FortisBC Inc.

NICOLA LAKE PUMPED STORAGE HYDROELECTRIC PROJECT

PRELIMINARY PROJECT DEFINITION

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1.0 EXECUTIVE SUMMARY

The Nicola Lake Pumped Storage Hydroelectric Project is located above the north shore of Nicola Lake, approximately 10 km northeast of Merritt, BC. The project will have an installed capacity of 770 MW. As a pumped storage project, the project will be a net consumer of energy but will provide important ability to balance intermittent non-storage hydro and wind sources of energy with the fixed load profile of FortisBC's retail customers. The project will also have the ability to provide key ancillary services to the transmission grid in FortisBC's service area as voltage stability, reactive support and spinning reserve.

The project comprises a submerged Intake / Tailrace in Nicola Lake, two 700 m tunnels to an underground pump station / powerhouse, a 3,050 m tunnel to a submerged portal in a newly created upper reservoir, a 39 metre high dam, two 600 to 800 m long access tunnels and an 18.1 km 500 kV transmission line to connect to BC Hydro 5L87.

The project will be operated to draw energy from the grid over an 8 to 16 hour period during system Light Load Hours in each day at a rate of 385 MWh/h to 770 MWh/h. This power will be used to pump water diverted from Nicola Lake into the basin of the upper reservoir, some 750 metres above. During the 8-hour Heavy Load Hours period in the same day, the water will be released through turbines back into Nicola Lake at a rate of 770 MWh/h. Typically, the net storage at the end of each 24-hour cycle will be zero. In some instances, storage may be maintained in the upper reservoir over the course of several days, again to better match supply and demand of the short term energy market.

The plant will be operated to the benefit of FortisBC's more than 157,000 direct and indirect customers.

2.0 PROPONENT IDENTIFICATION

The application is in the name of FortisBC Inc.

FortisBC is an integrated, regulated utility operating in the southern interior of British Columbia. The company serves over 157,000 customers directly or indirectly and meets a peak demand of 746 MW. FortisBC owns and operates 4 hydroelectric generating plants with a combined capacity of 223 MW. Its electricity system includes over 7,000 kilometers of transmission and distribution power lines.

The prime contact for this project will be:

Ian Dyck
Project Manager, Resource Plan
FortisBC Inc.
1290 Esplanade
Trail, BC
V1R 4L4

ph: 250-368-0345
ian.dyck@fortisbc.com

3.0 PROJECT DESCRIPTION

3.1 GENERAL

The project will be a pumped storage capacity project. At its heart, it will serve as a load centre during low cost times for power (typically nights and weekends) or "Light Load Hours", by using electricity to drive four pump/turbines to lift water from Nicola Lake to a manmade temporary storage reservoir high on the north shore of the lake. Then, during expensive times for power (mornings to evenings) or "Heavy Load Hours", the project will in turn re-generate electricity from the stored water by running it through the four pump/turbines and replacing the water back into Nicola Lake.

In essence, the project will act as a large, very efficient battery.

No pump or turbine is 100% efficient and as such, the project will be a net consumer of energy over a complete recharge/discharge (pump/generate) cycle. This drawback however is more than compensated for by its ability to store and deliver power during periods of high demand.

Another important and material benefit that the project will provide stems from a pumped storage project's extraordinary ability to "load follow", whereby it can operate to pump only with excess energy available on the grid and conversely it can operate to generate whatever additional energy is required precisely when it is required. The plant can switch modes between pumping and generating within a very short period of time, which would give FortisBC a very large capacity range of 1,540 MW – from negative 770 MW during full pump mode to plus 770 MW during full generate – with which to balance their customers' supply with generating resources available on the transmission grid.

This ability would allow a greater integration of renewable wind and other intermittent green energy projects into FortisBC's supply mix. These renewable energy sources are by their very nature unpredictable and are very hard to incorporate into a supply mix without significant predictable generation (such as traditional storage hydro plants) backstopping the portfolio. The pumped storage project can also act as that backstop.

One final advantage of the project would be its supply of "ancillary services" to the operation of FortisBC's transmission grid. The services include spinning reserve, voltage support and supply of reactive power, all of which are integral to operating a reliable and efficient electrical grid.

FortisBC acknowledges that this project is a significant size and will require extensive study and consultation to ensure that its final design and operation minimize any negative impacts to the environment and local residents and provide positive benefits to British Columbia and First Nations.

3.2 HYDROLOGY

The hydrology of the Nicola River watershed is well documented. Historically and presently, the Water Survey of Canada (WSC) has maintained at one point in time or another 12 water level or discharge measurement stations within the entire Nicola watershed. There are currently four active discharge gauges on the Nicola River and one active lake level gauge on Nicola Lake. These are summarized in the table below:

Operating WSC Discharge Gauges on Nicola River

Station ID	Station Name	Latitude and Longitude	Watershed Area	Years of Record
08LG006	Nicola River Near Spence's Bridge	50°19'47" N 121°13'32" W	7,280 km^2	96 years
08LG007	Nicola River near Merritt	50°8'40" N 120°53'6" W	4,350 km^2	96 years
08LG049	Nicola River above Nicola Lake	50°10'57" N 120°22'30" W	1,500 km^2	92 years
08LG065	Nicola River at Outlet of Nicola Lake	50°9'52" N 120°39'51" W	2,990 km^2	24 years

Operating WSC Lake Level Gauge on Nicola Lake

Station ID	Station Name	Latitude and Longitude	Watershed Area	Years of Record
08LG046	Nicola Lake near Nicola	50°9'40" N 120°39'40" W		74 years

The outflow from Nicola Lake is controlled by a dam. The dam was originally constructed at the turn of the 20th Century by a private land owner for irrigation and power generation. Power generation ceased in the 1950s but the dam continued to provide storage for irrigation. The original dam was replaced by the Province of BC in 1985 with a larger structure to provide storage for fishery enhancement downstream and continued irrigation storage.

Mean monthly discharge data from the gauge at the outflow of the lake indicates a unit runoff of approximately 1.7 L/s/km^2. The monthly average discharge from the lake is summarized below in m^3/s:

Monthly Average Discharge from Nicola Lake (m^3/s)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Av.
1.58	1.82	2.45	4.20	15.6	16.0	6.83	3.88	2.32	1.91	1.84	1.65	5.02

Water levels in Nicola Lake fluctuate seasonally as a result of inflows and controlled releases. The monthly average lake level is summarized below in metres above sea level geodetic:

Monthly Average Lake Level in Nicola Lake (masl geodetic)

Jan	Feb	Mar	Apr	May	Jun
624.966	624.993	625.011	625.072	625.648	626.031

Jul	Aug	Sep	Oct	Nov	Dec
625.792	625.490	625.261	625.119	625.036	624.994

Av.
625.262

A brief look at intra-day lake levels graphically from Water Survey of Canada (WSC) real-time data for the Nicola Lake gauge shows that the lake has experienced minimal diurnal lake level fluctuation in 2009 to date.

Canadian Climate Normals, published by Environment Canada, indicate that between 1971 and 2000, average annual total precipitation for nearby Merritt was 322.2 mm. The nearest Climate Normal station that shows lake evaporation data is Kelowna A, which shows the following monthly average lake evaporation in mm.

Monthly Average Lake Evaporation in Kelowna (mm)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Av.
			2.7	3.8	4.5	5.0	4.2	2.5				22.7

Nicola Lake has a surface area, measured from BC's online map, of 25.1 km^2.

The project will be designed to generate power from a maximum flow of 119 m^3/s for 8 hours per day, with diversion rate and duration ranging from 60 m^3/s for 16 hours each day to 119 m^3/s for 8 hours per day depending on available energy sources and costs. The upper reservoir will have an operational storage volume of 3.43 million m^3.

Although these diversions and inflows materially exceed the natural inflows and regulated outflow from Nicola Lake it is important to note that all diverted flows will typically be returned to the reservoir within a 24-hour period during the high electrical consumption hours each day.

Assuming static inflows and outflows in Nicola Lake, the diversion volume implies a daily drawdown and rebound in lake levels of 14 cm. A detailed study of the lake's littoral zone can determine the extent of impact that this implies.

On one final note, the Nicola River watershed has been the subject of the Nicola Water Use Management Plan (WUMP) of which the DRAFT Report – For Discussion and Approval was released in April of 2009. Water quantity and water quality are of special concern to the varying stakeholders in the region. Successful development of this project will clearly require the integration and consideration of the issues and actions noted therein.

There are currently significant water withdrawals from the watershed for agricultural, residential and municipal uses. During the permitting process FortisBC will work to ensure that project design and operations can fit into the current watershed regime.

3.3 PROJECT COMPONENTS

3.3.1 Access Roads

Two access tunnels will be excavated to the powerhouse. The tunnels will have portals on a short driveway on the slope above Monck Park Rd, on the north shore of Nicola Lake.

The dam and upper reservoir site will be accessed by existing forestry roads.

Apart from the short driveway off of Monck Park Rd, which is intended to provide separation from traffic, no new roads will be required for the project site. An 18.1 km access track will be required for construction and maintenance of the transmission line. The proposed line partially runs parallel to an existing right of way and therefore, only 10 km of the route will require new road.

3.3.2 Nicola Lake Intakes

Project Flows will be diverted from and returned to Nicola Lake through two tunnel portals built below the natural low water level of the lake.

Detailed bathymetry will be carried out to map the bed of the lake. Also fishery studies will be carried out to determine the productivity and extent of the littoral zone of that part of the lake. The intake will be sited with reference to these studies. The method of construction will be determined depending on the depth and material of the lakebed.

If required, the intakes will be screened to prevent fish from Nicola Lake being entrained in project works.

3.3.3 Tailrace Tunnels

Water will flow between the powerhouse and Nicola Lake through two tailrace/intake tunnels, each 4.6 m in diameter. The tailrace/intake tunnels will be approximately 700 m long, depending on the final location of the intake/portal in Nicola Lake. The tailraces will slope from the intake/portals down to the powerhouse at approximately a 6 % gradient.

Portions of the tailrace tunnels may be steel lined as appropriate.

3.3.4 Penstocks

Each tailrace tunnel will bifurcate into two penstock/draft tube tunnels. The four penstock tunnels, each with a diameter of 1.8 m, will deliver water to and from the underground powerhouse and Nicola Lake.

3.3.5 Powerhouse

The powerhouse chamber will be at an elevation of 585 metres above sea level, or approximately 40 m below the lake surface. It will be excavated in solid rock below the upper reservoir. It will contain 4 pump-turbine units, switchgear and transformers needed to step-up and step-down between the generator/motors and transmission system voltages.

3.3.6 Pressure Shaft/Tunnel

Upstream of the powerhouse chamber, a 5.8 m diameter shaft / tunnel combination will deliver water to the upper reservoir at an elevation of 1,370 to 1,390 metres above sea level. Detailed design investigations of the host rock strength and quality will determine the need for steel lining of the high pressure portions of the tunnel.

3.3.7 Upper Reservoir Portal

Flows will be discharged into and drawn from the upper reservoir through a below water portal excavated in the south wall of the reservoir.

3.3.8 Dam and Upper Reservoir

Water will be stored in the upper reservoir behind a 40 metre high earth and rockfill dam. The dam will have a crest length of 300 m. Initially, side slopes of 2:1 on both the upstream and downstream faces have been assumed. The adequacy of this assumption will be confirmed during preliminary engineering studies.

It is initially assumed that materials sourced from the excavation of the underground works will be used in the construction of the shell of the dam. Additional material for the dam will be sourced from within the upper reservoir footprint.

The upper reservoir behind the dam will have a maximum flooded area of 25 ha and a minimum flooded area of 8 ha. The site is currently dry. This area will be harvested for trees and detailed slope stability assessments will be carried out to ensure that landslides will not be a factor into the reservoir.

The upper reservoir will have a live storage volume of 3.43 million m^3 of water and a total impounded water volume of 3.798 million m^3.

3.3.9 Transmission Line

An 18.1 km 500 kV transmission line will interconnect into BCTC 5L87 near Harold Creek.

The cleared right-of-way for the transmission line will be in the order of 70 metres, however a right of way width of 500 metres has been applied for in this application to allow for route optimization.

It is possible that the route will be changed during the development process. Transmission route options will be further reviewed by FortisBC once the development phase of this project begins.

4.0 CAPACITY OF PROJECT

The project will have 4 pump-turbine combined units capable of generating at a peak capacity of 192 MW each for a total installed capacity of 770 MW.

Assuming a full utilization factor, annual generation of energy would be 2,250 GWh of energy while annual consumption of energy would be approximately 3,000 GWh depending on final pump-turbine and generator efficiencies.

5.0 LINKAGES WITH OTHER PROJECTS

The Nicola Lake project is being developed as a stand alone project.

6.0 MARKET FOR POWER AND ENERGY

FortisBC will use the pumped storage project to balance loads and generation within its service area and will use it to help integrate non-firm renewable generation sources into its supply mix.

FortisBC serves over 157,000 directly and indirectly.

7.0 DEVELOPMENT AND CONSTRUCTION SCHEDULE

FortisBC has included the project in the Resource Plan it recently submitted to the BCUC. Acceptance of this Resource Plan by the BCUC would constitute the kick-off of active development of this project.

At that point, FortisBC will initiate environmental baseline and impact studies which are expected to take 18-months to 2-years. After completion of the environmental studies FortisBC would prepare and present the Project Development Plan for review and adjudication.

Upon acceptance of this application, the initial activity FortisBC will embark on is to review the Map Reserves in place on the foreshore of Nicola Lake and the hillside above the lake.

These are:

(Interest ID 176241 - Miscellaneous Land Uses)
(Interest ID 172335 - Environmental Conservation and Recreation)

Project works will pass under the foreshore map reserve (Interest ID 172335) and have no surface impact on it. The upper reservoir will be near the hillside map reserve (Interest ID 176241).

This is a large, capital intensive project that will attract significant interest from regulators, First Nations and the public. FortisBC anticipates an extensive study, review and consultation process with affected stakeholders.

Preliminary review of the environmental values present in the Nicola watershed reveals some areas for study and consultation that FortisBC anticipates. This list is preliminary and may not reflect the final activities carried out. Final determination of required studies and consultation activities will be determined with the EA Terms of Reference.

Anticipated Environmental Studies

- Fishery and aquatic life studies in Nicola Lake and downstream in Nicola River
- Fishery habitat studies in Nicola Lake littoral zone and lake bed
- Fish populations in Nicola Lake – entrainment protection

- Nicola River – Impact and drawdown on dam operations and releases and related downstream flows
- Transmission Line – Terrestrial impact

Anticipated Engineering Studies

- Nicola Lake Bathymetry – for intake placement and lake level fluctuation impacts
- Host Rock mineralization – for ARD potential evaluation
- Dam design and stability assessment for downstream protection

Key Anticipated Consultation Activities

- Discussions with First Nations – Upper Nicola Band and the Okanagan Nation Alliance
- Integration into Nicola Watershed WUP negotiations
- Local Residents – Impact of Lake level fluctuations

The project will be permitted over a 3 to 5 year period after which construction and procurement of major equipment will take upwards of 4 years. Key dates are as follows:

Permitting

August 2009	–	Acceptance of project application with Front Counter BC
October 2010	–	Approval of FortisBC Resource Plan by BCUC
October 2010	–	Start of environmental studies and permitting process
March 2012	–	File CPCN application with BCUC
March 2012	–	Complete and submit DRAFT terms of reference to BC EAO
Mar to Oct 2012	–	Field studies for environmental baseline and impacts assessment
January 2013	–	Enter into EA Review
August 2013	–	Obtain EA Certificate
November 2013	–	Receive Water Licence and Land Tenure
March 2014	–	Receive other relevant permits

Design and Construction

March 2013	–	Begin detailed engineering design
February 2014	–	Begin supplier and Contractor selection process
June 2014	–	Construction contractor selected
November 2014	–	Finalize construction contract with contractor

January 2015 – Begin construction and equipment procurement

October 2019 – Planned "In-service" date