IN THE MATTER OF
the *Electrical Power Control Act, 1994*,
SNL 1994, Chapter E-5.1 (the "*EPCA*")
and the *Public Utilities Act,* RSNL 1990,
Chapter P-47 (the "*Act*"), as amended; and

IN THE MATTER OF an application by
Newfoundland and Labrador Hydro for
approval of a capital expenditure for the
Upgrade of the Transmission Line Corridor
from Bay d' Espoir to Western Avalon,
pursuant to section 41 of the *Act.*

PUBLIC UTILITIES BOARD
REQUESTS FOR INFORMATION

PUB-NLH-1 to PUB-NLH-68

Issued: July 17, 2014

PUB-NLH-1 On page 5 of the Upgrade Transmission Line Corridor Report reference is made to the capacitor banks at Come by Chance. Does Hydro have any contractual obligations with Nalcor Energy regarding the operation, maintenance and use of these capacitors? If yes, explain the obligations in detail.

PUB-NLH-2 Please refer to page 7, footnote 4 of the Upgrade Transmission Line Corridor Report. Explain in detail why the 200ms shutdown time for a short circuit near Soldiers Pond was assumed. Include in the response the fault detection and fault clearance time assumed and whether the contingencies of second stage protection are considered.

PUB-NLH-3 Please confirm that the criteria outlined on pages 8-10 of the Upgrade Transmission Line Corridor Report are the only criteria used by Hydro to analyze steady state and transient stability performance of the Newfoundland and Labrador electrical system. If no, then explain what other criteria are included.

PUB-NLH-4 On page 12 of the Upgrade Transmission Line Corridor Report it is noted that high side disconnects are used instead of breakers on multiple transformers attached to the same bus. Does Hydro have a plan developed to replace these disconnects with breakers? If yes, explain the plan in detail.

PUB-NLH-5 On page 12 of the Upgrade Transmission Line Corridor Report it is stated that "the three phase fault at Bay d'Espoir is particularly severe as the fault causes a temporary shutdown of the Soldiers Pond converter (commutation failure) and, at the same time, the electrical power from the Bay d' Espoir Generating Station feeds into the fault to the detriment of system stability". It is also stated that this was "accepted as the cost to mitigate would be a major capital expense". Does the design system for the upgrades required for the HVdc interconnection address a three phase fault at Bay d' Espoir? If yes, describe how. If no, why not? Include in the response the cost of capital to address this condition.

PUB-NLH-6 On page 12 of the Upgrade Transmission Line Corridor Report it states "*As the current power system is also unable to remain stable with a similar three phase fault at Holyrood, it was decided……*" Please explain the reference to the three phase fault at Holyrood.

PUB-NLH-7 Please refer to page 14 of the Upgrade Transmission Line Corridor Report. Explain in detail the local regulations concerning the use of ground return for bipolar schemes operating in monopole configuration.

PUB-NLH-8 Please refer to page 14 of the Upgrade Transmission Line Corridor Report. Explain whether or not the HVdc cable, overhead line and converter equipment are all rated for continuous monopolar operation at 675MW

(Muskrat Falls), or if there will be a shortening of the life expectancy of parts or all of the mentioned equipment during such an operating condition. In the response include the implications of continuous operation at maximum specified ambient temperature.

PUB-NLH-9 On page 16 of the Upgrade Transmission Line Corridor Report it is noted that any enhancements needed to ensure the technical operation of the Maritime Link would be the responsibility of Emera and have been previously identified in separate studies. Please outline the proposed enhancements that are required and state the impact on the proposed line of these not being completed.

PUB-NLH-10 On page 16 of the Upgrade Transmission Line Corridor Report ("Report") Hydro states that the third transmission line from Bay d'Espoir to Western Avalon is necessary for both the isolated system alternative and the HVdc intertie. Do the post contingency and steady state issues outlined in the Report exist in either alternative? Explain your response in detail.

PUB-NLH-11 On page 17 of the Upgrade Transmission Line Corridor Report it is stated that 3 high inertia synchronous condensers located at Soldiers Pond and operation of Holyrood Thermal Generating Station Unit 3 in a synchronous condenser mode are adequate for stability purposes and that all other MVAR requirements can be supplied through either static sources or a low inertia rotating unit. Please confirm that this continues to be Hydro's position.

PUB-NLH-12 On page 18 of the Upgrade Transmission Line Corridor Report reference is made to the proposed combustion turbine for Holyrood being capable of operation as a synchronous condenser and that should this not occur, additional MVAR requirements will need to be in service for the Labrador Island Link. The proposed gas turbine for Holyrood does not have synchronous condenser capability. How is this deficiency being addressed and what, if any, implications does it have for the proposed 230kV line?

PUB-NLH-13 Further to PUB-NLH-12 does the loss of either of the existing gas turbines at Hardwoods or Stephenville or the synchronous condenser at Holyrood create a stability problem for the system after the Labrador Island Link is placed in service?

PUB-NLH-14 On page 18 of the Upgrade Transmission Line Corridor Report the proposed gas turbine at Holyrood is said to be equipped with a 166 MVA generator. Is that consistent with the current proposal?

PUB-NLH-15 Please refer to page 19, Table 6.1 of the Upgrade Transmission Line Corridor Report. Please explain why there is no base case with system load of 1757MW and maximum import on the Labrador Island Link.

PUB-NLH-16 On page 20, Table 6.2 of the Upgrade Transmission Line Corridor Report a spinning reserve requirement of 154MW with Holyrood offline is noted. Is this a new criteria established for when the Labrador Island Link is placed in service?

PUB-NLH-17 On page 21 of the Upgrade Transmission Line Corridor Report it is noted that the Hardwoods gas turbine can be started to alleviate an overload condition on a transmission line in a post contingency situation. Is this solution to an overload permitted under the NERC reliability standards?

PUB-NLH-18 On page 22 of the Upgrade Transmission Line Corridor Report it is noted that imports at Soldiers Pond can be increased to alleviate overloads on the 230kV system in a post contingency situation. Explain in detail any restrictions on the use of the Labrador Island Link in these situations including how much can be supplied and how fast the response can be.

PUB-NLH-19 Numerous overload conditions on the 230kV system are noted in section 6 of the Upgrade Transmission Line Corridor Report for post contingency situations. Are each of these overloads present on the existing system for the same or similar contingencies? Explain your response in detail.

PUB-NLH-20 On page 23 of the Upgrade Transmission Line Corridor Report report reference is made to the pre-contingency overload of TL202 and TL206 when dealing with maximum island hydraulic generation. Does this condition exist presently and how is the proposed solution different other than the substitution of the Labrador Island Link for the Holyrood Plant?

PUB-NLH-21 Commencing on page 24 of the Upgrade Transmission Line Corridor Report thermal overloads are discussed. Several scenarios are outlined where TL266 line becomes overloaded. Please explain the implications of the overloading of TL266.

PUB-NLH-22 Has Hydro given consideration to upgrading the overloaded lines which are outlined in section 6.2.1 of the Upgrade Transmission Line Corridor Report through the use of composite conductors that could accept higher current (and conductor temperature) without increased sag? If yes, explain how. If no, why not?

PUB-NLH-23 On page 25 of the Upgrade Transmission Line Corridor Report it is noted that for analysis purposes TL203 is considered to be rebuilt. Does Hydro intend to rebuild TL203 and what are the implications for system operations if this rebuild is not done?

PUB-NLH-24 On page 26 of the Upgrade Transmission Line Corridor Report it is noted that for maximum hydraulic generation and reduced Labrador Island Link imports at Soldiers Pond, voltage collapse will occur for the loss of either TL202 or

TL206. How is this different from the existing system with maximum hydraulic generation? If there is no difference, how does Hydro manage such a condition with the existing system and why wasn't this addressed before?

PUB-NLH-25 Please refer to the last paragraph in section 6.2.2 of the Upgrade Transmission Line Corridor Report. Provide a list of the other options considered, and explain briefly for each of these why they were excluded from detailed analysis.

PUB-NLH-26 Please refer to the last paragraph on page 30 of the Upgrade Transmission Line Corridor Report. It is stated that BC4 was problematic with voltage collapse with the Labrador Island Link in monopolar operation. Please explain whether the monopolar link was modelled with just the ac harmonic filters and reactive power banks of one pole, or if the banks for the pole out of service were also considered and used, if relevant, for reactive power support.

PUB-NLH-27 On page 32 in Table 6.3 of the Upgrade Transmission Line Corridor Report text is missing in the Upgrades column for Winter Peak, "loss of TL207 overload of TL203 in monopole no standby to start". Should this be Bay d'Espoir to Western Avalon Line? If not, did the proposed line not have any impact on this case?

PUB-NLH-28 Please refer to Table 6.4 on page 34 of the Upgrade Transmission Line Corridor Report. Has the possibility of a commutation failure during the restoration period been considered? Have sensitivity studies been performed to determine the consequence of longer restoration time? If so, what were the results?

PUB-NLH-29 Please refer to section 6.3, page 34, footnote 12 of the Upgrade Transmission Line Corridor Report. Explain why Base Case 11 could not be studied. Include in the response whether this was due to a software limitation, or because of a perceived need to prevent the dc power from dropping below 10% of nominal during the dynamic swings, or some other reason.

PUB-NLH-30 Further to PUB-NLH-29, Appendix B shows the results for cases 1 to 10 while footnote 12 on page 34 of the Upgrade Transmission Line Corridor Report states analysis was performed on only 9 cases. Please explain this discrepancy.

PUB-NLH-31 Please refer to Figure 6.8 on page 41 of the Upgrade Transmission Line Corridor Report. What type of SVC was represented? Large shunt capacitors are mentioned in section 6.2.2.1 of the Upgrade Transmission Line Corridor Report. Are these included in the Transient Stability model for these cases?

PUB-NLH-32 Please refer to page 49 of the Upgrade Transmission Line Corridor Report. Please explain how the Maritime Link HVDC scheme was represented in the

additional transient stability study performed with this link in service. In the response include the type of HVDC scheme represented (LCC or VSC), the operating mode of the scheme, i.e. import or export to/from Newfoundland, whether the Maritime Link supported the Newfoundland ac network through ac voltage control or reactive power control during the event and whether the Maritime Link change operating mode (import/export and/or reactive power) during the event.

PUB-NLH-33 On page 51 of the Upgrade Transmission Line Corridor Report it is noted that the load on TL206 must be limited to 50MW when TL202 is out for maintenance in order to maintain stability. Does this now occur with current system conditions pre Labrador Island Link?

PUB-NLH-34 Please refer to page 53 of the Upgrade Transmission Line Corridor Report. The possible benefit of the Maritime Link in respect of potential power transfer from Nova Scotia to Newfoundland is stated. There will be times when the Maritime link is out of service (e.g. maintenance, breakdowns, dc cable repairs etc). Is Hydro proposing to reduce the number of synchronous compensators to be provided or to reduce the number in service when the Maritime Link is in operation?

PUB-NLH-35 On page 56 of the Upgrade Transmission Line Corridor Report the beginning of paragraph 2 states: "There are other unquantified benefits of a new line, such as reduction in losses." In the same paragraph, Hydro begins to quantify the MW loss, and on page 60 quantifies the reduction in economic losses. Are there other loss reductions that are not listed within this paragraph that this sentence refers to? If so, what are they and why are they not quantified?

PUB-NLH-36 On page 56 of the Upgrade Transmission Line Corridor Report, the second paragraph ends with the statement "....if there were major issues at Sunyside, there would be a high capacity circuit through the isthmus of Avalon that would be unaffected by such issue". Please describe the types of events that are envisioned by the term "major issue".

PUB-NLH-37 Further to PUB-NLH-36, given that the new and existing 230 kV circuits from Bay d' Espoir to Western Avalon (including Sunnyside and Come-by-Chance) are in network topology, please explain how a "major issue" at Sunnyside would not affect the new circuit.

PUB-NLH-38 Please describe the type(s) of circuit breakers to be installed at Bay d' Espoir referred to on pages 63-65 of the Upgrade Transmission Line Corridor Report.

PUB-NLH-39 When is approval from the Lieutenant Governor in Council expected for the request to revise the Management Plan which is referred to on page 66 of the

Upgrade Transmission Line Corridor Report? When is it required in order to maintain the schedule proposed in the application?

PUB-NLH-40 Has the Upgrade Transmission Line Corridor project been registered yet under the Provincial Environmental Assessment Act as stated on page 66 of the Upgrade Transmission Line Corridor Report? If yes, state when. If no, when is it anticipated that it will be registered?

PUB-NLH-41 Page 66 of the Upgrade Transmission Line Corridor Report states that the right of way needs approximately 35 km of the circuit that is within or borders the Bay du Nord Wilderness Reserve. For the 153 km balance has all of the necessary right of way been secured for this new circuit? If not, what are Hydro's plans for securing any outstanding properties and are there any potential litigations with either the province or individual property owners that could delay the schedule?

PUB-NLH-42 On page 67 of the Upgrade Transmission Line Corridor Report, it is stated that: "It is anticipated that processes will have to be undertaken to allow a third circuit to be constructed". Please describe these "processes". How would the cost and/or schedule of the project be affected if these "processes" do not proceed as envisioned?

PUB-NLH-43 The last three sentences of the last paragraph on page 67 of the Upgrade Transmission Line Corridor Report address the issue of three major transmission circuits sharing a common corridor. The last sentence seems to address the incremental cost of bypassing only the corridor through and adjacent to the Bay du Nord Wilderness Reserve. Please explain if Hydro performed any analyses of alternate routes between Bay d' Espor and Sunnyside, other than that portion affecting Bay du Nord Wilderness Reserve.

PUB-NLH-44 On page 67 of the Upgrade Transmission Line Corridor Report Hydro states that there are no issues of these three circuits sharing a common corridor. Is this consistent with operating experience of the three 230 kV circuits sharing the corridor between Churchill Falls and Montagnais (Hydro Quebec)?

PUB-NLH-45 On page 67 of the Upgrade Transmission Line Corridor Report it is stated that the cost for this project has increased from $210,000,000 in 2011 to $292,000,000 in the current application. Please describe what controls will be in place to control costs, scope and schedule to ensure that the current cost will not be exceeded.

PUB-NLH-46 Please describe the role of the "Consultant" referred to on page 68 of the Upgrade Transmission Line Corridor Report and describe the skills and benefits this position brings to the project that are not resident within Hydro.

PUB-NLH-47 What is the basis for the escalation estimate on page 68 of the Upgrade Transmission Line Corridor Report?

PUB-NLH-48 The start and end dates for the PUB approval of the Application stated on page 70 of the Upgrade Transmission Line Corridor Report are the same (April 30, 2014). When is PUB approval required in order to meet the overall schedule? Explain how a delay in approval affects the schedule.

PUB-NLH-49 The construction schedule for the transmission line is 18 months as stated on page 71 of the Upgrade Transmission Line Corridor Report. Is this rate of progress consistent with prior Hydro experience? Include in the response the three most recent Transmission Line construction projects over 50 km in length with the actual progress over the entire construction period.

PUB-NLH-50 Please refer to page 1 of Appendix B, figure 1.1. Please provide the names of the generating plants associated with the legend.

PUB-NLH-51 For Appendix B please provide details of the model used to represent the HVDC links in the stability study. In the response state whether a PSSE model or a PSCAD model was used and explain how the model was benchmarked to show that it provides a reasonable representation of the response that would be expected of a real HVDC system.

PUB-NLH-52 For Appendix B please provide a zoomed in version of the DC power, DC Voltage, AC Bus Voltage in the time period 0.9 second to 2 seconds for figures B2, B3, B4, B5, B8, B9, B10, B11, B14, B15, B16, B17, B20, B21, B22, B23.

PUB-NLH-53 Please refer to Appendix B. Explain the meaning of "Sheddable Load".

PUB-NLH-54 Please refer to Appendix B. Was the then proposed new refinery near Pipers Hole represented in the study?

PUB-NLH-55 What is the capacity of the transmission interconnection between Nova Scotia and New Brunswick?

PUB-NLH-56 In Appendix C8 on page ix it is recommended that a more complete study be undertaken to evaluate the use of VSC HVDC technology. Has this study been done? If so, please provide a copy.

PUB-NLH-57 In Appendix C8 in the last paragraph on page xi it is noted that the load shedding is proposed to be modified to increase the load being shed from 530MW to 750MW. Is it still being proposed to shed that magnitude of load in the event of a bipole trip?

PUB-NLH-58 On page 5 of Appendix C10, reference is made to a new 230kV line from Granite Canal to Bottom Brook. Is it still the intent that this will be a 230kV line built in support of the Maritime Link? What approvals does Hydro consider will be required for this asset and any other that is listed in PUB-NLH-09 that needs to be constructed in support of the Maritime Link?

PUB-NLH-59 On page 6 of Appendix C10 it is noted that as part of the study criteria load shedding should not occur for loss of the largest generator in Newfoundland while on page 7 it is noted that this criteria has been in general use in Newfoundland and Labrador. When did load shedding stop being used as part of the criteria for the loss of generation?

PUB-NLH-60 Please refer to Appendix C10, section 2. Confirm that single contingency outages on the ac network were not considered as the starting condition for any of the stability studies.

PUB-NLH-61 Please refer to Appendix C10, section 2.1. Explain in detail the basis for the assumption that multi-phase faults will always be cleared in 100ms.

PUB-NLH-62 Please refer to Appendix C10, section 2.1. Describe what would be the consequence if one of the off-line standby generators does not start.

PUB-NLH-63 Please refer to Appendix C10, section 2.1. Explain in detail the consideration given to negotiating an emergency power support agreement with Nova Scotia, i.e. to keep the Maritime Link in service and to enable the Maritime Link to change from export to import during major incidents, such as a permanent bipole trip. What is the status of such an agreement?

PUB-NLH-64 Please refer to Appendix C10, section 3.1.1. Explain in detail the 175ms de-ionisation time for a bipole overhead line fault. Include in the response the sensitivity of the ac network to longer de-ionisation times and to a re-occurrence of the line fault on re-energisation.

PUB-NLH-65 Please refer to Appendix C10, section 3.1.1. Explain the consequence of a commutation failure during the recovery because of the low ac voltage.

PUB-NLH-66 Please refer to Appendix C10, section 3.13, page 26. The power order reduction scheme referred to would require telecommunications. Please state whether there would be redundancy in the telecommunications systems required.

PUB-NLH-67 Please refer to Appendix C10, section 4.3, objective 3. It is noted that this study has identified the potential for low ac voltages during the recovery from 3-phase faults in the ac network, which could result in the Labrador Island Link inverter at Soldiers Pond suffering commutation failures during the critical recovery period. Has a sensitivity study been performed to reflect the

slower recovery that may be necessary, or could be caused by commutation failures? If so, please provide the results of this study. If no, why not?

PUB-NLH-68 Please refer to Appendix C10, section 4.3, objective 3. It is noted that under some conditions very high temporary over-voltages could occur as a consequence of blocking of the Labrador Island Link. The report states that the Maritime Link VSC converter may be able to control this over-voltage. Has it been established whether or not the Maritime Link VSC converter will be able to provide the necessary ac voltage control?

DATED at St. John's, Newfoundland this 17th day of July, 2014.

BOARD OF COMMISSIONERS OF PUBLIC UTILITIES

Per _____
Cheryl Blundon
Board Secretary