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**Cc:** [DeanneFisher@nalcorenergy.com](mailto:DeanneFisher@nalcorenergy.com)  
**Subject:** Re: Wetland Capping initiative  
**Date:** Wednesday, February 13, 2019 3:28:47 PM  
**Attachments:** [ATT00002.jpg](#)  
[ATT00004.jpg](#)  
[Memo - Supplementary Feasibility Targeted Mitigations 2019 01 23 \(Final\).pdf](#)

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Jamie/Paul:

As a follow up to our previous note, I wanted to make sure you have a copy of SNC Lavalin's comments regarding wetland capping.

Further to our discussion earlier today, I also asked SNC Lavalin if they could take a stab at estimating the extent of any natural slide events that may happen after impoundment. I will report back on any findings they come up with .

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**Cc:** Deanne Fisher/NLHydro@NLHYDRO, Stan Marshall/NLHydro@NLHYDRO  
**Date:** 01/16/2019 09:04 AM  
**Subject:** Wetland Capping initiative

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Jamie,

Further to our discussions on Monday regarding potential wetland capping, there are a number of points arising from the SNC-Lavalin report on wetland capping that need to be carefully considered in determining next steps.

In their report to the IEAC, SNC Lavalin assumed that work would be undertaken starting in the fall of 2018 and completed prior to April 2019 (Ref SNC-L Report, Attachment 2 - Assumptions). Section 5 of the report outlines the assumption that work be completed prior to the 2019 spring freshet, which in turn is prior to impoundment in 2019. They assumed that the contractor for the work would be mobilized over the summer and fall of 2018 so that work could be undertaken during the winter of 2018-19. That construction

window is no longer available to us.

On the other end of the schedule, we are now running up against our impoundment window, which begins mid July and runs until September 30, 2019. From a construction perspective, we need to maintain the impoundment schedule and impound as early as possible to complete the spillway concrete placement and to permit commissioning activities for Unit 1 in advance of first power this year.

The areas targeted for capping are low lying wetlands, and as such, site conditions will not enable construction activities until after spring has passed and conditions have dried out this summer. Further, six of the 10 prospective areas are on the south bank of the Churchill River and access from our previous reservoir clearing program would have to be re-established before we could access those areas. I don't see a scenario where a contractor could complete the capping work after the spring thaw and before scheduled impoundment in mid July.

To summarize, the conditions assumed by SNC Lavalin in their report for the IEAC are no longer applicable, and consequently their execution plan and cost estimates are no longer valid. To understand what could be undertaken given the current situation, I have asked SNC Lavalin to identify whether any mitigation might be available to us. This could be in the form of work done after impoundment, which they discussed briefly in their report, or through some alternate approach that they may be able to suggest.

Gilbert



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**MEMO**

**TO:** File **DATE:** 23-Jan-2019

**CC:** Scott O'Brien  
Gilbert Bennett  
Michel Tremblay  
Ken Sparkes  
Greg Snyder  
Regis Bouchard **DOC NO.** 505573-0000-33CC-I-1530

**FROM:** David Haley P. Eng, FEC, EP **REF:** MEM-MFG001-0019

**SUBJECT:** Supplemental Feasibility Assessment of Targeted Mitigation  
Scenario A (Wetland Capping)

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**1. Background**

SNC-Lavalin Inc. (SNCL) conducted a feasibility assessment of the Targeted Mitigation Actions – Scenarios A and B, as defined by the Independent Expert Advisory Committee (IEC) (IEC memo dated 23 January 2018). The SNCL report prepared in March 2018, “Muskrat Falls - Soil & Vegetation Removal from the Future Reservoir Area – Targeted Scenarios”, MFA-SN-CD-0000-EN-RP-0015-01 RevB1 provided an assessment of the scope and cost associated with targeted mitigation (removal or cover) scenarios in the Muskrat Falls Reservoir.

The original SNCL assessment was completed on March 4th, 2018, when the time available to complete the targeted mitigation actions was 15 months prior to the 2019 spring freshet. The following information is provided as a **supplement** to this report and considers the impact of implementing Scenario A (wetland capping) in a five month window from January, 2019 in order to be complete prior to spring freshet, and reservoir impoundment which is scheduled to take place following the freshet.

**2. Scope of Work (Scenario A)**

The following scope is extracted from IEC memo dated 23 January 2018: “Cap all fen and low shrub bog (but not marsh) wetland Ecological Land Classification (ELC) areas identified by the IEC between 23.5 and 39 m asl with sediments that are low in total organic carbon (<2%), locally available and will be stable (resistant to erosion from water flow) on the reservoir bed.” The total target areas identified are comprised of two large contiguous areas on the north side and three sporadic areas on the south side of the lower Churchill River. The north side areas cover approximately 36 ha of the 39.5 ha identified in Scenario A.

In addition, the IEC memo also stated:

- The IEC subcommittee does not expect capping material to be imported, but will be sourced from areas adjacent to the target areas that are typically identified as lower in carbon. IEC has provided mapping that identifies the fen/bog areas for the Scenario A work.
- Stability of the sediment cap is more important than thickness; a minimum thickness of 50 cm is required to provide a suitable surcharged mass to resist bog floating. The Cap should isolate the organic wetland soils, particularly peat accumulations, from the water column. It has been assumed [by the IEC] that sand or sandy clay (preferred) are locally available as a capping material. This has not been confirmed.
- Conduct work during frozen ground conditions (to minimize access and nearby ground disturbance).

### **3. Constructability Considerations**

Access is the most challenging factor given the available schedule. All bodies of water have been frozen since December and will not reopen until after April 2019. This limits access to shore front and precludes the opportunity to use barges and water borne access to the south side targets. Therefore, access to the south side wetland targets must occur overland during the winter freeze period, as barge access will not be possible before the commencement of inundation mid-Summer 2019. It is also important to note that the roadway built to support vegetation clearing was decommissioned once the work was completed and is no longer suitable for safe travel (see Photograph #1), unless completely frozen. Building a new, 21 km long road, suitable for haul trucks to the three south side target sites will require a full construction season. This road would include the replacement of the substantial bridge across Thomas Brook, which was decommissioned on completion of the clearing contract.

On the north side there are two wetland target areas to consider. Target Area 1 is located in Lower Brook area and is at an estimated elevation of 23 m to 24 m asl. The water in the reservoir is currently being maintained at an elevation of 23.0 m asl with an operating range of +/- 0.5 m, and therefore this wetland is already all, or partially, below the reservoir level. Approaches for access road construction to this area are also lower than the current reservoir level. In addition, it is currently planned to raise the reservoir level to 25 m asl prior to the spring freshet to allow sufficient capacity at the Muskrat Falls spillway for passage of the spring freshet, and to address ice handling issues.

The access to the other target area on the north side, Target Area 5, is located near a former camp near Edwards Island. The access to this site was also decommissioned and the camp removed following completion of the work in 2018.

## **4. Additional Study Requirements**

### **4.1 Delineation of South Side Wetland Targets**

One of the wetland targets on the north side (Area 5) has been probed to delineate depth. Surveys were also completed to establish suitable access and areal extent of this north side target wetland. None of the other target wetlands have been probed or delineated. This work is required to develop engineering designs, as well as safety plans, to ensure any persons and equipment are not at risk working near or over the wetlands. The vertical and horizontal delineation of the target wetlands must be completed before the work is permitted. Probe studies during frozen conditions are challenging and require mechanical augers and equipment. A winter probe study will require special methodologies to be developed to accommodate an increase in safety risks, as well as challenging mobilization requirements. The results of the wetland delineation must then be compiled and the capping specification determined for each candidate area. This exercise would typically take several months to complete.

### **4.2 Identification of Suitable Capping Materials**

The original feasibility assessment assumes capping materials can be sourced in the proximity of the target wetlands sites. Suitable materials must have low organic content and be free draining. The material must also be workable in freezing conditions and exhibit reasonable erosion resistance. While suitable material has been identified for the north side Target Area 5, there is no information on the soils adjacent of the other target wetlands. A geotechnical survey will be required to identify capping materials on the south side.

## **5. Environmental Issues**

### **5.1 Migratory Bird and Habitat Protection**

The Project authorization and environmental assessment *Conditions of Release* provide for protection of migratory birds and related habitat. Buffer zones are required around seasonally established nest sites during reservoir development. Wetland areas are a favoured nesting habitat. Some migratory species may start arriving in late April. Work after this period will be restricted and require a pre-survey to identify nesting locations. Encroachment will be restricted at these locations. The removal and/or relocation of established nests require provincial regulatory approval.

### **5.2 Environmental Protection Plans (EPP)**

EPPs are an important component of overall Project planning and implementation. A Project - Wide Environmental Protection Plan (P-WEPP) has been prepared and will be applied to all Lower Churchill Project (LCP) activities, and attached to the Contract Specification. In addition, unlike the P-WEPP which is prepared by LCP, the Contract Specific Environmental Protection Plan (C-SEPP) is prepared by the Contractor and is a document that is specific to the project component and provides a practical way in which Contractors will demonstrate their understanding of environmental regulations, practices and

procedures required to reduce, or eliminate, potential negative environmental effects. A C-SEPP will be a mandatory requirement for wetland capping program.

## 6. Capping Target Wetlands After Inundation

The placement of the capping material over the wetland target areas after inundation was not assessed in detail in the original SNCL Feasibility Report. The report, however, did provide comment on this approach. Our opinion on this approach remains unchanged. It is not recommended. In addition to the points raised by the SNCL assessment (provided below) it is understood that the peak amount of methyl mercury will be released within the first few months following reservoir creation, after which the release rate drops slowly and eventually migrates back towards background. Mandatory safety considerations will not permit work on the river until the reservoir has been stable at full supply level of 39 m asl for some time, and certainly not until the threat of minor landslides and floating debris has passed. This is likely to take several months if not a full season. The mitigating value of placing capping material some time after reservoir creation may be of reduced value and comes with safety risks.

From previous SNCL comments on Working on Water to place capping materials:

- Any work over water is inherently more dangerous.
- Work would be restricted to the open water season (no ice present).
- 99% of the targeted area in Scenario A is below 37 m (2m of water) and 76% below 35 m (4m of water). This depth limits placement operation with a barge mounted backhoe. For depths greater than 4 m, a long reach excavator with a smaller bucket would have to be used; this would reduce progress.
- Placing material in a water column to cap a deposit presents its own challenges:
  - Sands disperse in a water column particularly where there is a current. The resulting deposit will be very loose and will disperse as it is placed requiring greater volumes being placed than need to achieve cover (the remainder distributed beyond the required areas).
  - Clays can be dropped as blocks but coverage may be variable requiring significantly more than 0.5m thickness to be confident of cover. Or extensive survey and controlled placement from barge mounted backhoe could be applied.
- Placement would be most effective with gravel which would be less affected by currents and less likely to be dispersed.
  - Placement systems can include the use of discharge pipes which are controlled from the surface. They can be very effective in improving placement of materials: rate of production, accuracy and reduction in the potential to disperse in a water column (providing the discharge is near the base of the water column).

- Removal of material from the reservoir can be achieved with dredging equipment. However, large woody debris and muskeg/peat (which has a high potential to float as it is lighter than water) can be drawn into the powerhouse intakes causing the equipment to be impeded and damaged. In similar operations in controlled tailings ponds in the oil sands the down time and damage to pumps has been high and costly. This has been true even where extensive robust multiple screen and boom systems have been used with up to five layers of filtering.
- All placement and removal operations that use tools (including arms and pipes) that come in near contact with the original ground or projection (trees, bushes etc.) from the newly created reservoir floor are at risk. The operation may be delayed (damage to equipment) and there is a significant safety risk to operators.

## **7. Slope Stability and Landslide**

The banks of the Churchill River are composed of sedimentary deposits that are prone to landslides. At the North Spur, extensive effort was put into the construction to reinforce and stabilize the slopes and mitigate the risk of landslides. On-going monitoring of the rim has been put in place during the construction period to record any landslides that may occur within the future reservoir area. The monitoring consists of a helicopter survey to view the banks of the river and note any areas of changing conditions such as high toe erosion which may indicate the potential for a landslide. It has been observed that there are frequent small, surficial landslides. If a landslide occurred at or near sites where capping work is underway, it could compromise access to the area or capping materials, and potentially endanger workers at the site. There is potential for this to happen in the vicinity of Target Areas 1 to 4, where the steep slopes indicate a high risk for slope stability.

The operation will involve working near sensitive clays. Movements in these clays could be triggered by engineering works, such as placement of material or construction of roads or the removal of material from the toe of the slope. Roads will have to be aligned to reduce risk of failure. Should an unstable slope develop, additional costs will be incurred in stabilizing the movement to allow the work to continue; this is likely to involve significant earthworks.

## **8. Engineering Design, Bidding and Award Timelines**

In order to undertake the work for capping of the target areas, engineering design and preparation of contract documents will need to take place. As identified in the previous studies, the lack of geotechnical information and on-site information about target areas, means that there will be uncertainty in certain aspects of the work, such as sources of capping materials and depth and extent of the areas to be capped.

Some initial preparations were made for capping of Target Area 5 in 2018, but that work did not proceed, and since then the road and camp have been decommissioned. This does give an indication of the amount of time required for design document preparations, as that took nearly two months to

complete, including the field work to determine the extent of the wetlands to be capped. Similar work would be required for the other areas, however undertaking the field work in the winter is problematic, as described previously.

The drawings, specifications and required contract documents could be completed within approximately two months. The documents would then be ready for issue for bidding by potential contractors. The bidding period required by the project is 90 days from the time of issue. Following the bid closing, bids must be assessed and recommendations made on award, which would typically take 30 to 60 days from bid closing.

Therefore, there will be a five to seven month period required for document preparation, bidding and award of the contract, which means it cannot be completed prior to spring freshet.

The previous review of the feasibility assumed a six month period available for procurement and Contractor mobilization, and the comment was made that it was unlikely that that was sufficient time for this to take place. The previous study also assumed that five months would be available to undertake the work once the Contractor was mobilized and ready to begin the work.

## 9. Conclusions

A supplemental feasibility assessment has been undertaken by SNCL of wetland capping prior to the 2019 spring freshet. This involved a review and assessment of the work identified in the SNCL report prepared in March 2018, "Muskrat Falls - Soil & Vegetation Removal from the Future Reservoir Area – Targeted Scenarios", MFA-SN-CD-0000-EN-RP-0015-01 RevB1. The spring freshet period spans from 15 April to 15 June.

This review has found that it is not feasible to undertake the capping in the five months available between end of January 2019 and the start of the freshet. Some of the key points for this conclusion include:

- Road access to south side sides is no longer in place.
- The reservoir will be raised to 25 m asl prior to the spring freshet.
- One of the target areas (Area 1) is already at or below the current reservoir level.
- The wetland targets have not been properly delineated or probed to determine extent of work.
- Sources of capping materials have not been identified.
- Permits and approvals are not in place.
- There is insufficient time for development and approval C-SEPP and safety plans.
- There is insufficient time for the design, bidding and award of the contract.
- There is insufficient time for mobilization of a Contractor to undertake the work.

Immediately after spring, the groundwater table remains high, and the ground surface is saturated, making access to the target sites difficult and dangerous, and with increased risk of landslides. It is unlikely that any work could be undertaken prior to mid-summer for this reason. It is also planned that



impoundment of the reservoir will begin after the spring freshet, in mid-summer, so there would not be sufficient time to undertake the work.

This review also examined the feasibility of capping target wetlands after impoundment based on comments provided in the previous study. This approach is not recommended as there would be a safety risk that will require a significant mitigation effort. In addition, it is likely to take a considerable amount of time following impoundment to address the issues before the capping could begin (likely more than two years). It is also understood that to maximize mitigation, under this scenario, capping should be completed immediately following reservoir creation, which will not be possible.

A handwritten signature in black ink, appearing to read 'D. Haley', with a horizontal line underneath.

David Haley P.Eng, FEC,EP  
Regional Director - Infrastructure Engineering  
**SNC-LAVALIN INC.**

Photograph # 1 – Southside Access Road Condition – Following decommissioning.

