construction may be sourced locally, including using local businesses and labour. Detailed work plans and worker requirements are not yet available, but the above local construction positions will be short-term (during the construction phase). Job skills acquired through employment on the Project may be applied to other employment opportunities.

There may be potential competition for local labour due to the potential for small-scale quartz mining at the Bellkeno property on the old UKHM site near Keno City. It is understood that the Bellkeno Project is anticipating a total workforce of about 200 people, with approximately 120 residing at an on-site work camp. Depending on the skills required for the Project, and the availability of local community members to work on either project, there is likely to be temporal overlap for local labour.

In summary, the Project's effects on local employment, training and business within the Project Study Region are expected to be both positive (increased employment) and adverse (potential for labour competition), short-term (two year construction window), low in magnitude and not significant.

It is anticipated that normal operation of the new powerhouse will be handled by existing Yukon Energy staff; however, occasional maintenance of the transmission line route and canal areas are expected to recur every five years (depending on vegetation growth) and may be sourced locally from local contractors. Project effects on local employment and business during maintenance activities are expected to be positive, short-term, low magnitude and not significant.

Regional Economy

The Project is expected to provide regional economic benefits within the Project Study Region and the broader Yukon region. Expenditures as a result of the construction phase of the Project may result in increases in direct and indirect tax or royalty revenue. In addition, Federal and Yukon government funding is expected to be required if the Project is to proceed. No funding commitments have been made to date with regard to this Project. In summary, construction of the Project is expected to have positive,

short-term effects on government fiscal flows which are low in magnitude and would extend beyond the Project Study Region.

Yukon Energy is currently engaged in a process of determining potential opportunities for NND to participate in the Project by way of investment. Details on the type of arrangement or investment are not known at the present; however, there are potentially significant, positive benefits to NND including financial returns commensurate with their investment. Residual Project effects during the operation of the Project are expected to be positive, long-term, and moderate in magnitude and potentially significant.

As discussed in Chapter 6.5, benefits are expected to be realized by all utility ratepayers when Yukon Energy's grids become interconnected, new industrial loads and on-going domestic load growth can be serviced through additional renewable generation capacity on the system. There will be no Project effects on utility ratepayers during the construction phase; however, there will be long-term benefits of providing a lower cost (relative to diesel generation) renewable energy and improving grid reliability. Project effects during operation and maintenance are expected to be positive, long-term, moderate in magnitude and extend beyond the Project Study Region, and potentially significant.

Community and Family Life

During the construction phase of the Project, Yukon Energy will establish a work camp for a peak work force of 50-75 workers during the two year construction period, located outside the Village of Mayo municipal boundaries. During the public consultation, Yukon Energy heard concerns about potential adverse effects from alcohol-related incidents from an influx of workers into the community. As one means of mitigating this concern, Yukon Energy will adopt a "drug and alcohol" policy for the camp. Such a policy could, among other elements, include a "zero tolerance" policy for construction workers who cause alcohol related disturbances in town. In addition, Yukon Energy has committed to provide a Project Liaison Contact Person during the construction period to triage any concerns that may arise.

The Village of Mayo has also suggested Yukon Energy consider encouraging construction workers residing at the camp to avail themselves of the recreational facilities and programs in town, offering opportunities for positive social mixing between community members and workers.

As noted previously, the Bellkeno Mine Project, if developed, may potentially have temporal overlap of construction workers coming into the Village for recreation or other purposes.

It is expected that residual Project effects on community and family life within the Project Study Region will be both adverse (social implications of alcohol-related incidents) and positive (increase in mixing through participation in recreational programs), short-term, moderate in magnitude and not significant. Operations and maintenance of the Project will entail a similar level of activity as the existing facilities and should not have any effect on community and family life (i.e., no Project effects).

Community Infrastructure & Services

Construction activities could result in increased reliance and stress on local infrastructure and social services (e.g., waste removal, water supply, wear and tear on roads etc.). In addition, construction workers may potentially use the community's recreation facilities; and job-related accidents may result in

increased pressure on local community health service providers, including policy, emergency response services and the local health centre.

Yukon Energy met with the Village Mayor and Council to discuss several of these potential impacts. Yukon Energy indicated a commitment to landfill bulky construction waste (including concrete, steel etc.) on YEC-owned property; incorporate recycling at the work camp; and re-use of as much rock and excavated material as possible, with the remaining spread over the equipment lay-down area (as required). There are several options for managing camp waste, including sewage, which could be trucked to the Village's sewage treatment and disposal facilities. Solid waste could be deposited at the local landfill. As further mitigation, Yukon Energy will continue consultation with the Village to determine the best strategy for waste disposal. All special and hazardous waste (including oil) will be recycled or disposed of in an approved manner.

Yukon Energy recognizes the responsibilities for health and safety are shared and accepts the responsibility of leadership of the health and safety program, for its effectiveness and improvement and for providing the safeguards required to ensure safe operations. In fulfilling this commitment to protect both people and property, Yukon Energy will provide and maintain a safe and health work environment in accordance with industry standards and in compliance with legislative requirements. Yukon Energy will strive to eliminate any foreseeable hazards that may result in property damage, accidents and/or personal injury/illness. Workers will be given the necessary instruction and training to complete the tasks; and will be adequately supervised while on the job-site. The job site will be in compliance with the Yukon's Occupational Health and Safety Act, the Yukon's Health and Safety Regulations and any other applicable territorial or federal laws or any other industry-specific requirements that may apply. Compliance with the above mitigation measures will help reduce the stress on community health and emergency response services.

As noted previously, the Bellkeno Mine Project, if developed, may potentially have temporal overlap of construction workers coming into the Village for some health services. It is not expected there will be any further overlap in terms of use of community infrastructure with the exception of the Silver Trail Highway.

The residual Project effects on community infrastructure and services are expected to be positive and adverse, short-term (i.e., construction phase), low magnitude, and not significant. Operations and maintenance of the Project will entail a similar level of activity as the existing facilities and should not have any effect on community infrastructure and services (i.e., no Project effects).

Traffic

Mayo B is a substantial construction Project requiring equipment, materials and personnel to be transported to the job site over the course of a two year construction schedule. This will result in an increase in traffic volumes over the Klondike and Silver Trail highways. There will be a temporal and geographic overlap between construction traffic and summer seasonal volumes on the Klondike and Silver Trail highways (i.e., tourists and seasonal workers). Discussions with YG Highways and Public Works indicate that according to the American Association of State Highway and Transportation Officials standards, traffic on the Silver Trail Hwy. (#11) is about 10% of its capacity; and traffic on the Klondike Hwy. (#2) is less than 20% of its capacity.

As noted previously, the Bellkeno Mine Project, if developed, may potentially have temporal and geographic overlap in terms of traffic volumes. Although details are not known at time of filing, it is understood by the Proponent that ore from the Bellkeno Mine will be transported out of the region by truck, thus increasing the traffic volume on the Silver Trail and Klondike highways. Given the current low level of capacity for the road infrastructure, it is expected that traffic volumes will be well within tolerance.

The residual adverse Project effects during the construction phase are expected to be short-term, low in magnitude, high in geographic extent (i.e., outside the Project Study Region), and not significant.

Operations and maintenance of the Project will entail a similar level of activity as the existing facilities and should not have any effect on traffic volumes (i.e., no Project effects).

Worker Health & Safety

As noted under Community Infrastructure and Services, construction activities could result in job-related accidents. This could result in increased reliance on local health services such as ambulance and nursing station services. The job site will be in compliance with the Yukon's Occupational Health and Safety Act, the Yukon's Health and Safety Regulations and any other applicable territorial or federal laws or any other industry-specific requirements that may apply. Although avoidance of all job-related accidents is impossible to guarantee, compliance with the above regulations, industry-specific requirements and Yukon Energy's job safety training will assist in reducing the frequency and number of job-related accidents.

The residual adverse Project effects related to worker health and safety are expected to be short-term (two year construction period), within the Construction Footprint Area, low magnitude and not significant.

As described in Chapter 6, the Project will include a powerhouse with tailrace entering into the Mayo River, a surface-run canal, a 69 kV transmission line and a 12.5 kV distribution line and an access road as components of the Project infrastructure. Operations and maintenance of these facilities will follow Yukon Energy's EMS manual, access to the property will be fenced and gated at the intersection with the existing access road, and safety signage will be posted where necessary. Where the canal and penstock meet, canal outlet structures will be a component of the construction and will be fenced to prevent people wandering into this area.

The residual adverse Project effects will be long-term, restricted to the Construction Footprint Area, low in magnitude and not significant.

7.4 OTHER EFFECTS

7.4.1 Effects of the Environment on the Project

In environmental assessment practice, the effect that the environment will have on the project is often considered as part of the environmental assessment and appropriate measures are applied to ensure that there will be no significant adverse effects in this regard. During the operational phase of the Project, for example, potential effects of the environment could occur as a result of seismic events or climate change.

Yukon Energy designs its dams to meet or exceed the Canadian Dam Association guidelines. Dam facilities are currently inspected monthly, annually and on a five-year cycle. On-site operations and engineering staff also perform ongoing, informal visual inspections as part of their normal routine. Monthly visual inspections are recorded at the same time instrument readings are taken. Formal annual inspections are made by qualified Yukon Energy staff. Outside engineers are hired to perform the five-year Dam Safety Reviews. The final designs for the proposed powerhouse, penstock, canal, access roads and transmission line structures will meet all relevant design standards in the applicable codes that apply to the specific facility. The final designs for all new components will incorporate consideration of the region's climate and take into account any relevant effects of climate change during the expected life of this facility.

Water retaining structures are designed and re-certified on a periodic basis to the latest seismic standards and extreme water events (i.e., probably maximum flood events). Buildings will be constructed to the latest design standards for that type of facility in that type of environment.

It has been suggested that the impact of climate change and its potential effects on the boreal forest ecosystem may result in a long-term increase in the number of extreme weather events (i.e., forest fire hazards, flooding, ice storms), gradual change in permafrost (resulting in instability of the soil), and potential erratic water regimes resulting from more frequent or erratic weather events. Notwithstanding this uncertainty as to potential changes, based on current information and projections, it is not presently expected that climate change will have likely significant effects on the proposed Project in respect of any of the above noted changes.

The *Yukon Government Climate Change Action Plan*, released in February, 2009 and the *Energy Strategy for Yukon*, released in January, 2009 both note that increases in renewable generation support government objectives. The plan and strategy, which were developed to complement one another, set reduction of greenhouse gas emissions as a priority. The *Yukon Government Climate Change Action Plan* identifies renewable resource development, including hydro, as a mitigation strategy which will help reduce or delay global warming (2009b). The *Energy Strategy for Yukon* sets out the goal of increasing renewable energy supply, including hydro, in the Yukon by 20% by the year 2020. Furthermore, the *Energy Strategy* seeks to "...optimize the efficiency and reliability of electricity generation and distribution" (2009a) and recognizes the importance of investing in electricity infrastructure to meet future needs and leverage economic development in the Territory. "Investments in additional renewable energy infrastructure will be required in order to enhance the kinds of long term legacy benefits that are currently enjoyed with the existing hydro system. These investments will also buffer Yukon's energy sector from volatile fossil fuel prices and help to minimize greenhouse gas emissions from diesel generated electricity" (2009a).

Yukon Energy monitors changes in the regional climate in the Project Study Region as necessary using climate information including measurements of temperature, precipitation, and wind speed provided by the Meteorological Service of Canada.

Yukon Energy expects to continue to monitor the capability of major Global Climate models and Regional Climate models to accurately represent climate change variables. As these models are calibrated to predict climate regimes with confidence they potentially may be able to predict the frequency and

magnitude of extreme events in the Project Study Region (e.g., severe storms, wind events, flooding). In the event such technological developments are successful, it is anticipated that the results of such models would form a component of Yukon Energy's future planning.

7.4.2 Accidents and Malfunctions

YESAA⁷ and the various YESAB guides require that significance of accidents and malfunctions be considered as a part of the environmental and socio-economic effects assessment. In this assessment, possible accidents and malfunctions with regard to the Project were considered and appropriate mitigation is planned to be applied to ensure there is no significant adverse effects in this regard.

During the construction, operations and maintenance phases of the Project spills of hazardous materials could occur during refuelling of equipment or due to failure of substation components. Soil contamination, which affects soil productivity, could potentially occur when a hazardous substance is spilled or leaked. Where contaminants enter ground water or other water courses, there is a risk to public health and safety as well as potentially adverse effects on wildlife populations and habitat. The magnitude and duration of any potential effects of accidental spills depends on the nature of material spilled, the quantity spilled, the location of the spill, and the time of year in which the incident occurs.

The new powerhouse and tailrace will be constructed almost entirely in the dry to avoid the potential for spills and sedimentation of the Mayo River. Appropriate sediment control will be in place when the plug for the tailrace is removed, and will be timed so as to avoid Chinook salmon spawning.

Standard environmental protection practices, as described in Yukon Energy's EMS (Appendix 6A) and Job Site Spill Contingency Plan, Reporting Procedures (Appendix 6B) commit Yukon Energy to store fuel, lubricants, and other potentially hazardous materials within dedicated storage areas in work camps and marshalling areas. Dedicated areas would be located away from sensitive features and would provide spill containment and necessary bermed storage areas, and spill response. Any products transferred from storage sites to work areas would not exceed the daily requirement. Yukon Energy also requires its contractors to have an emergency response plan in place that is consistent with Yukon Energy's EMS and spill response procedure.

Adherence to Yukon Energy's environmental protection practices and any additional specific mitigation measures identified as a condition of licence approval will further minimize the potential impact of accidents or malfunction on soil, wildlife or aquatic resources. As noted above, Yukon Energy designs and reviews its Projects to meet or exceed current relevant standards applicable to the specific generation or transmission facilities in question.

Water related accidents and malfunctions are covered in detail in Yukon Energy's Mayo Lake and Wareham Dam Emergency Preparedness Plan which is described in Section 6.10.4.

⁷ Section 42(1)(c) of YESAA sets out that an examination is required of the significance of environmental and socio-economic effects of the project or existing project that have occurred or might occur in or outside of the Yukon, including the effects of malfunctions or accidents.

8.0 MONITORING AND FOLLOW-UP PROGRAMS

The Executive Committee is required to consider the need for any monitoring and follow-up of environmental or socio-economic effects of any project or activity conducted under Section 42(2)(a). Environmental and socio-economic monitoring and follow-up can be undertaken for the following reasons:

- To ensure the implementation and success of any mitigation measures identified as required or preferred during the assessment process.
- To confirm the accuracy of baseline information or any assumptions made with regard to the Project during the assessment process.
- To test the accuracy of predictions made during the assessment process and ensure that effects are consistent with the conclusions in the assessment and any conditions of the approvals provided by the regulator. In the event that a monitoring program identifies concerns in this regard, adaptive management practices can be applied to ensure effects are consistent with the findings of the assessment and the conditions of the regulator's approvals.
- To detect any unanticipated Project effects and implement mitigative or corrective measures as necessary to ensure that no significant adverse effects result from the construction or operation of the Project.

This chapter outlines monitoring and follow-up recommended with respect to the proposed Project. Generally, monitoring and follow-up are recommended in the following circumstances:

- Where the success of the proposed mitigation measures is determinative in the assessment finding that potential residual adverse effects are not likely to be significant. In these cases monitoring and follow-up are recommended to confirm the findings of the assessment.
- Where there is uncertainty with respect to the assessment findings such that monitoring is required to ensure that there are no residual significant adverse effects of the construction or operation of the Project.

In all cases, it is the intent of YEC to ensure, in consultation with regulators, that monitoring is undertaken in a focused manner and is aligned with the potential for specific corrective actions ("adaptive management"). Corrective actions may include further detailed investigation and implementation of mitigation options. In all cases, YEC will seek to ensure necessary mitigation measures are undertaken such that there remain no residual significant adverse effects related to the Project.

8.1 MONITORING PROGRAMS

During the course of the assessment (summarised in Chapter 7), several recommendations for monitoring were identified. Recommendations for specific monitoring programs are set out in further detail below. Monitoring programs recommended below are required to ensure the effectiveness of mitigation options that were important in the consideration of the effects assessment.

8.1.1 Chinook Salmon Rearing Channel

Monitoring is recommended to evaluate the success of the Chinook Salmon Rearing Channel in relation to identified requirements for this habitat developed in conjunction with regulators. YEC commits to undertake a periodic survey of the number of juvenile fish observed. In the event that monitoring identifies that use of the channel is sub-optimal, corrective measures will be investigated and implemented as appropriate.

8.1.2 Chinook Spawning and Juvenile Rearing in Zone 2

Monitoring is recommended once the new water flow regime has been established, to include a spawning and rearing survey to count the redds, map habitat and trap juvenile fish to determine distribution and abundance. If spawning and rearing does not appear to be as successful as desired, remedial action could be undertaken focused around in-stream habitat enhancement.

8.1.3 Lake Trout Age Class/Spawning Monitoring

The conclusions reached in Chapter 7 in respect of the Project's effects on lake trout require a program of monitoring for two variables:

- (a) The specific year-class recruitment
- (b) The overall health of the population, in light of overall characteristics of Mayo Lake.

A program of monitoring of lake trout (and to a lesser degree Lake Whitefish) age class patterns in Mayo Lake is required at appropriate intervals.

While Chapter 7 identifies several important variables related to lake trout spawning on Mayo Lake, which suggests that given the location of the spawning grounds and the history of the population in Mayo Lake, the Lake Trout population may be better suited to responding to the revised water regime than may be the case on other systems. In the event, however, that the monitoring work identifies concerns with respect to age class distribution, and key measures regarding the stock health are determined to be below a reasonably expected range in relation to the observed potential for Mayo Lake, a series of sequenced mitigation measures will be required.

First and foremost, mitigation is expected to focus on habitat enhancement particularly related to the quality and quantity of spawning habitat¹ at suitable depths commensurate with the managed regime of the lake.

Concurrently, other options would require discussions with regulators and governments at appropriate intervals, including coordination with governments with respect to other forms of enhancement that could be pursued (for example, YG and Yukon Energy presently cooperate with respect to the operation of a fish hatchery.)

¹ Given the current lake operates with a range of elevations above the historic (pre-1950) elevation of the lake, there is solid reason to expect that the spawning beds historically used by lake trout pre-1950 continue to exist, but may be used only to a limited extent or not at all including possibly due to siltation. Efforts to restore some portion of these spawning beds to a clean and optimal state would be a first priority for mitigation and enhancement options.

Ultimately, staged amendments to the operating regime for the lake could be considered, focused on either (a) incremental decreases to the absolute operating range used by Yukon Energy (i.e., increases to the LSL), or (b) changes to the frequency with which the larger drawdowns are permitted to occur (i.e., ensuring the use of more than 2.59 metres of winter drawdown is not permitted to occur for the 2 years in a row that is permitted under the operating regime for the proposed Project as set out in Chapter 6).

8.1.4 Compliance Monitoring

An environmental compliance monitoring program will ensure that commitments made to regulatory authorities and others are implemented through all phases of Project development. Activities in each phase are subject to relevant legislation, regulations and guidelines, the Project authorizations, as well as to commitments made in the Project Proposal.

Pre-construction monitoring will be undertaken in order to help mitigate any potentially avoidable environmental site-specific impacts during the construction phase of the Project. This will include ongoing management of potential heritage resource sites (consistent with the commitments in the Project Proposal) and will include construction on-site monitoring by an archaeologist at specific sites considered to be of high potential archaeological value. This would also include evaluation of potential lost wildlife habitat or rare plant habitat and re-vegetation where appropriate.

Following construction and clean-up activities, a report of post-construction inspection of the proposed facilities and infrastructure will be prepared. Both aerial and ground surveys will be used to conduct the inspection. If problem areas are noted, site-specific rehabilitation programs will be identified in the inspection report, implemented, and the problem areas will be monitored. Monitoring during the operations and maintenance phases of the Project will continue and will be conducted through routine aerial and ground patrols. General environmental conditions will continue to be monitored.

8.1.5 Worker Safety and Environmental Briefings

Yukon Energy Corporation recognizes the responsibilities for health and safety are shared and accepts the responsibility of leadership of the health and safety program, for its effectiveness and improvement and for providing the safeguards required to ensure safe operations. In fulfilling this commitment to protect both people and property, management will provide and maintain a safe and healthy work environment in accordance with industry standards and in compliance with legislative requirements. Yukon Energy will strive to eliminate any foreseeable hazards that may result in property damage, accidents, and/or personal injury/illness.

On every Project, all workers are given the necessary instruction and training to complete the tasks. Workers are adequately supervised while taking into account the nature of the work and the abilities of the workers. They will be provided with a list of emergency response plans and reporting protocols, and specific information on waste management practices to be utilized during the construction phase of the Project, including all liquid and solid wastes generated.

The Corporation's internal responsibility system for health and safety is naturally extended to contractors and consultants. Yukon Energy Corporation also expects contractors and consultants to accept their responsibility to ensure that Project work is performed in a safe manner, and that it is in compliance with

the Yukon's *Occupational Health and Safety Act*, the Yukon's Health and Safety Regulations and any other applicable territorial and/or federal laws or any other industry-specific requirements that may apply.

In regards to construction, operations, maintenance, and decommissioning activities, mitigation of environmental effects throughout the full life cycle of the Project will be facilitated by providing construction and maintenance personnel with clear instructions on mitigation measures to be implemented (based on commitments in the Project Proposal and requirements issuing from regulatory approvals and permits) and on the appropriate lines of communication and means of reporting to be followed. Upon modification of construction methods and schedules, reporting will take place which summarizes environmental sensitivities and mitigative actions taken.

8.2 FOLLOW-UP PROGRAMS

Follow-up programs are recommended in certain cases where there is a potential opportunity to reduce uncertainty identified in the effects assessment process. Specifically, in many cases conclusions can be reached that an effect is not significant (for example, effects that are clearly low in magnitude due to affecting very few individuals out of a population) but nonetheless uncertainty remains as to the precise magnitude of the effect and more specifically, any potential to reduce the adverse effects or enhance benefits. However, it is important to note that Follow-up programs are not integral to the determinations of significance made in Chapter 7. Rather, recommended follow-up programs can be undertaken:

- as ready opportunities arise within Yukon Energy's operations;
- in conjunction with programs or efforts of other agencies or undertaken by government departments; or,
- where there are potential benefits to be obtained.

8.2.1 Chinook Salmon Habitat Cross Sections

Obtaining 2-3 representative cross-sections in different types of habitat at low flow conditions (i.e. 5-6 cms) to translate the information and apply the Habitat Suitability model for future projections.

8.2.2 Mapping and Categorization of Lake Trout Spawning Habitat

Mapping and categorizing of lake trout spawning habitat would provide higher levels of confidence in mitigation measures identified above. Follow-up would include mapping the location, depth and variety of substrate material the lake trout are using to help determine if future additional mitigation is required.

8.2.3 Examining Changes in Channel Morphology

Consistent with YEC's on-going efforts to review physical environment changes in the water systems, a periodic review of aerial photography supplied by the YG or Government of Canada could be incorporated as part of a time-sequence review of the lower Mayo River. Planned higher flow events could be induced if determined appropriate.

8.2.4 Examination of Fish Stranding

To the extent necessary, monitoring of fish stranding as a result of more frequent dewatering in Zone 3 could be undertaken.

8.2.5 Nesting Surveys

Pre-construction and post-construction nesting surveys could be undertaken to determine or confirm the presence of nesting sites for Rusty Blackbird as well as waterfowl and waterbirds. Nesting surveys could also be undertaken to confirm Project effects on local nesting sites.

8.2.6 Aquatic Mammal Surveys

Pre-construction and post-construction surveys of food caches and lodges in areas potentially affected by the Project could help confirm local animal population responses and adaptations to changing water levels on Mayo Lake.

8.2.7 Notification and Project Liaison

Yukon Energy will designate liaison personnel to triage any concerns that may arise during construction, operation and maintenance phases. The scope of liaison will include regulatory and environmental affairs, as well as work to maintain close communications with Nacho Nyak Dun, the Village of Mayo, other local and territorial organizations, and citizens as concerns may arise.

9.0 ACKNOWLEDGEMENT & CERTIFICATION

The information submitted in the Project Proposal is required for the purpose of conducting a screening under the Yukon Environmental and Socio-economic Assessment Act. I acknowledge that, pursuant to section 119 of the Act, a copy of the Project Proposal will be placed on a public register and will be available to any member of the public to review.

I understand that misrepresenting or omitting information required for the evaluation may cause delays in the screening or render the recommendation invalid.

I certify that the information provided is true and correct to the best of my knowledge and belief.



February 27, 2009

David Morrison
President and CEO
Yukon Energy Corporation

10.0 GLOSSARY & REFERENCES

10.1 GLOSSARY OF ACRONYMS & TERMS

10.1.1 List of Acronyms

ASL:	Above Sea Level
BC:	British Columbia
C:	Celsius
CCME:	Canadian Council of Ministers of the Environment
CEA:	Cumulative Effects Assessment
CEAA:	Canadian Environmental Assessment Agency
COSEWIC:	Committee on the Status of Endangered Wildlife in Canada
CPAWS:	Canadian Parks and Wilderness Society
CSA:	Canadian Standard Association
CMS:	Cubic Metres per Second
CWS:	Canadian Wildlife Service
DFO:	Department of Fisheries and Oceans
EA:	Environmental Assessment
EIA:	Environmental Impact Assessment
EIS:	Environmental Impact Statement
EMF:	Electric and magnetic field
EMO:	Emergency Measures Officer
EMR:	Yukon Government Energy, Mines and Resources
EMS:	Environmental Management System
FISS:	Yukon Fisheries Information Summary System
FN:	First Nation
FSL:	Full Supply Level
G:	Government
GHG:	Greenhouse gas
GIS:	Geographic Information System
GPS:	Global Positioning System
GWh:	Gigawatt hour
Ha:	Hectare
HPW:	Department of Highways and Public Works
IJC:	International Joint Commission
Km:	kilometre
kV:	kilovolt
LSL:	Low Supply Level
m:	metre
MCM	Million Cubic Metre

MD:	Mayo-Dawson Grid
MDRCC:	Mayo District Renewable Resources Council
MOU:	Memorandum of Understanding
NGO:	Non-government organization
NND:	Nacho Nyak Dun First Nation
NOx:	Nitrogen Oxide
NTFN:	Northern Tutchone First Nations
NTS:	National Topographic System
OCP:	Official Community Plan
OP:	Other Public
PIP:	Public Involvement Program
Project Proposal:	Project Proposal Submission
Proponent's Guide:	Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions
the Resource Plan:	Yukon Energy's 20-Year Resource Plan (2006-2025)
RMO:	Resource Management Officer
ROW:	Right-of-Way
RRC:	Renewal Resource Council
RSF:	Rate Stabilization Fund
RTC	Registered Trapline Concession
SARA:	Species at Risk Act
SEEA:	Socio-Economic Effects Assessment
TDS:	total dissolved solids
the Project:	Mayo Hydro Enhancement Project (Mayo B)
TK:	Traditional Knowledge
TSS:	Total Suspended Solids
USGS:	United States Geological Survey
UTM:	Universal Transverse Mercator Co-ordinate System
VC:	Valued Component
WAF:	Whitehorse-Aishihik-Faro grid
WKA:	Wildlife Key Areas
WTAY:	Wilderness Tourism Association of the Yukon
YCS:	Yukon Conservation Society
YEC	Yukon Energy Corporation
YECL:	Yukon Electrical Company Limited
YESAA:	Yukon Environmental and Socio-Economic Assessment Act
YESAB:	Yukon Environmental and Socio-Economic Assessment Board
YTA:	Yukon Trappers Association
YG:	Yukon Government
YUB:	Yukon Utilities Board
Yukon Energy:	Yukon Energy Corporation

10.1.2 List of Terms

Aboriginal community: A community where most of the residents are Aboriginal (i.e., Indian, Métis, Inuit or other Aboriginal Peoples) and that has a separate form of government, provides some level of service to its residents, and has clear community boundaries.

Access road: Any road on the construction footprint area leading to the powerhouse, penstock-canal corridor distribution line or transmission line.

Active labour force: All persons 15 years of age and over, who were either employed or unemployed and looking for work in the week prior to the Census day. Typically, those not considered to be part of the active labour force include full-time students, homemakers, retired workers, seasonal workers in an “off-season” who are not looking for work, and individuals with disabilities or illnesses that preclude them from being able to work.

Adaptive management: Involves the implementation of new or modified mitigation measures over the life of a project to address unanticipated environmental effects. The need for the implementation of adaptive management measures may be determined through an effective follow-up program.

Adverse effects: Negative effects on the environment and people that may result from a proposed project.

Aesthetic: Pertaining to a sense of beauty. Judgments of aesthetic value are sensory, emotional, and intellectual.

Aggregate: Gravel; crushed rock used in construction.

Alevins: A newly hatched fish that has yet to leave the redd it was born into. Once the yolk sac is used up, the fish is referred to as fry.

Alluvial: Pertaining to, contained in, or composed of, alluvium; relating to the deposits made by flowing water; washed away from one place and deposited in another; as, alluvial soil, mud, accumulations, deposits.

Alternative means of carrying out a project: The various technically and economically feasible ways, other than the proposed way, for a project to be implemented or carried out. Examples include other project locations, different routes and methods of development, and alternative methods of project implementation or mitigation.

Alternatives to a project: The functionally different ways, other than the proposed project, to meet the project need and achieve the intended purpose. For example, if a need for greater power generation has been identified, a proposed project might be to build a new power generation facility. An alternative to that project might be to increase the generation capacity of an existing facility.

Artifact: An object produced or shaped by human craft, especially a tool, weapon, or ornament of archaeological or historical interest.

Assessment: An evaluation by a designated office, a screening by the executive committee or a review by a panel of the Yukon Environmental and Socio-economic Assessment Board established by Section 8 of YESAA.

Auger: A machine having a rotating helical shaft for boring into the earth.

Authorization: A licence, permit or other form of approval that is issued or given by: the Governor in Council, a government agency, an independent regulatory agency or a municipal government, or (b) a first nation under its final agreement or a first nation law, but does not include an access order issued under the Yukon Surface Rights Board Act or a consent given by a first nation for access to settlement land in circumstances where an access order could be issued under that Act.

Baseline: Past and current conditions in which a Valued Component exists or has existed.

Bathymetry: The study of underwater depth and the mapping of underwater environments using contour lines.

Beringia: A habitat corridor extending a few hundred kilometres on each side of the Bering Strait.

Berm: Structures, generally made of earth, used to control erosion and sedimentation by reducing the rate of surface runoff. The berms either reduce the velocity of the water, or direct water to areas that are not susceptible to erosion, thereby reducing the adverse effects of running water on exposed top soil.

Bifurcation: To be split or branched off into two parts

Biodiversity: The existence of a wide range of different species in a given area or during a specific period of time.

Board: The Yukon Environmental and Socio-economic Assessment Board established by Section 8 of the Yukon Environmental and Socio-Economic Assessment Act.

Boreal Cordillera: The ecological region encompassing 444,000 square kilometres of the Yukon and northern British Columbia. This is a mountainous region that includes the majority of the Yukon's population.

Breeding bird survey: Standardized surveys conducted during the breeding season for a given area whereby observers record the number of birds seen or heard along a travel route.

Brush: Includes trees, snags, stumps, shrubs, bushes and vines less than 12.5 cm in diameter measured at 30 cm above the highest ground contacting the base of the tree.

Buffer: An area between two different land uses that is intended to resist, absorb, or otherwise preclude developments or intrusions between the two use areas.

Bus: The heavy-duty, rigid connector that connects the circuit breakers or fuses to the incoming power.

Canal: Man-made, open-air structure that guides water along a desired path to a desired location.

Category A settlement land: Settlement Land where a Yukon First Nation has equivalent to fee simple title to surface and sub-surface rights. This means a Yukon First Nation has the right to use the surface of the land and the right to use what is below the surface such as minerals and oil and gas. A First Nation also has exclusive hunting rights on Category A Settlement Land. A First Nation retains aboriginal title on Category A lands.

Category B settlement land: Settlement Land where a Yukon First Nation has rights equivalent to fee simple to the surface of the lands only. There is no right to mines and minerals other than gravel and top soil (referred to as Specified Substances). The Yukon public continues to have access to Category B lands for fish and wildlife harvesting. A First Nation retains aboriginal title on Category B lands.

Centreline: A line that bisects a right-of-way into equal parts.

Chert: A compact rock consisting essentially of microcrystalline quartz.

Colluvium: The name for loose bodies of sediment that has been deposited or built up at the bottom of a low grade slope or against a barrier on that slope, transported by gravity. The deposits that collect at the foot of a steep slope or cliff are also known by the same name.

Commissioning: To put into active service.

Compliance monitoring: A broad term for a type of monitoring conducted to verify whether a practice or procedure meets the applicable requirements prescribed by legislation, internal policies, accepted industry standards or specified terms and conditions (e.g., in an agreement, lease, permit, license or authorization). Mitigation monitoring is one type of compliance monitoring.

Conductor: Any material that will readily carry a flow of electricity. In the context of transmission lines, each of the three wires comprising a circuit is referred to as a conductor.

Confluence: The point of juncture of two or more streams (or other waterways).

Conservation: Any various efforts to preserve or restore the earth's natural resources, including such measures as: the protection of wildlife; the maintenance of natural prairie grasses, wetlands or wilderness areas; the control of air and water pollution; and the prudent use of farmland, mineral deposits, and energy supplies.

Contaminant: A form of pollutant or substance that may directly or indirectly damage humans or the environment.

Corona: An electrical discharge, frequently luminous. Corona occur on transmission lines and sub-station components, including insulators, conductors, lines, cable terminations, bushings, and transmission line surge arresters, and can indicate faulty equipment.

Corridor: A narrow tract of land forming a passageway.

Course of action: The action that a responsible authority may or may not take in relation to a project as a result of the environmental assessment decision.

Cover: Vegetation such as trees or undergrowth that provides shelter for wildlife.

Crawler tractor: A vehicle with tracks instead of wheels. The tracks spread the weight of the vehicle across a larger area, resulting in a lower ground pressure compared to wheels. This makes them well suited for use on soft ground, mud and snow.

Critical habitat: As defined in the federal Species at Risk Act, "critical habitat" means the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species.

Crown Corporation: A state-controlled company or enterprise.

Cumulative effects: The likely effects of the project in combination with the likely effects of other past, existing and future projects and activities. To be considered a cumulative effect, the other past, existing and future projects being considered in the assessment must affect a VC that is also being affected by the principal project; in this way the projects act cumulatively upon a valued component.

Dam: A barrier built across a river or stream to obstruct or control the flow of water, especially in order to create a reservoir

Danger tree: Any tree outside the specified clearing boundaries determined by Yukon Energy's Representative to be a hazard to the security of the transmission system.

dBA: A-weighted decibels, though originally intended for the measurement of low-level sounds, are not commonly used for the measurement of environmental noise and industrial noise.

Dead-end structure: Transmission line towers made of heavier gauge steel that equalize stresses on the conductors and which are normally located at angle points and large spans.

Debitage: Lithic debris and discards found at the sites where stone tools and weapons were made.

Decision document: A decision document issued by a decision body under section 75, 76 or 77 of YESAA.

Decommission: To take out of active use (typically involves the dismantling and removal of the original structure(s) and associated facilities).

Deflection: A deviation or a specified amount of deviation from a given point.

Demographic: Information pertaining to human population dynamics, including the size, structure and distribution of populations, and how populations change over time due to births, deaths, migration and ageing. Demographic analysis can relate to whole societies or to groups defined by criteria such as education, nationality, religion and ethnicity.

Density: The number of individuals in relation to the space in which they occur.

Designated office: An office maintained under subsection 22(1) of YESAA.

Determination of significance: Taking into account the implementation of appropriate mitigation measures, a conclusion about whether adverse environmental effects are likely to be significant. The significance of adverse environmental effects is determined by a combination of scientific data, regulated thresholds, standards, social values and professional judgment. For example, the ecological context of a project may be a determinant of whether likely adverse effects are significant.

Direct effect: The initial, immediate effects caused by a specific activity. This may include: a change that a project may cause in the environment; or a change that the environment may cause to a project.

Direction or nature of the effect: positive, neutral, or negative/adverse; in the case of socio-economic effects, as noted in the YESAB Guides, effects may at times be considered to be both positive and negative.

Distribution system: The wood poles, conductors, and transformers that deliver electricity to customers. It transforms higher voltage to lower voltage, usable levels.

Disturbance : A disruption in the normal functioning of an organism or system.

Domestic resource use: The harvest of natural resources for personal use or consumption (i.e., not sold).

Drainage basin: A region of land where water from rain or snowmelt drains downhill into a body of water, such as a river, lake, dam, estuary, wetland, sea or ocean. Each drainage basin is separated topographically from adjacent basins by a ridge, hill or mountain, which is known as a water divide or sometimes a watershed.

Drawdown: The difference between the highest level a lake reaches in one summer and the lowest level a lake reaches during the following winter. For hydro reservoirs, drawdown indicates the amount of water required to satisfy the electrical loads placed on it and its water use license commitments.

Drunken forest: A stand of trees displaced from their usual placement. Usually occurs when discontinuous permafrost or ice wedges melt.

Duration of the effect: How long the effect would last. Effects may be considered low, moderate or high. Low effects are short term, lasting less than one year or not materially beyond the duration of the construction phase or the decommissioning phase of the Project. Moderate effects are medium term, lasting from 1 to 10 years or no more than one-generation span of the species affected. High effects are long term, lasting more than 10 years or more than one generation of the species affected or lasting throughout a major portion of the operations phase of the Project.

Easement: The permission or right to use a defined area of land for a specific purpose such as transmission line rights-of-way.

Ecodistrict: Integrated map units characterized by relatively homogeneous physical landscape and climatic conditions. Subdivisions of an ecoregion.

Ecological or socio-economic context: The sensitivity to environmental or socio-economic disturbance, capacity to adapt to change. This may be ranked as low, moderate or high; where ranked low, the VC is resilient to imposed change, where ranked moderate the VC has some capacity to adapt to imposed change and where ranked high the VC is fragile and has low resilience to imposed change.

Economic leakage: The fraction of money which is not re-spent in the circular flow of money through the economy. Leakages typically include personal savings and the purchase of imported goods.

Ecoregion: An integrated map unit characterized by a unique combination of landscape physiography and ecoclimate. Subdivisions of an ecozone.

Ecosystem: A functional unit consisting of all living organisms (plants, animals, microbes, etc.) in a given area, and all non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be any size (e.g., a log, pond, forest) but always functions as a whole unit.

Ecozone: Areas of the earth's surface representative of very generalized ecological units that consist of a distinctive assemblage of physical and biological characteristics.

Effects monitoring: The monitoring of environmental and socio-economic effects, or of the effectiveness of mitigative measures.

Elevation: An indication of the vertical distance of a point above or below sea level, expressed in metres.

Emission: A substance discharged into the air; the giving off of gases from industrial processes or engine exhaust from transport vehicles.

Employment rate: The proportion of individuals in the active labour force that have a job. This includes all persons working for wages or salaries, all self-employed persons (with or without paid help) working in their own business, farm or professional practice, and all persons working without pay on a family farm or business during the reference week.

Endangered: As defined by COSEWIC: a species facing imminent extirpation or extinction.

Environment: The components of the earth and includes: (a) air, land and water; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; and (d) the interacting natural systems that include the components referred to in (a) to (c).

Environmental component: Fundamental element of the physical, biological or socio-economic environment, including the air, water, soil, terrain, vegetation, wildlife, fish, birds and land use that may be affected by a proposed project, and may be individually assessed in the environmental assessment.

Environmental Management System (EMS): Part of an organization's overall management practices related to environmental affairs. It includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining an environmental policy. This approach is often formally carried out to meet the requirements of the International Organization for Standardization (ISO) 14000 series.

Environmental monitoring: Periodic or continuous surveillance or testing, according to a predetermined schedule, of one or more environmental components. Monitoring is usually conducted to determine the level of compliance with stated requirements, or to observe the status and trends of a particular environmental component over time.

Erosion: Physical and chemical breaking down and transportation of geologic material.

Executive committee: The executive committee of the Board established by section 8 of YESAA.

Existing project: An activity that has been undertaken or completed and that, if proposed to be undertaken, would be subject to assessment under section 47 of YESAA.

Eyrie: Variant of aerie, and referring to the nest of a bird of prey, typically built at high altitude.

Fauna: The animal life of a region.

Federal minister: With regard to YESAA this means the Minister of Indian Affairs and Northern Development, unless another member of the Queen's Privy Council for Canada is designated by the Governor in Council as the federal minister for the purposes of this Act.

Fee simple settlement land: Land that is, or is to be treated as, fee simple settlement land, as referred to in the definition "settlement land". Settlement Land owned under the same form of fee simple title as is commonly held by individuals who own land. For example, buying an individual lot in a subdivision will normally be held in fee simple title.

Feller buncher: A piece of forestry machinery equipped with an attachment that cuts trees in place. It consists of a standard heavy equipment base with a tree-grabbing device furnished with a circular saw or a shear - a pinching device designed to cut small trees off at the base. The machine then places the cut tree on a stack suitable for a skidder or forwarder, or other means of transport (yarding) for further processing.

Final agreement: A final agreement within the meaning of the Yukon First Nations Land Claims Settlement Act.

Financial assistance: A payment, loan or loan guarantee, but does not include: (a) a refund, remission, reduction or deferral, or any other form of relief from the payment, of a tax, duty or fee, other than relief provided by law to permit the undertaking of an activity specifically named in the law; (b) assistance for anything done preliminary to a project, such as a feasibility study, that does not have effects on the environment; or (c) assistance for an environmental or socio-economic study undertaken in relation to the assessment of a project, except a study that itself comprises a project.

Firm power: Power (electricity) that must be supplied as agreed under contract, even under adverse conditions.

First Nation: A Yukon First Nation, within the meaning of the Umbrella Final Agreement, and includes the Gwich'in Tribal Council, in relation to consultation, or the Tetlit Gwich'in, in relation to any other matter.

Fish habitat: Spawning, nursery, rearing, food supply and migration areas upon which fish depend

Fish ladder: A structure on or around artificial barriers to facilitate fishes' natural migration.

Flora: The plant life of a specific area or locality.

Flow: Motion characteristic of fluids (liquids or gases); any uninterrupted stream or discharge.

Fluvial: Refers to all topics associated with the flow of water. Fluvial usually refers to rivers, streams and sometimes through flow, overland flow and percolation. It may also refer to glaciers and oceans, though these are usually known as glacial, oceanic and coastal.

Footprint: The surface area occupied by a structure or activity.

Fragmentation: See Habitat fragmentation.

Frequency of the effect: Refers to how often an impact would occur, and may be ranked as low, moderate or high. Low frequency means the effects would never occur, occur once or seldom occur. Moderate frequency means the effect would occur occasionally. High frequency means the effect would occur continuously, on a regular basis or at regular intervals.

Fry: the young of fish

Furbearer/ furbearing mammals: Referring to those mammal species that are trapped for the useful or economic value of their fur.

Generating Station: A generating station is a structure that produces electricity. It can be run many different ways, including by burning coal or natural gas, or by using water (hydro) power. If it uses water, the station will normally be a dam, with turbines inside.

Geographic or socio-economic extent of the effect: May be ranked as low, moderate or high. Where there is a low geographic extent the effect extends only within the Project footprint or Project Site Area; for socio-economic effects this includes residents and activities in the Project Study Region other than communities. Where there is a moderate geographic extent the effect extends beyond the footprint and is within the Project Study Region; for socio-economic effects the effects would extend to a moderate number of people within a definable group in this region. Where there is a high geographic extent the effect extends beyond the Project Study Region and is within Yukon, or extends outside Yukon. For socioeconomic effects the effect may extend to a major portion of a definable group of people, e.g., a major portion of specific communities.

Geographic Information System (GIS): A computerized information system which uses georeferenced spatial and tabular databases to capture, store, update, manipulate, analyze, and display information.

Geo-membrane: A sheet-like material used to line canals and other structures to prevent erosion.

Geomorphic: Of or resembling the earth or its shape or surface configuration.

Gigawatt: A Gigawatt is the unit of electrical power equivalent to one billion watts or one million kilowatts.

Glacial till: Till is an unsorted glacial sediment. Glacial drift is a general term for the coarsely graded and extremely heterogeneous sediments of glacial origin. Glacial till is that part of glacial drift which was deposited directly by the glacier. It may vary from clays to mixtures of clay, sand, gravel and boulders.

Glaciofluvial: Pertaining to the meltwater streams flowing from wasting glacier and especially to the deposits and landforms produced by streams.

Glaciolacustrine silts: Sediments pertaining to, derived from, or deposited in glacial lakes.

Government agency: A federal agency or a territorial agency.

Government fiscal flows: The composition and level of government revenues and expenditures. Revenues are generally collected through direct and indirect taxation or bond issuance, and expenditures typically include operations, capital investment and transfers.

Greenhouse gas: Gaseous components of the atmosphere that contribute to the "greenhouse effect". Some greenhouse gases occur naturally in the atmosphere, while others result from human activities. Naturally occurring greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and ozone. Certain human activities, however, add to the levels of most of these naturally occurring gases.

Grid power: An electrical power transmission system over a large area is often referred to as the grid. Redundant paths and lines are provided so that power can be routed from any power plant to any load center, through a variety of routes, based on the economics of the transmission path and the cost of power. Power that is supplied from such a system is referred to as grid power.

Groundwater: The portion of sub-surface water that is below the water table, in the zone of saturation.

Guy wires: A metal wire used to aid stability in tall structures. It is attached to the structure on one end and the ground on the other.

Habitat: The area or environment where an organism or ecological community normally lives or occurs. It is the space uniquely suited to required functions (e.g., breeding) through the arrangement of food, water, shelter, and cover.

Habitat fragmentation: The process of environmental change resulting from the emergence of discontinuities in an organism's preferred habitat. Habitat fragmentation can be caused by geological processes that slowly alter the layout of the physical environment or by human activity such as land conversion, which can alter the environment on a much faster time scale.

Habitat Protection Area: An area identified as requiring special protection under Yukon's Wildlife Act. It is an area where disturbance to wildlife, or to the plants on which it depends, could lead to the decline of a species or population. It may be an area where a wildlife species is concentrated at certain times of year, a habitat type that is rare in the Yukon or a site that is particularly fragile. Habitat Protection Areas can provide the buffering and linkage of core protected areas described in the Yukon Protected Areas Strategy.

Hand clearing: clearing vegetation in sensitive areas using tools carried by hand such as chain saws, brush saws, axes or similar equipment.

Head: Elevation drop from a reservoir's full supply level to the turbine. Since the head is what provides the power that drives the turbine, this number can be influenced by elements that create friction along the turbine's penstock, such as trash racks and debris.

Heavy equipment: That type of machinery used in clearing operations, such as skidders, crawler tractors, loaders and tree shears and does not include hand-held equipment or vehicles approved for travel on access roads.

Hectare (ha): A metric unit of square measure equal to 10,000 square metres or 2.471 acres.

Herbicide: A product used to destroy or inhibit plant growth.

Heritage resource: (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.

Heritage site: A heritage site is a location where a landmark of natural or cultural importance is legally protected. Heritage resources in the Yukon are protected under the Historic Resources Act and are defined as (i) historic sites, (ii) historic objects, and (iii) any work or assembly of works of nature or human endeavour that is of value for its archaeological, palaeontological, pre-historic, historic, scientific, or aesthetic features.

Hydroelectric power: Hydroelectric power is electricity harnessed from the energy of moving or falling water. Most hydroelectric power comes from the potential energy of dammed water driving a water turbine and generator.

Hydrology: The science dealing with the properties, distribution and circulation of water.

Hydrograph: Hydro (meaning water) and graph (meaning chart) refers to a record of discharge (flow) in a stream or river through time.

Ice jamming: Melting ice becomes trapped in narrow reaches of the river resulting in flooding upstream.

Impact: A positive or negative effect of a disturbance on the environment or a component of the environment.

In the dry: Construction completed on dry land. "In the dry" indicates a construction project that will be submerged once completed but where main construction or components of main construction are accomplished in an area separated from a river, lake or other body of water. Construction projects normally prefer to work in the dry, if possible. The last stage of construction usually involves the removal of a cofferdam or "plug" of some kind that allows the water in.

In the wet: The portion of a construction project that cannot be completed while separated from the river. This stage of construction usually involves the removal of the cofferdam structures or materials but can also include underwater welding, and maintenance functions associated with a completed project.

Indirect effect: An effect caused by a given action but occurring later in time or further removed in distance.

Infrastructure: The basic features needed for the operation or construction of a system or community (e.g. roads, utilities etc.).

Insulators: An insulator is a material or object which contains no movable electrical charges. When a voltage is placed across an insulator, no charges flow, so no electric current appears.

Interested publics/ other publics: Any person or body having an interest in the outcome of an assessment, for a purpose that is not frivolous or vexatious, and includes: (a) the Fish and Wildlife Management Board established under the Umbrella Final Agreement, in relation to a project that is likely to affect the management and conservation of fish or wildlife or their habitat; (b) the salmon subcommittee of the Fish and Wildlife Management Board, in relation to a project that is likely to affect the management and conservation of salmon or their habitat; and (c) a renewable resource council established under a first nation's final agreement, in relation to a project that is likely to affect the management and conservation of fish or wildlife or their habitat within the traditional territory of that first nation.

Intermontane plain: Geographic term referring to a largely area of land, with generally low relief, located between mountains.

Invasive Species: noxious weeds or other vegetation which are not native to a particular habitat. These species may be harmful to the existence of other plants or may be unwanted, wild or feral plants that may be harmful to human, animal or property.

Journeyman: A tradesman who may well have completed an apprenticeship but is not yet able to set up his or her own workshop as a master.

Kilovolt (kV): A volt is the unit of electrical force or potential that causes a current to flow in a circuit. One kilovolt (kV) is equal to 1,000 volts.

Kilowatt (kW): The unit of power equivalent to 1,000 watts.

Kilowatt Hour (kWh): The unit measure of electrical power equivalent to use of 1,000 watts for a period of one hour (e.g., ten 100-watt light bulbs switched on for one hour would use one kWh [or 1,000 watts for one hour]).

Lacustrine: Of, pertaining to, or inhabiting lakes.

Labour Force Participation Rate: The labour force available in the week (Sunday to Saturday) expressed as a percentage of the population 15 years of age and over.

Land Use Permit: A Land Use Permit allows a specific activity over a specified period of time. It does not give any exclusive rights or tenure to the land.

Laydown Area: A temporary part of a construction site for contractors to use to store elements of the project before they are put in place or can be disposed of appropriately.

Likelihood: The degree of certainty of an event occurring.

Littoral area: On or near a shore or the shallow area of a lake. This is an area where there is vegetation growth, providing primary habitat and eco-system food sources.

Lithic: An artifact consisting of stone

Local knowledge: Information held by community members, such as farmers, hunters, fishers and naturalists, who are familiar with the environment in a specific geographic area. Community knowledge may be used in the environmental assessment of a proposed project. For example, fish harvesters in a specific area may know where the best “fishing spots” are, and therefore may contribute to identifying potential fish habitat.

Magnitude of effect: The level of detectability of effect, which for the purposes of assessment may be described as low, moderate and high. Effects described as low are unlikely to be detectable or measurable, or are below established thresholds of acceptable change; for some environmental assessments this means that less than 5% of the VC population or area is affected. Effects described as moderate could be detectable within normal range or variation with a well designed monitoring program, or below established thresholds of acceptable change. For some environmental assessments, from 5-10% of the VC population may be affected. Effects described as high would be readily detectable without a monitoring program and outside normal range of variation, or exceeds established thresholds of acceptable change. For some environmental assessment, greater than 10% of the VC population may be affected.

Marshalling area or yard: An open area used to stock-pile, store and assemble construction materials.

Megawatt (MW): A watt is the unit used to measure electric power. A megawatt (MW) is 1,000,000 watts.

Memorandum of Understanding (MOU): A legal document describing an agreement between parties.

Merchantable: A tree or a stand of trees that has reached maturity (rotation age and/or size) and is suitable and/or ready for harvest and of sufficient quality for buying and selling.

Maintenance: Periodic service required to ensure equipment and facilities are in good working order.

Mitigation (mitigative measures): measures for the elimination, reduction, or control of adverse environmental or socio-economic effects, which include: (a) Avoiding effects altogether by not taking a certain action or parts of an action. (b) Minimizing effects by limiting the degree of magnitude of the action and its implementation. (c) Rectifying the effects by repairing, rehabilitating, or restoring the affected environment. (d) Reducing or eliminating the effects over time by preservation and maintenance operations during the life of the action. (e) Compensating for effects by replacing or providing substitute resources or environments.

Moiety: Term used to describe each descent group in a culture which is divided exactly into two descent groups.

Monitoring: Any on-going process or program for measuring the actual effects of constructing or operating a development.

Non-productive Land: Includes all forest land not capable of producing timber of merchantable size.

Northern Tutchone Land Use Planning Region: One of eight planning regions in the Yukon.

Not sufficiently regenerated land: land that is still in the process of recovering from prior forest fire activity.

Oligotrophic: Characterized by a low accumulation of dissolved nutrient salts, supporting but a sparse growth of algae and other organisms, and having a high oxygen content owing to the low organic content.

Operating regime: The pattern of use applied to the operations of a hydro facility, including any constraints placed on it by its water use license or other legislation and the strategy developed to maximize the electricity that can be produced within those constraints.

Organic material: Refers to any material that is capable of decay or of being decomposed or is the product of decomposition, and is usually the remains of a recently living organism, and may also include still-living organisms. Also called organic matter.

Orthographic photos: An aerial photographs that have been geometrically corrected ("orthorectified") such that the scale of the photograph is uniform, meaning that the photo can be considered equivalent to a map.

Overburden: The soil (including organic material) or loose material that overlies bedrock.

Panel of the Board: A panel established under subsection 65(1), paragraph 93(1)(a) or subsection 95(1), 103(1) or 105(1) of YESAA.

Penstock: Pipe designed to convey water to a turbine.

Penstock-canal conveyance system: Proposed route to convey water from Wareham Lake to the powerhouse. The penstock canal conveyance system is comprised of three main sections: low-pressure upstream penstock, canal, and pressurized downstream penstock.

Permafrost: Permafrost is defined on the basis of temperature, as soil or rock that remains below 0°C throughout the year, and forms when the ground cools sufficiently in winter to produce a frozen layer that persists throughout the following summer.

Phase: Describes the distinct time periods in which project related effects accrue. There are three phases associated with the project: Construction, Operation and maintenance, and Decommissioning.

Physiography: A description of the natural features of the surface of the earth.

Piscivorous: Habitually feeding on fish; fish-eating

Plan: Any plan, program, policy or proposal that is not a project or existing project.

Placer: Deposit of river sand or gravel containing particles of gold or another valuable mineral

Pole framing: The construction of poles and corner towers, including cross arms, bracing, and preparation of foundation for poles.

Pole setting: Pole setting involves the installation of poles in the ground. This includes digging the holes with an auger or drill, placing the poles upright into the holes, and screwing in anchors to hold the pole in place.

Poorly Drained Soils: Poorly drained soils are typically deposited on locally shallowly sloping terrain and tend to accumulate water due to the site's inability to drain water away from the location, poor soil percolation potential or a combination of both.

Potential labour force: All persons in a given population, excluding institutional residents, age 15 years and over.

Power grid: A network of electric power lines and associated equipment used to transmit and distribute electricity over a geographic area; or, the network of transmission lines that link all generating plants in a region with local distribution networks to help maximize service reliability

Powerhouse / Power station: Component of a hydro generating facility where turbines and generators are housed. This facility comprises the most important component of a hydro generating facility because this is where the kinetic energy from the water is transformed into usable electrical energy available to stakeholders via transmission lines connected to the powerhouse generators.

Probability: The chance or possibility that a specific event will occur.

Project: An activity that is subject to assessment under section 47 or 48 and is not exempt from assessment under section 49 of YESAA. For the purposes of this submission document it is the Mayo Hydro Enhancement Project (Mayo B).

Project Study Region: An area extending beyond the Construction Footprint Area identified to examine potential environmental and socio-economic effects of a project. For the Mayo Hydro Enhancement Project (Mayo B), this includes adjacent aquatic and terrestrial regions along the Mayo River from the Village of Mayo at the Stewart River to the eastern shores of Mayo Lake.

Proponent: Proponent, in relation to a project or other activity, means a person or body that proposes to undertake it, or a government agency, independent regulatory agency, municipal government or first nation that proposes to require — under a federal or territorial law, a municipal by-law or a first nation law — that it be undertaken.

Push brace: A wood brace attached to a wood pole supporting an overhead service. The push brace is attached to the same side of the pole as the service drop cable, to prevent tension on the cable from pulling the pole over.

Quaternary Ice Age: Refers to a period of glaciations that began about 1.6 million years ago and continues until today.

Range: The geographical area where a species can be found.

Raptor: A bird of prey (for this study, includes eagles, hawks, falcons, owls and osprey).

Ratepayer: A person who pays a regular charge for the use of a public utility, as gas or electricity, usually based on the quantity consumed.

Rare: Infrequently occurring in Yukon or uncommon.

Reactor: A device whose primary purpose is to introduce reactance into a circuit.

Reconnaissance: An examination or survey of a region in reference to its general geological character (e.g., wildlife occurrence in Project area).

Recreational: Where the primary intent is enjoyment.

Redds: A spawning nest made by a fish, especially a salmon or trout

Regeneration: The renewal of the natural vegetation, either by natural or artificial means.

Registered Trapping Concession (RTC): A parcel of land on which the holder is given exclusive rights to harvest furbearing animals.

Regulatory: Relating to a regulation or pertaining to legal requirements.

Remediation: The act or process of correcting a fault or deficiency

Renewable Resources Council (RRC): The Yukon First Nation Final Agreement provided for the establishment of Renewable Resources Councils (RRC's) in each of First Nation's Traditional territories. Acting as independent public interest advisory bodies, the RRC's may make recommendations on any matter related to fish and wildlife conservation, the establishment of Special Management Areas and to forest resources management.

Reservoir: A large natural or artificial lake used for collecting and storing water for human use.

Residual effects: Effects of a project that are expected to remain after mitigation measures have been implemented.

Re-vegetation: The reestablishment and development of self-sustaining plant cover on disturbed sites. This may require human assistance such as ground preparation and reseeding or the natural vegetation of the area will be encouraged to re-grow in the area.

Right-of-way (ROW): Area of land cleared and maintained to accommodate a structure such as a road or a transmission line.

Riparian: Along the banks of rivers and streams.

Riparian Zone: The interface between land and a water body. They are typically characterized by hydrophilic vegetation and are often subject to flooding. Riparian zones are associated with water bodies and wetland areas.

Rut: A furrow or track in the ground, especially one made by the passage of a vehicle or vehicles.

Schist: A rock whose minerals have aligned themselves in one direction in response to deformation stresses, with the result that the rock can be split in parallel layers.

Scoping: The iterative process of identifying issues of concern related to the project, including the selection of Valued Components (VCs), identification potential pathways of effects along with the spatial and temporal boundaries for assessing effects of the project.

Sedimentation: Deposition of suspended solids in surface water.

Sediment load: Sediment load is divided into three categories: 1) Suspended load: Contains organic and inorganic particulate matter that is suspended in and carried by moving water. 2) Dissolved load: All organic and inorganic material carried in solution by moving water. 3) Bed load: Coarse materials such as gravel, stones, and boulders that move along the bottom of the channel. These materials move by skipping, rolling, and sliding.

Seismic refraction: The most commonly used geophysical method to identify soil and rock types and depth to the local bedrock. It is based on the measurement of seismic energy travel time through the subsurface and the development of an interpretive model of velocity and thickness for various layers of earth materials through which the seismic wave has passed in its travel from source to detector.

Settlement land: Land that is category A settlement land, category B settlement land or fee simple settlement land under a final agreement or under section 63 of the Yukon Surface Rights Board Act, or land that is to be treated as such by virtue of a self-government agreement, and includes Tetlit Gwich'in Yukon land, but does not include water or mines and minerals defined to be non-settlement land.

Shale: A dark fine-grained sedimentary rock composed of layers of compressed clay, silt, or mud.

Shoreline: The narrow strip of land in immediate contact with the sea, lake or river.

Significance: A measure of the residual effects after the application of mitigation measures. Effects may be considered significant (high residual effect), potentially significant (moderate residual effect), not significant/ insignificant (low residual effect) or not significant/ negligible (no definable effects).

Slash: Debris resulting from the felling of trees and shrubs.

Sluice: An artificial channel for a flow of water that is controlled by a valve or a gate. (Also often used in reference to placer mining and the long inclined trough used to separate gold ore from sand or gravel).

Socio-economic effects: Includes effects on economies, health, culture, traditions, lifestyles and heritage resources.

Soil fixing vegetation: Plants with root structures that grab the soil and hold it in place.

Soil liquefaction: The process by which saturated, unconsolidated soil or sand is converted into a suspension. It is commonly observed in quicksand, quick clay, turbidity currents, and as a result of earthquake shock in unconsolidated sediments. It can be caused when flowing water reduces the friction between sand particles (as from an underground spring), or when a sudden change in pressure or repeated shock acting on water saturated or supersaturated sediments (as in an earthquake).

Species: A group of inter-breeding organisms that can produce fertile offspring.

Species at risk: Plants or animals that are in danger of extinction or extirpation throughout all or a portion of their range.

Spillway: A channel for carrying away excess water, for example at a reservoir or dam.

Staging: Resting and gathering of waterfowl such as geese and ducks on a water body prior to, or during fall migration.

Stand: A community of trees sufficiently uniform in species, age, arrangement, or condition to be recognized as a separate group from the forest or other growth in the area.

Step-down transformer: Equipment that steps down high voltages and currents of the electrical power system to convenient levels for use.

Subsistence economy: An economy in which a group obtains the necessities of life through self-provisioning. In such a system wealth is not measured in any form of currency, but rather exists in the form of natural resources.

Substation: An assemblage of equipment for switching and/or transforming or regulating the voltage of electricity.

Surface-run canal: Man-made, open-air structure that guides water along a desired path to a desired location.

Surficial geology: The geology of surficial deposits, including soils; the term is sometimes applied to the study of bedrock at or near the earth's surface.

Synchronous condenser: Equipment used to automatically regulate and correct power quality.

Tailrace: Area in a river or lake below a dam where water flows once it has passed through the turbines.

Temporal: Pertaining to time.

Tangent: A line meeting another line at a common point and sharing a common tangent line or tangent plane at that point.

Tendering: Providing different groups and companies with an opportunity to bid on a job. The general principle is that the qualified bidder with the lowest price gets the job. "Open tendering" means that anyone can bid. "Restricted tendering" means that only some types of companies can bid.

Terrestrial: Living on or in the ground, or related to the ground.

Territory: (a) in relation to a first nation for which a final agreement is in effect, that first nation's traditional territory and any of its settlement lands within Yukon that are not part of that traditional territory; (b) in relation to the first nation known as the Tetlit Gwich'in, the areas described in Annex A of Appendix C to the Gwich'in Agreement; and (c) in relation to any other first nation, the geographic area within Yukon identified on the map provided by that first nation under the Umbrella Final Agreement for the purpose of delineating the first nation's traditional territory.

Thermokarst: Refers to a land surface that forms as ice-rich permafrost melts. The name is given to very irregular surfaces of marshy hollows and small hummocks. Small domes that form on the surface due to frost heaving with the onset of winter are only temporary features. They then collapse with the arrival of next summer's thaw and leave a small surface depression.

Threatened species: As defined by COSEWIC, a species likely to become endangered if limiting factors are not reversed.

Three-phase circuit: Three-phase power is a type of polyphase system to power motors and other devices. Three-phase systems may or may not have a neutral wire, which allows the three phase system to use a higher voltage while still supporting lower single phase appliances. In high voltage distribution systems it is common not to have a neutral wire as the loads can simple be connected between phases.

Threshold: A limit of acceptable change. Threshold measurements enable both project proponents and regulators to evaluate the acceptability of a project-related effects on a specific component of the environment by comparing the effects of the project against a pre-determine limit of acceptable change. Thresholds may be refined over time, as understandings of populations and ecological interactions evolve.

Topography: the relief features or surface configuration of an area.

Total suspended solids: The material residue that is left in a sample of water after it is evaporated that does not pass through a filter.

Traditional economy: A traditional economy is an economic system in which decisions such as the who, how, what, and for whom questions are all made on the basis of customs, beliefs, religion, habit, etc.

Traditional knowledge: The accumulated body of knowledge, observations and understandings about the environment, and about the relationship of living beings with one another and the environment, that is rooted in the traditional way of life of first nations. Note: Often referred to as Aboriginal Traditional Knowledge (ATK), which is knowledge held by, and unique to Aboriginal peoples. It is a living body of knowledge that is cumulative and dynamic and adapted over time to reflect changes in the social, economic, environmental, spiritual and political spheres of the Aboriginal knowledge holders. Sometimes used interchangeably with Traditional Ecological Knowledge (TEK), however TEK is generally considered to be a subset of ATK and is primarily concerned about knowledge about the environment.

Traditional lifestyle: Activities which have been followed by communities and people for long periods, often for generations.

Traditional resource use: Hunting, trapping, fishing and food gathering by Aboriginal peoples whether for subsistence purposes or otherwise.

Traditional territory: Lands designated under the Umbrella Final Agreement that provide rights for subsistence hunting and fishing activities; allocation of 70 percent of traplines; representation on land use planning bodies; membership on the Yukon Water Board, Development Assessment Board, Surface Rights Board, Fish and Wildlife Management Board and the Renewable Resources Councils.

Transect: A long, continuous sample area.

Transformer/Switching Station: A transformer/switching station is a facility that transforms electricity from a generating station to the higher voltages needed to carry it on the existing transmission system, or a facility that transforms electricity from the transmission system to the lower voltages needed to distribute it to customers.

Transmission line(s): A structure consisting of a series of towers and wires used to carry electrical power, generally at high voltage.

Tributary: A stream or river that flows into another river or other body of water.

Uncertainty: The possible error or range of error which may exist within assumptions.

Understory vegetation: An underlying layer of vegetation, especially the plants that grow beneath a forest's canopy.

Unemployment rate: The proportion of individuals in the active labour force that do not have a job. The classification of unemployed does not account for the underemployed, or those individuals working part time but desiring a full time position. As well, the classification does not include discouraged workers: those individuals who wish to work but have ceased looking because they do not believe they will find a job.

Ungulate: Hoofed mammals, including elk, moose, deer and caribou.

UTM Grid: A grid system based upon the Transverse Mercator projection. The UTM grid extends North-South from 80°N to 80°S latitude and, starting at the 180° Meridian, is divided eastwards into 60, 60 zones with a half degree overlap with zone one beginning at 180° longitude. The UTM grid is used for topographic maps and geo-referencing satellite images.

Valued Component: Described in YESAB guides as an element of a project area that is valued for environmental, scientific, social, aesthetic, or cultural reasons. For the Project, VCs were identified in the process of scoping the Project and through the Public Involvement Program (PIP).

VAR (volt-amperes-reactive): In alternating-current power transmission and distribution, voltamperes reactive (vars) are the product of the rms voltage and current, or the apparent power, multiplied by the sine of the phase angle between the voltage and the current.

Vegetative/ treed buffer: An area that protects or reduces impacts to a natural resource from human activity; a strip of land along roads, trails or waterways that is generally maintained to enhance aesthetic values or ecosystem integrity.

Vegetative mat: The living vegetative layer found at ground level. This includes root, rhizome and mycelium structures and the material contained in the H (humus) and A₁ (soil horizon with organics) soil horizons.

Waterfowl: Ducks, geese and swans (game birds that frequent water).

Water regime: A description of water body (i.e., lake or river) with respect to elevation, flow rate, velocity, daily fluctuations, seasonal variations, etc.

Watershed: The area within which all water drains to collect in common channel or lake.

Watt-hour: A watt-hour is a unit of energy. One watt-hour is the amount of electrical energy equivalent to a one-watt load drawing power for one hour.

Wetlands: Those lands where the water table is at, near or above surface or where land has been saturated for a long enough period to produce such features as wet-altered soils and water-tolerant vegetation.

Wildlife habitat: Any area providing food, shelter, cover, air and space, or any one of the aforementioned, to wildlife such as mammals, birds, reptiles, amphibians and/or invertebrates.

Wildlife Key Areas - WKA: Any area that is critical to wildlife during at least a portion of the year. This importance may be due to vegetative characteristics such as residual nesting cover, or behavioral aspects of the animals such as lambing areas. Key areas include: winter ranges, lambing/fawning/calving areas, dancing/strutting grounds, nesting areas, breeding grounds, riparian and woody drainages, and roosting areas.

Work Force: Persons within the labour market or are working or who are available for work.

Yukon Environmental and Socio-Economic Assessment Act – YESAA: An Act to establish a process for assessing the environmental and socio-economic effects of certain activities in Yukon.

Zooplankton and phytoplankton (oligotrophic): Phytoplankton is a category of microscopic organisms that live in aquatic environments. Zooplankton represents a category of slightly larger aquatic organisms that feed on the phytoplankton. Together, these two categories of aquatic organism make up some of the primary building blocks of that aquatic environment's food web. Oligotrophic is a term that refers to ecosystems that feature a marked scarcity of food.

10.2 REFERENCES

The following references apply to information contained or referenced in Chapters 1 through 9. Each stand-alone aquatic, terrestrial, socio-economic and heritage report (Appendices 7A through 7D) include their own list of references at the back of each respective document.

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