Nalcor Energy – Lower Churchill Project

Muskrat Falls Wetland and Riparian Plan:

Compensation and Monitoring

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Status / Revision	Date	Reason for Issue	Prepared by	Functional Manager Approval	Quality Assurance Approval	Project Manager Approval
B5	29-Nov-2022	Revised based on regulatory review	Jackie Wells (signed)	N/A	N/A	N/A
B4	05-July-2021	Revised based on regulatory review	Jackie Wells	Marion Organ	David Green	Gilbert Bennett
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B2	08-May-2019	Revised based on Regulatory Review	Jackie Wells	Marion Organ	David Green	Gilbert Bennett

Note: 1. "LCP" coded documents require all Project Managers' approval.

Inter-Departmental / Discipline Approval (where required)

Department	Department Manager Approval

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1 PURPOSE

The purpose of this *Muskrat Falls Wetland and Riparian Plan: Compensation and Monitoring* (the Plan) is to:

- Fulfill the requirements of environmental assessment release of a Wetland Habitat Compensation Plan, in accordance with the recommendations of the Joint Review Panel and the response from the Province of Newfoundland and Labrador that it be in accordance with the Federal Wetland Conservation Policy.
- Facilitate the re-establishment of functional native wetland and riparian plant species in the Muskrat Falls Project (Project) Area;
- Identify and optimize synergies with the reclamation of Project features to facilitate wetland and riparian development;
- Contribute to boreal wetland restoration partnership opportunities;
- Contribute to boreal wetland and wildlife habitat use research;
- Promote the stewardship of wetland conservation in the province via strategic partnerships; and
- Apply the principles of environmental assessment (EA), including monitoring, follow-up and adaptive management to wetland mitigation for the Project.

Nalcor Energy (Nalcor) will provide the provincial Environmental Assessment Division, Department of Environment and Climate Change with draft and finalized copies of this Plan and at all times adhere to its provisions.

The focus of the initiatives outlined in the Plan are consistent with the *Federal Policy on Wetland Conservation* (FPWC) and the *Operational Framework for Use of Conservation Allowances*.

2 SCOPE

This Plan addresses wetland and riparian contribution to the ecosystem in the Project area pre- and post-construction. The Plan fulfills regulatory requirements associated with the Muskrat Falls Project, in addition, monitoring and follow up data associated with the Plan will be applicable to future hydroelectric development of the lower Churchill River. This Plan is prepared in fulfillment of Section 4 (d)(iv), (d)(v), and (e)(viii) of the Lower Churchill Hydroelectric Generation Project Undertaking Order (O.C. 2012-061).

This Plan focuses on facilitating the development of wetlands and riparian areas, monitoring and adaptive management.

3 DEFINITIONS

Environmental Assessment: The evaluation of the Project's potential environmental risks and effects before it is carried out and identification of ways to improve project design and implementation to prevent, minimize, or mitigate for adverse environmental effects and to enhance positive effects. This includes the Environmental Impact Statement (EIS) (Nalcor 2009a), subsequent Information Requests, and statements issued by the Project during the course of the Environmental Assessment Hearings in 2011.

Environmental Management: The management of human interactions with the environment (e.g., air, water and land and all species that occupy these habitats including humans).

Environmental Management System: Part of the project management system used to develop and implement its environmental policy and manage its environmental aspects.

Environmental Protection Plan: Document outlining the specific mitigation measures, contingency plans and emergency response procedures to be implemented during the construction or operations of the Project.

Environmental Effects Monitoring: Programs designed to monitor Project effects and to fulfill EA commitments.

Environmental Compliance Monitoring: Monitoring of Project activities to confirm compliance with regulatory requirements and commitments.

Project Features: Infrastructure required in constructing components of the Project which will not be required during the operational phase. Examples include borrow pits, laydown areas, camp locations, and access roads.

4 ABBREVIATIONS AND ACRONYMS

DMAE – Department of Municipal Affairs and Environment

DUC – Ducks Unlimited Canada

EA – Environmental Assessment

EIS –Environmental Impact Statement

ECCC – Environment Canada and Climate Change

ELC – Ecological Land Classification

FSL – Full Supply Level (Reservoir)

IEAC – Independent Expert Advisory Committee

JRP – Joint Review Panel

MASL – metres above sea level

Project – Lower Churchill Project

LSL – Low Supply Level (Reservoir)

Nalcor – Nalcor Energy

TC – Transport Canada

WRP – Wetland and Riparian Plan

FPWC - Federal Policy on Wetland Conservation

5 REGULATORY COMPLIANCE

Nalcor is required to submit a wetland and riparian plan to the Government of Newfoundland and Labrador for approval by the Minister of Environment and Climate Change pursuant to the Lower Churchill Hydroelectric Generation Project Undertaking Order (the *Order*), under the *Environmental Protection Act* (O.C. 2012-061). JRP recommendation 7.1 stated "The Panel recommends that, if the Project is approved, Nalcor be required to develop a detailed wetland compensation plan in consultation with Environment Canada, the provincial Department of Environment and Conservation, Aboriginal groups and appropriate stakeholders. The plan should set appropriate goals for the re-establishment of wetlands taking into account the purpose served by each type of wetland in the context of the surrounding ecosystem." The Province of Newfoundland and Labrador accepted this recommendation stating that "The Department of Environment and Conservation will work with Environment Canada, Aboriginal groups and appropriate stakeholders to advise Nalcor on the development and implementation of a detailed wetland compensation plan in accordance with the Federal Policy on Wetland Conservation." (JRP, 2012).

The Government of Canada also accepted the JRP recommendation 7.1 regarding the preparation of a wetland mitigation plan in close accordance with the FPWC. With the exception of the requirement for a plan in the *Order* there is no regulatory framework for guidance in development of a plan, however it does consider the Operational Framework for the Use of Conservation Allowance.

On February 5, 2021 Nalcor received further correspondence from the Government of Newfoundland and Labrador, Department of Environment, Climate Change and Municipalities (ECCM), Environmental Assessment Division (see Appendix 15.3). This correspondence was provided by the Department in response to Nalcor's submission of a revised Wetland and Riparian Plan (B3 version). The additional direction provided by the Department specifically addresses the requirement under the Federal Policy on Wetland Conservation with a goal of "no net loss be achieved".

Based on this direction Nalcor has revised the plan to include a comprehensive and multi-faceted approach that extends beyond physical compensation, and is in keeping with the strategies identified in the Policy such as the importance of developing public awareness in wetland conservation.

The Plan approach includes consideration of:

- Mitigation objectives – Performance objectives respecting each adverse environmental effect;
- Mitigation – Measures planned to achieve the mitigation objectives;
- Metrics and targets – Specific, quantifiable, relevant and time constrained;
- Follow-up or Monitoring Programs – How the Project will include follow-up or monitoring surveys to confirm that mitigation strategies are meeting the mitigation objectives; and

- Contingency – Plan to be implemented should monitoring reveal that mitigation measures have not been successful.

6 PROJECT DESCRIPTION

6.1 Muskrat Falls Generation

The Muskrat Falls Hydroelectric Generation Project includes the following sub-components which are broken down under the five principal areas of the development:

- 22 km of access roads, including upgrading and new construction, and temporary bridges;
- 1,500 person accommodations complex (for the construction period); and
- North roller compacted concrete overflow dam;
- South rockfill dam;
- River diversion during construction via the spillway;
- 5 vertical gate spillway;
- Reservoir preparation and reservoir clearing;
- Replacement fish and terrestrial habitat;
- North spur stabilization works;
- Close coupled intake and powerhouse, including:
- 4 intakes with gates and trash racks;
- 4 turbine/generator units at approximately 206 MW each with associated ancillary electrical/mechanical and protection/control equipment;
- 5 power transformers (includes 1 spare), located on the draft tube deck of the powerhouse; and
- 2 Overhead cranes each rated at 450 Tonnes
- Full Supply Level at 39.0 masl; maximum drawdown 0.5 m

The Project includes the development of a hydroelectric generation facility requiring the construction of a dam and reservoir at Muskrat Falls. The Muskrat Falls reservoir will be 101 km^2, with 41 km^2 of newly flooded land. Mitigation for Gull Island will be addressed during construction of that facility.

Figure 1 - Muskrat Falls Generating Facility

6.2 Labrador Transmission Assets (LTA)

LTA consists of the ac transmission line system from Churchill Falls to Muskrat Falls, specifically:

- Churchill Falls switchyard extension;
- Muskrat Falls switchyard;
- Transmission lines from Muskrat Falls to Churchill Falls: double-circuit 315 kV ac, 3 phase lines, double bundle conductor, Single circuit galvanized lattice steel guyed suspension and rigid angle towers; 247 km long; and
- 735 kV Transmission Line at Churchill Falls interconnecting the existing and the new Churchill Falls switchyards.

7 WETLAND HABITAT LOSS

7.1 Wetland Loss

It is estimated through the wetland habitat assessments undertaken that there exists approximately 270 ha of wetland habitat in the future Muskrat Falls reservoir area, with the exact area dependent on seasonal variations in water levels. Appendix 12.1 contains detailed mapping illustrating wetland and riparian area expected within the Muskrat Falls reservoir.

7.2 Existing Wetland and River Habitat

Many of the existing wetlands were surveyed and classified in 2006 (Minaskuat, 2008) for the lower Churchill River system. It was determined that based on the Canadian Wetland Classification System criteria that all five classes of wetland (bog, fen, marsh, swamp, and shallow-water) were found within the system. The assessment area for this study comprised of the Churchill River from Churchill Falls to Muskrat Falls.

From an avian habitat perspective, marshes and riparian habitat found in the lower Churchill area provide the most unique habitat compared with peatland wetlands that are dominant on the surrounding landscape. This habitat is of particular importance to wetland sparrow species as well as waterfowl. Due to the uniqueness of this habitat, re-establishment of this habitat would be a key objective of the wetland restoration process.

A wetland assessment completed from the environmental assessment found there were 103 wetlands. The study area covered a 2 km buffer on either side of the Churchill River from Churchill Falls to Muskrat Falls around the FSL of the reservoir and includes wetland found within this area (AMEC and Minaskuat Limited Partnership, 2008). As the original assessment included the Gull Island Reservoir, Nalcor commissioned Wood PLC to visually assess the occurrence and type of wetland habitats below the 39 m FSL (full supply level) using high resolution imagery. The total terrestrial area to be flooded by the Muskrat Falls reservoir is 41 km^2 which was the focus area for the Wood PLC 2017 assessment.

Wood PLC used multiple data sources including high resolution, LiDAR-based aerial photography, the previous Ecological Land Classification developed by Minaskuat (2008), and Google Earth (2015). These data sources facilitated the identification of wetlands by displaying these areas across multiple seasons (late autumn, summer) when certain wetland features (e.g., ice-covered water bodies) were more apparent. Similarly, the different datasets also displayed the study area prior to and following vegetation clearing and improved the ability to detect small wetland patches such as bogs and fens. Wood PLC used the Canadian Wetland Classification System (National Wetlands Working Group, 1988) as the standard for describing wetland types within the study area. This system contains three hierarchical levels: (1) class, (2) form, and (3) type. Classes are recognized on the basis of the origin of wetland ecosystems; forms are differentiated on the basis of surface morphology, surface pattern, water type and morphology of underlying mineral soil; and types are classified according to vegetation physiognomy. For this assessment coarse-scale wetland classes were defined as being a bog, fen, swamp, marsh, or shallow water based on the apparent presence/absence of peat, and the occurrence and extent of surface water and vegetation cover. For each of sixty images provided by Nalcor, using the highest resolution imagery, the boundary of each wetland was delineated. The wetland class (described above) and area was determined for each polygon.

Wood PLC's analysis of wetland habitat within the Muskrat Falls Reservoir (<39 m) yielded a total of 270.13 ha distributed across 91 discrete habitat patches (Table 1). Table 1 also lists the specific wetland classes by area (in descending order) and indicates that marsh/fen complexes were the dominant habitat type followed by fens, string bogs, and marsh/swamp complexes. Other wetland classes identified throughout the study area included shallow water and combinations of all coarse-level habitat types (Table 1). The analysis identified a larger area of wetland habitat to be lost compared with the earlier ecological land classification (ELC; Minuskuat 2008a) which estimated 219 ha of wetlands below the 39 m contour level. This discrepancy is likely the result of a combination of improved, higher resolution imagery that facilitated the identification of smaller habitat patches that were previously undiscernible during the ELC and also allowed for more accurate mapping of wetland habitat perimeters, as well as seasonal and annual variation in water levels as depicted by the datasets. Given the shallow nature of wetlands (<2 m), rain and/or high spring run-off may drastically affect the areal extent of marshes and shallow water bodies; particularly in low lying areas adjacent to the Churchill River. Given this natural fluctuation, mean annual wetland area is expected to fall within a range rather than as a finite value.

The 91 discrete habitat patches resulting from this review are comprised of five classes including marsh/fen complexes, fens, string bogs, and marsh/swamp complexes. Of the identified classes of wetlands within the study area, the marshes and shallow marshes would be considered unique in a landscape setting. See Appendix 12.1 for mapping of each wetland.

The spatial distribution of each of these wetlands identified in this analysis shows that the largest wetland areas occur in the low elevation zone near the shoreline of the Churchill River (e.g., Appendix 12.1, Figures 9-12). The area of each wetland polygon identified from our analysis is provided in Table 2.

Table 1. Wetland classes and area identified within the Muskrat Falls reservoir (<39 m), using high-resolution imagery, 2017

Wetland class	Area (ha)	% of area	# of polygons
Marsh/fen complex	97.85	36.22	8
Fen	50.60	18.73	22
String bog	20.53	7.60	6
Marsh/swamp complex	20.37	7.54	3
Swamp/fen complex	15.79	5.85	3
Shallow water	14.91	5.52	8
Swamp	12.98	4.81	16
Marsh/swamp	8.39	3.11	1
Shallow water/fen complex	6.36	2.35	3
Fen/swamp complex	5.15	1.91	2
Shallow water/swamp complex	4.51	1.67	2
Bog	4.42	1.64	10

Shallow water/bog complex	3.42	1.27	1
Swamp/shallow water	2.86	1.06	2
Bog/swamp complex	0.96	0.36	1
Marsh	0.65	0.24	2
Swamp/fen	0.39	0.14	1
Total	270.13		91

Table 2. Wetland class and area (ha) for all polygons identified within the Muskrat Falls Reservoir (<39 m) using recent (2016) LiDAR based aerial photography.

Polygon ID	Wetland Class	Area (ha)	Polygon ID	Wetland Class	Area (ha)
B1	Swamp	0.44	B47	Fen	0.42
B2	Bog	0.64	B48	Bog	1.80
B3	Bog	0.23	B49	Bog	0.38
B4	Bog	0.19	B50	Marsh/swamp complex	4.78
B5	Bog	0.20	B51	Fen	1.18
B6	Shallow water	0.24	B52	Swamp	0.30
B7	Marsh/fen complex	1.42	B53	Swamp	0.16
B8	Fen	0.06	B54	Swamp	0.58
B9	Fen	0.35	B55	Swamp	0.80
B10	Swamp	0.63	B56	Fen/swamp complex	3.06
B11	Swamp	2.84	B57	Swamp	0.29
B12	Fen	1.17	B58	Marsh/fen complex	0.55
B13	Swamp/fen complex	14.47	B59	Bog	0.46
B14	Swamp	3.82	B60	Marsh/fen complex	0.80
B15	Marsh/swamp complex	13.48	B61	Fen	2.70
B16	Fen	0.43	B62	Marsh/swamp	8.39
B17	String bog	1.30	B63	Bog	0.08
B18	Marsh/fen complex	8.84	B64	Shallow water/fen complex	1.79
B19	Bog	0.37	B65	Shallow water	0.09
B20	Fen	1.22	B66	Shallow water	0.17
B21	Swamp/fen complex	0.87	B67	Marsh/fen complex	1.25
B22	Marsh/swamp complex	2.10	B68	Fen	0.45
B23	Fen	0.77	B69	Shallow water/bog complex	3.42
B24	String bog	2.62	B70	Fen	1.14
B25	Fen	0.62	B71	Fen	0.09
B26	String bog	3.97	B72	Fen	1.28
B27	String bog	2.96	B73	Marsh/fen complex	82.09
B28	String bog	2.92	B74	Fen	18.27
B29	String bog	6.76	B75	Fen	7.17
B30	Fen	0.59	B76	Shallow water	6.78
B31	Swamp	0.44	B77	Shallow water	2.75
B32	Bog	0.64	B78	Shallow water	3.51
B33	Bog	0.23	B79	Shallow water/fen complex	2.07

B34	Bog	0.19	B80	Shallow water	0.60
B35	Bog	0.20	B81	Shallow water/fen complex	2.50
B36	Shallow water	0.24	B82	Marsh/fen complex	0.64
B37	Marsh/fen complex	1.42	B83	Marsh	0.54
B38	Fen	0.06	B84	Fen	1.06
B39	Fen	0.35	B85	Fen	0.40
B40	Swamp	0.63	B86	Fen	9.41
B41	Swamp	2.84	B87	Swamp	0.93
B42	Fen	1.17	B88	Swamp	0.91
B43	Swamp/fen complex	14.47	B89	Swamp/shallow water	2.57
B44	Swamp	3.82	B90	Marsh/fen complex	2.24
B45	Marsh/swamp complex	13.48	B91	Fen	1.70
B46	Shallow water	0.77		**TOTAL**	270.13

8 WETLAND HABITAT CREATED

8.1 Reservoir Preparation and Riparian Re-establishment

Construction of the north and south dams will result in the formation of a 59 km long reservoir. At FSL, the area of impoundment will be 41 km², resulting in a reservoir with a total surface area of 101 km². Preparing the reservoir prior to impoundment involved removal of vegetation (timber and brush) along the reservoir perimeter to 3 m below LSL (ice impact zone) (see Figure 2). As indicated, this area extends vertically to elevation 42 m (3.0 m above FSL). Reservoir preparation included the removal of approximately 70% in volume of vegetation from the future reservoir area.

The reservoir will operate near 39 m at FSL. The reservoir preparation approach included clearing an additional 15 m above FSL around the edge of the future reservoir which will result in a new natural shoreline and riparian zone. Reservoir preparation, combined with the operating regime of the reservoir, will result in the development of a stable littoral zone, shoreline, new wetland habitat, and a vegetated riparian zone.

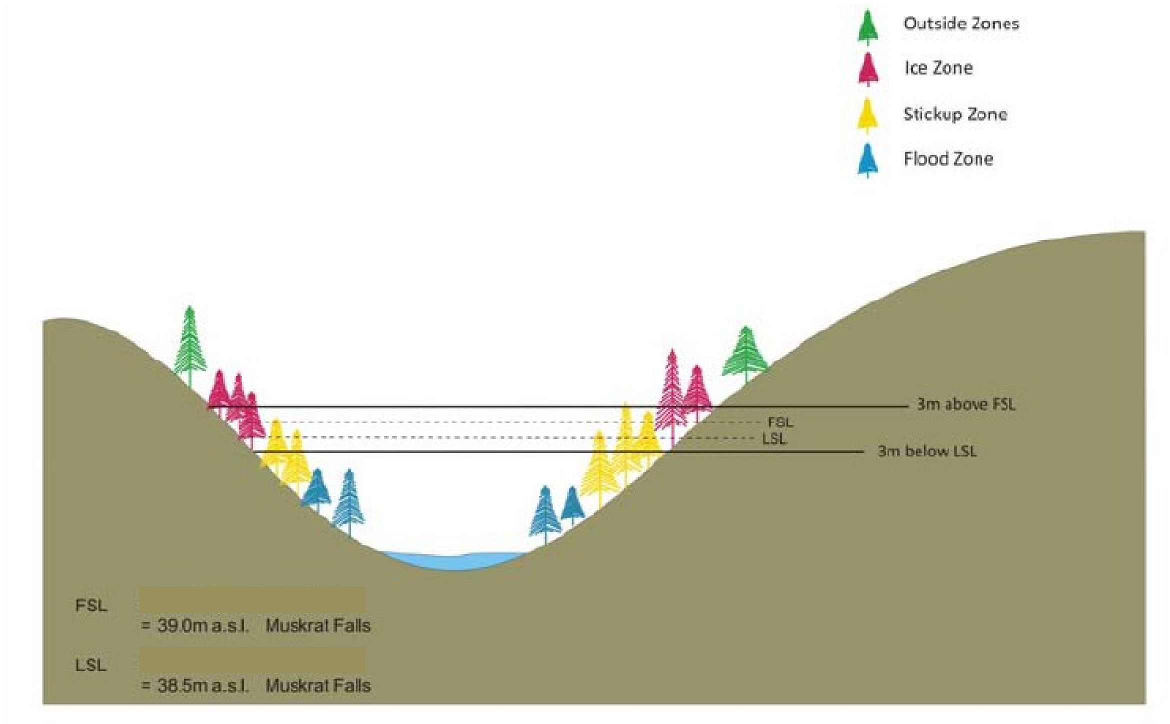

Figure 2 - Reservoir Preparation

Clearing associated with the Project included the clearing of timber in the ice and stickup zones, where it is safe to do so (i.e., slope ≤30%). Buffer zones (15 m) of undisturbed vegetation were maintained along all existing tributaries and the main stem of the lower Churchill River to limit the potential for siltation resulting during pre-impoundment runoff events and act as a wildlife refuge.

Preparation at these sites included normal clearing associated with the reservoir clearing activities, however, stumps, root systems, organic material, and topsoil remain to bio-mechanically protect these sites from erosion and provide an organic substrate for the establishment of wetland vegetation. Figure 3 illustrates the Muskrat Falls reservoir preparation that will facilitate wetland and riparian re-establishment.

The reservoir clearing strategy facilitates the re-establishment of wetland habitats within the lower Churchill River valley and Nalcor will monitor the success of the reestablishment of wetlands. The re-establishment of wetland habitats in these areas will be monitored and classified and compared with the percentages previously present below the FSL (see Section 10).

Figure 3 - Illustrates flat area just above the FSL which has been cleared and will have high potential for natural wetland development once reservoir impounded to FSL

8.2 Natural Wetland Development

Wetlands will naturally develop in areas influenced by reservoir impoundment where wetlands have not previously existed. In an analysis completed by Stantec (2011) there will be 167.4 ha adjacent to the reservoir where wetlands are expected to develop due to the ground elevation and hydrologic conditions. A subsequent review of LiDar and orthoimagery was completed in November 2017 to further delineate wetland formation and the area was estimated to be 154 ha in the reservoir area (see Appendix 12.2). This included locations where suitable organic substrate is found within a range of 0.5 m beneath the FSL to 0.5 m above FSL (38.5 m-39.5 m) that are not subjected to erosion or destructive scour by waves, current and ice.

Where erosion and destructive waves and ice occur, wetlands will naturally develop above FSL, typically as riparian thicket habitats. Sources of seed and vegetative propagules of hydrophytic plant species will be naturally introduced into these areas to promote wetland development, typically from the abundant adjacent wetland areas, borne on wind and flowing water, or via wildlife dispersal. This re-creation of habitat is expected to provide areas for affected species to exploit.

Additionally, in areas where slumping occurs, the creation of additional wetlands may also naturally occur.

8.3 Wetland Development from Project Features

The Muskrat Falls Project, Labrador Transmission Assets and the Labrador-Island Link footprint include areas that are outside the future reservoir. The network of roads, tower boxes, and other features within the project footprint will result in new impoundments and the formation of wetlands. Nalcor has an objective of developing approximately 5 ha of functional wetland throughout these areas. These locations will be confirmed through the monitoring program. Project related features may include laydown areas, quarries, camp and administration sites, transmission rights-of-way, and roads.

Creating wetlands in an altered landscape would create additional wetland function while minimizing project footprint by rehabilitation rather than disturbing new areas.

9 RESIDUAL WETLAND LOSS

Based on the quantification provided in sections 7.0 and 8.0, it is expected that the estimated residual loss in wetlands will be approximately 100 ha. In order to determine an appropriate conservation allowance the FPWC framework for mitigating proposed impacts to wetlands was applied. It should be noted that the Policy "commits all federal departments to the overall goal of no net loss of wetland functions: 1) on federal lands and waters, 2) in areas affected by the implementation of federal programs where the continuing loss or degradation of wetlands has reached critical levels, and 3) where federal activities affect wetlands designated as ecologically or socio-ecologically important to a region." Neither of these terms applies to this Project. Nalcor does however, support the FPWC objective of "promoting the conservation of Canada's wetlands to sustain their ecological and socio-economic functions, now and in the future."

10 DIRECT COMPENSATION FOR RESIDUAL WETLAND LOSS

The Operational Framework for the Use of Conservation Allowances provides guidance to proponents on the use of conservation allowances when the residual environmental effects cannot be avoided or sufficiently minimized. It states that consideration should be given to: 1) Nature of the proposed impact and the sensitivity of the receiving environment; 2) Financial implication and the effects on the environment; 3) Current state of technical knowledge and the likelihood the option can be successful; and 4) Ability to successfully mitigate the effects by replacing the affected habitat with a new area performing similar ecological function to those lost.

1) The nature of the proposed impact and the sensitivity of the receiving environment was described and documented during the environmental assessment. The residual environmental effect of construction (i.e., the creation of the reservoir) on the wetland sparrow population in the lower Churchill River valley was determined to be not significant, given that wetland sparrows will continue to breed in abundant undisturbed habitat in the assessment area and anticipated new wetland areas (Nalcor Energy, 2009). The ecological land classification (Minaskuat 2008a) for the Lower Churchill Project estimated that there are 3,518 km^2 of primary wetland sparrow habitat within the lower Churchill River watershed which could function as alternative nesting and foraging areas for birds displaced by flooding. Assuming that all habitat niches are not fully occupied (i.e., the system is below ‘carrying capacity’) it is likely that many individuals will become established throughout this region during the period of re-establishment. Population-wide declines for wetland sparrows (i.e., the key indicator species from the environmental assessment) is not predicted given the small area of impacted wetlands (approximately 270 ha) relative to their availability across the greater landscape.

2) The financial implication and the effects on the environment have also been considered. Nalcor recognizes the concerns expressed by stakeholders related to the potential relationship between wetlands and methyl mercury formation in reservoirs. In October, 2016, the Independent Expert Advisory Committee (IEAC) was established as a result of an agreement reached by the Government of Newfoundland and Labrador, the Nunatsiavut Government, the Innu Nation and the NunatuKavut Community Council. The three Indigenous groups and the local population have

concerns about the impact of methylmercury on country foods – which are important culturally, socially and to food security. The contribution of wetlands and associated organic soils was recognized by the IEAC which stated, "All the options considered by the IEC for pre-project mitigation are based on the well-established, positive, linear relationship between concentrations of organic carbon in flooded soils and associated lower vegetation, and the rate of mercury methylation." Based on this known relationship one of the mitigations considered by the IEAC was the capping of existing wetlands in the reservoir noting that, "One other way of 'removing' OC (organic carbon) is to make it physically unavailable to methylating bacteria (refer to Jansen, February 28, 2018, capping methodology)."

The creation of *additional* wetlands adjacent to the Churchill River could potentially lead to additional contribution of methylmercury from natural flooding events of those new wetlands. While it is considered extremely unlikely that the project would significantly increase future human methylmercury exposures and risks beyond what occurs under current, existing baseline conditions (Dillon 2018; Azimuth 2018a), and the likelihood that the contributions would be small, based on the findings of the IEAC and the concerns expressed by local indigenous groups, the decision to do so would not be prudent.

3) & 4) Likelihood of success

Based upon consultant experience from other reservoir projects (Golder, 2011; 2010a; 2010b), it is anticipated that the initial formation of the Muskrat Falls reservoir will present a challenging environment for development of wetlands until the reservoir stabilizes. However, as observed in reservoirs in British Columbia, there are examples of natural development of wetlands since their initial impoundment. Considering this, the Project proposes reservoir-independent options in addition to the anticipated naturally developed wetland areas. The intent is to limit expenditures associated with large-scale wetland initiatives in what is largely an experimental setting that has evolving and/or potentially unstable habitat conditions during the formative years of the reservoir.

Typical approaches to wetlands compensation that involve construction to replace the quantity of lost habitat and functions are expensive, and vulnerable to various modes of failure, usually associated with natural events and the manipulation of the natural components that make up wetland compensation projects. It is not unusual for wetland compensation projects to unexpectedly fail to meet some or all performance objectives, despite substantial expenditure of money and effort. Such failures can lead either to abandonment of the project, or require expensive adaptive management measures and potentially renegotiation with regulators involved with the project.

Wetland compensation projects involving grading and construction, introduction or alteration of hydrologic regimes, and planting vegetation involve risks associated with various potential modes of failure that can be costly. Such risks may be difficult to minimize with engineering efforts since naturally functioning systems with minimal engineering controls are typically the desired outcome of wetland compensation projects. Attempts at wetland compensation involving increasing degrees of engineering are typically expensive and do not necessarily result in greater reduction in the risk of failure. The most typical mode of failure on wetland compensation projects is the inability to establish a targeted vegetation community, often due to the introduction of nursery-grown plant material or seed into unsuitable constructed substrates and into hydrologic regimes that either limit or prevent growth, reproduction, and proliferation of target vegetation. Such failures typically also result in erosion and loss of soil mediums due to the lack of vegetative cover (Bongarten 1997).

Wetland compensation undertaken within reservoir environments also carries unique risks associated with the physical processes of reservoir establishment and operation. Destructive processes associated with ice, wind, waves, and hydrologic operating regime can induce shoreline erosion and remove soil and vegetation associated with riparian and marsh habitats (Tip of the Mitt Watershed Council 2007). Shoreline erosion in reservoirs can be compounded by the saturation and exposure of soil types that have not evolved under the influence of surface water regimes, as well as exposure to the aforementioned forces, often resulting in large slope failures and deposition of the eroded material into the reservoir perimeter (Klohn Crippen Berger and SNC Lavalin 2009). These disturbance processes can continue for many years, and can result in changing shoreline morphology that is challenging to predict. Efforts expended to establish wetlands along the fringe of a reservoir by constructing such features prior to impoundment of the reservoir, or efforts involving stabilization of the reservoir shore line, are therefore at greater risk of failure than attempting construction post-impoundment. This is of particular concern given the relatively large risk of slope failure in the future Muskrat Falls reservoir.

Reservoir hydrologic operating regime is an additional constraint associated with establishing wetlands within the zone of the hydrologic influence of the reservoir. Reservoir hydrology usually does not mimic the natural hydrologic regimes found in natural wetlands. In the case of Muskrat Falls, reservoir operation will likely enhance the erosive effects of ice, wind and waves at the edge of the reservoir as the reservoir pool fluctuates daily due to draw down for power generation and water storage.

The area of the reservoir fringe within the range of drawdown of both reservoirs will be prone to erosion from wind, ice and waves. Additionally, because reservoir level is expected to be maintained at as close to FSL as possible, most typical wetland vegetation will be prevented from establishing naturally within the littoral fringe of the reservoir below FSL. Most wetland vegetation, with the exception of true aquatic macrophytes, is suppressed by lack of oxygen, a process typically associated with natural drawdown of water levels over extended periods, such as through the late summer and into the fall through to the spring freshet. Otherwise, propagation of vegetation must occur vegetatively, from the established root systems of existing plants. Newly introduced vegetation will require an extended period of drawdown within which to become established on exposed suitable soil.

11 WETLAND AND RIPARIAN CONSERVATION AND REHABILITATION PROGRAMS AND MONITORING

11.1 Wetland and Riparian Conservation and Rehabilitation Programs

11.1.1 Wetland and Riparian Project Partnerships in Newfoundland and Labrador

Given the challenges associated with direct wetland compensation within the reservoir and project areas in order to achieve the objectives of the Operational Framework of no net loss, and to address the deficiency letter received from the Government of Newfoundland nad Labrador, (see Appendix 15.3), Nalcor proposes to provide funding for wetland conservation and rehabilitation. To determine the appropriate funding amount, a literature review was completed, with a focus on Canadian initiatives. *Navigating the Swamp: Lessons on wetland offsetting for Ontario* states average land values according to the Alberta Wetland Mitigation Directive for public land is $10,300 when used as compensation for restoration, and monitoring (Poulton and Bell, 2017). Based on this, Nalcor commits to making available funding in the amount of $1,000,000. As outlined above, it is expected that approximately 100 ha of wetlands would be the net loss, and based on an approximate $10,000/ha value, Nalcor is commiting to making available annually, $100,000 for a 10 year period commencing in 2022 and ending in 2031. A compensation ratio of 1:1 for net loss of wetlands was used to align with the ratio used at the time of the issuance of the JRP recommendations and therefore the expectation associated with the responses of the Government of Newfoundland and Labrador and the Government of Canada to the Panel's recommendations.

The funding will be made available to wetland conservation and rehabilitation programs within Newfoundland and Labrador. Proposals would be identified through coordination with non-governmental organizations, municipalities and the appropriate regulatory agencies. The following priority and preference order will be established: firstly, provide funding to indigenous groups and/or partnerships in Labrador for wetland conservation and/or rehabilitation programs in Labrador; secondly, provide funding to municipalities, non-governmental organizations and community groups proposing wetland conservation and rehabilitation programs in Labrador; and thirdly, provide funding to municipalities, non-governmental and community groups in Newfoundland proposing wetland conservation and rehabilitation programs.

11.1.2 Other Partnerships in Newfoundland and Labrador

If opportunities to fund projects in 11.1.1 are not realized, Nalcor will identify other opportunities for sponsorships that aid in the creation and/or preservation of known important wetland habitats such as those used by wetland sparrows and/or waterfowl, or identified species under Canada's *Species at Risk Act* and/or Newfoundland and Labrador's *Endangered Species Act*, preferably adjacent to the Project area or elsewhere in Newfoundland and Labrador. Such initiatives could include, but are not limited to:

1) Wetland Inventory: A wetland inventory map of Newfoundland and Labrador was recently created using a remote sensing image processing framework based on five pilot areas throughout the province. The framework comprises multiple algorithms including segmentation, feature extraction, and random forest classification to map wetlands in the province and classify them into five major wetland classes according to the Canadian Wetland Inventory system: bog, fen, marsh, swamp, and shallow water. The framework was tested by extensive field surveys in the five pilot areas that included over 1200 wetland and non-wetland sites. The project was a collaboration by C-CORE, the State University of New York - College of Environment Science and Forestry (ESF), Memorial University of Newfoundland, University of Ottawa, Environment and Climate Change Canada (ECCC), Canada Centre for Remote Sensing, Newfoundland and Labrador Provincial Department of Municipal Affairs and Environment, Ducks Unlimited Canada (DUC), and Nature Conservancy Canada. The Project was undertaken with financial supports of ECCC, Natural Sciences and Engineering Research Council, InnovateNL, and DUC.

   Opportunity may exists to support and further extend this Newfoundland and Labrador derived wetland mapping and inventory system through investment in a more diverse range of multi-temporal datasets (such as the 30 years Landsat dataset) to detect and understand wetland dynamics and trends over time in the province.

2) Education initiatives: The FPWC outlines guiding principles and strategies to meet its objective of “promoting the conservation of Canada’s wetlands to sustain their ecological and socio-economic functions, now and in the future.” One of the guiding principles and strategies involves public attitudes and perceptions regarding wetlands. Potential education initiatives could include:

   - Sponsoring development of elementary or secondary class curriculum that involves field trips to a wetland conservation or rehabilitation project;

- Sponsorship, such as scholarships/bursaries for post-secondary education directed at individuals studying wetland ecology or related fields of study at a post-secondary institution such as the Memorial University of Newfoundland.
    - This initiative could include funding studies on specific wetland mitigation sites implemented by Nalcor to aid in developing future mitigation opportunities, or hiring summer students to aid in annual monitoring activities as part of the Plan.

11.2 Wetland and Riparian Mitigation Plan Monitoring

In accordance with the EA approach, a major component of the wetland mitigation plan includes monitoring the success of the methods associated with habitat development and adjusting them through adaptive management to improve their effectiveness, and to reduce environmental degradation of habitat for wetland sparrows and other wildlife species associated with riparian marsh and thicket habitats.

Monitoring protocols will include: assessing the natural development of the riparian habitat facilitated through reservoir preparation and passively reforming wetlands adjacent to the reservoir; and assessing the effectiveness of rehabilitation of project features.

Monitoring of mitigation methods will involve both physical and biological indicators.

The monitoring plan will be based on assessing four wetland features, including:

- spatial coverage of wetlands;
- classification of wetland types;
- wetland hydrology; and
- coverage of wetland vegetation.

A common scientific and regulatory definition of a wetland is “land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation and various kinds of biological activity which are adapted to a wet environment “ (Hanson et al. 2008). Wetlands are a critically important component of boreal regions and provide multiple 'ecosystem services' including water purification, flood control, carbon storage, and provision of habitats for a wide range of plant and wildlife species (Kusler 2004). In context of the Lower Churchill Project, it is important to monitor the formation of newly created wetlands (following flooding of the Muskrat Falls Reservoir) and to assess their spatial coverage and ecological functioning. This can be achieved by assessing the physical, chemical and biological properties of these wetlands and monitoring these attributes through time. The following section describes a series of monitoring indicators and associated timelines to achieve this goal.

11.2.1 Monitoring Components

Spatial Coverage of Wetlands

An essential monitoring component following creation of the Muskrat Falls Reservoir will be to assess the spatial area (ha) and physical distribution of newly created wetland habitats. Though modelling exercises have provided some indication of where these wetlands will form, a range of environmental factors including precipitation, ice formation, and erosion may influence the eventual extent and size of wetland habitats. The approach for assessing the area and distribution of newly created wetlands will be to obtain high resolution aerial imagery and to use GIS (Geographic Information Systems) to quantify these variables. Remote-sensing data will be collected at three year intervals or until the extent of wetlands is considered stable.

Classification of wetland types

Subsequent to quantifying spatial coverage as described above, all wetland polygons will be described using the hierarchically-based Canadian Wetland Classification System (National Wetlands Working Group 1988). This monitoring indicator is important since the individual wetland classes (marsh, fen, bog, etc.) have varying ecological roles and provide habitat for different biotic communities. Since wetland classes are expected to vary through time (e.g., from flooded woodland to marsh) monitoring the extent and distribution of these classes will provide further insight into wetland compensation efforts. Classification of wetland types can also be accomplished using aerial imagery in combination with ground-truthing a sub-sample of wetland locations.

Wetland hydrology

The assessment of hydrological characteristics is an integral component of wetland monitoring as it can be used to address questions on the physical extend of a wetland type (i.e., 'where does the wetland begin or end?') or whether a restoration program has been successful (Minnesota Board of Soil and Water Resources 2013). Wetland hydrology indicators provide evidence that the site has a continuing wetland hydrologic regime and that hydric soils and hydrophytic vegetation are not temporary states or relicts of the past. Nalcor will establish piezometers to record long-term data on the depth and duration of near-surface saturation and water table fluctuations to provide insight on whether chosen flooded lands are developing and retaining the physical characteristics associated with wetland habitats. Given the tendency for these parameters to fluctuate widely among years and seasons, hydrology measurements will be recorded annually.

Coverage of wetland vegetation

The occurrence of hydrophytic vegetation is one of the defining features of a wetland ecosystem and can be assessed to further refine the class, form, and type of wetland under the Canadian Wetland Classification System (National Wetlands Working Group 1988). Emergent vegetation is indicative of a shallow, stable (or slow moving) water systems and their capacity to support biotic communities including invertebrates, amphibians, birds and mammals. Consequently, the presence of hydrophytic vegetation suggests one component of an ecologically functioning system. We will measure the spatial coverage of hydrophytic vegetation in a random sample of newly created wetlands (shallow water, swamp and marsh habitats only) using a combination of low-level aerial photography and ground truthing. Ground based methods will involve overlaying a 1 m^2 grid along pre-determined transects and measuring the percent cover in each grid cell. The general type of vegetation (e.g., sedges, grasses) and the average height class within each sampling unit will also be recorded. The natural establishment of wetland vegetation is expected to be a long-term process, particularly if active shoreline erosion and rafting of debris occurs during the initial years of reservoir development (Golder Associates 2013). Consequently, the collection of data necessary to track this long-term process will be adjusted to the appropriate frequency.

Avifauna monitoring

As outlined in the Avifauna Protection and Environmental Effects Monitoring Plan (APEEMP), one of the key monitoring programs related to wetland sparrows is the point count breeding bird surveys. The study objective of this monitoring program is to document avian species use of habitat types within the Project area, including cleared habitat types, control habitat types, and created wetland habitat (including the naturally 'encouraged'). It will also determine species abundance and species use of habitat types within the Project area, and provide an evaluation of the success of the wetland habitat created naturally, and will aid in determining if additional wetland creation is required (i.e., effects on wetland sparrow is different than those predicted during the environmental assessment).

In addition to the establishment of birds within newly created wetlands along the high water level, individuals displaced from flooding will be able to exploit vacant territories that occur in similar wetland habitats throughout the lower Churchill River valley and adjacent landscape (as noted in Section 9.0).

Point count breeding bird surveys were conducted in selected habitat types both outside and within the Project area to measure presence and relative abundance of breeding birds. Point locations were distributed to target wetland and other habitat types preferred by at risk bird species. For additional information on this monitoring program, see APEEMP. The results from the pre-construction, construction and post-construction surveys are presented in Stantec (2018). This will be repeated 5 years post-flooding, i.e., 2024, and will be used to determine if there was an effect on wetland sparrows.

Composition of wildlife communities

Since naturally occurring wetlands in the boreal forest biome are known to support diverse biotic communities (Castelle et al. 1994, Fairbairn and Dinsmore 2001), monitoring the diversity and abundance of representative avian and mammalian species will be useful for assessing the ecological health of newly created wetlands. The utilization of these habitats will be assessed by recording species' presence, their estimated abundance, and the type of behaviour displayed (e.g. nesting, foraging, resting, chick/kit-rearing). Similar to anticipated shifts in the physical nature of wetlands, the composition of wildlife communities is expected to change following the emergence of hydrophytic vegetation, increased structural diversity, and the establishment of invertebrate prey species. Species of interest for this monitoring indicator will include the four 'wetland sparrow key indicators', select waterfowl and shorebird species (American Black Duck, Green-winged Teal and Greater Yellowlegs), wetland-associated species at risk (Rusty Blackbird), and American beaver.

Table 3. Monitoring indicators and schedule for assessing the extent of wetland establishment and ecological functioning.

Category	Metric	Sampling frequency
Spatial coverage of wetlands	Area (ha) of naturally developing wetlands	2022; 2025; 2028
Classification of wetland types	Percent cover of dominant wetland types (bog, fen, etc.) relative to pre-flooding coverage	2022; 2025; 2028
Wetland hydrology	Depth and duration of near-surface saturation	2022; 2025; 2028
Coverage of wetland vegetation	Percent cover of hydrophytic vegetation	2022; 2025; 2028
Composition of wildlife communities	Occurrence and density of KI sparrows; species richness (select bird species)	2024

The monitoring approach will include a plan for identifying, and reporting natural wetland development at such locations to quantify the amount and character of wetlands naturally regenerated. This will document the degree of wetland re-establishment that has accrued through natural processes with facilitation through the reservoir preparation approach, while providing valuable experience in not only modeling where such natural development may be expected in future developments, but also aid in methods that may be applied to enhance or augment such naturally developed wetlands in the Muskrat Falls reservoir.

11.3 Scientific Research and Knowledge and Reporting

The results of the conservation and rehabilitation programs as well as the monitoring program will be made available to all stakeholders via the company website. Summaries of the funded partnerships and conversation and rehabilitation programs, and the wetland monitoring program will be shared to contribute to the knowledge base for the northern hydroelectric industry and other developments that could impact wetlands.

12 ADAPTIVE MANAGEMENT

Adaptive management is a structured and rigorous process designed to improve management policies and practices by learning from the outcomes of operational programs (D'Eon 2008; Walters 1986). As such, adaptive management is considered one of the best ways for managers to proceed in the face of uncertainty (Golder 2009). Adaptive management will be an essential component of the Plan since modifications to the approach implemented in the Plan will be necessary to redirect effort, cost, and schedule in response to environmental conditions and the success of specific wetland mitigation methods. Adaptive management, as part of the Plan, will utilize performance evaluation observations to implement decisions to change or modify the intensity or extend the duration of support of efforts directed towards wetland restoration and/or stewardship. Other opportunities will exist to facilitate wetland development, in case the habitat type becomes limiting for key indicators, such as introduction of hydrophytic vegetation, to sites with hydrologic conditions sufficient for wetland development.

If the findings of the avifauna environmental effects monitoring study in 2024, indicate there has been an effect on the wetland sparrow population, adaptive management considerations could include an extension to the avifauna monitoring program, or a focus on their specific habitat requirements and initiatives to restore the specific habitat requirements for these species near the study area.

13 CONSULTATION

The Plan is subject to the Government of Newfoundland Aboriginal Consultation Guidelines. In addition, this Plan will be circulated to the Innu Nation via the Project's Environmental Management Committee for review and comment. The Plan will be made available to all stakeholders via the Project website. All comments and input will be considered by the Project.

All relevant reports from this plan will be made available on the NL Hydro website and provided to the Department of Fisheries, Forestry and Agriculture, Wildlife Division.

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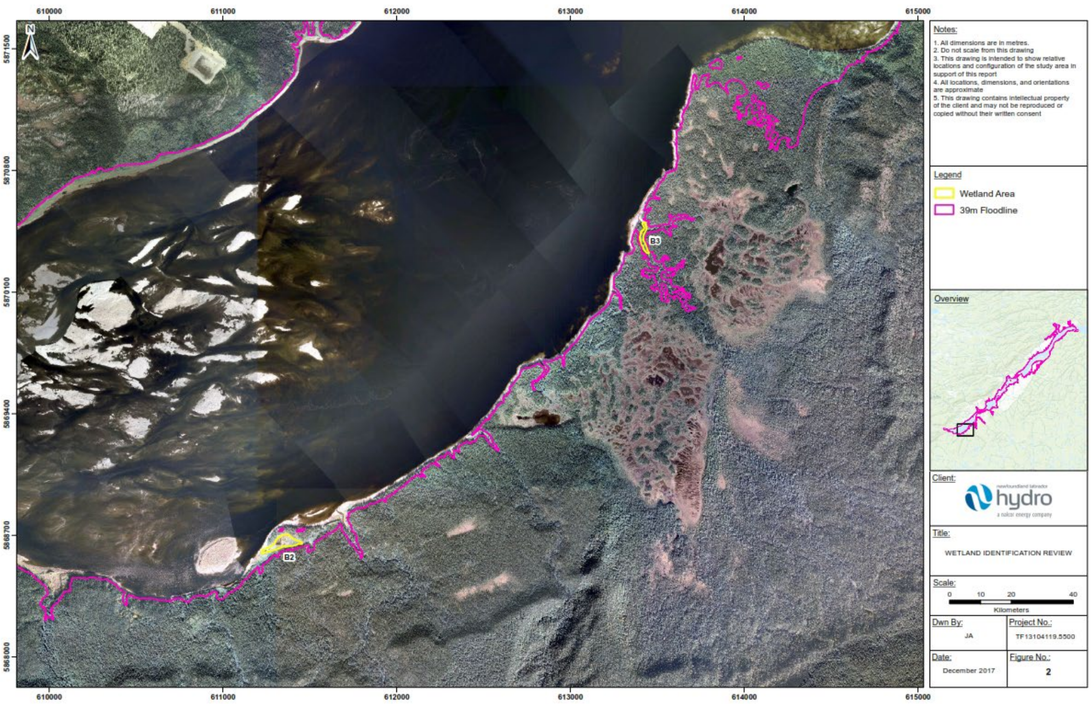
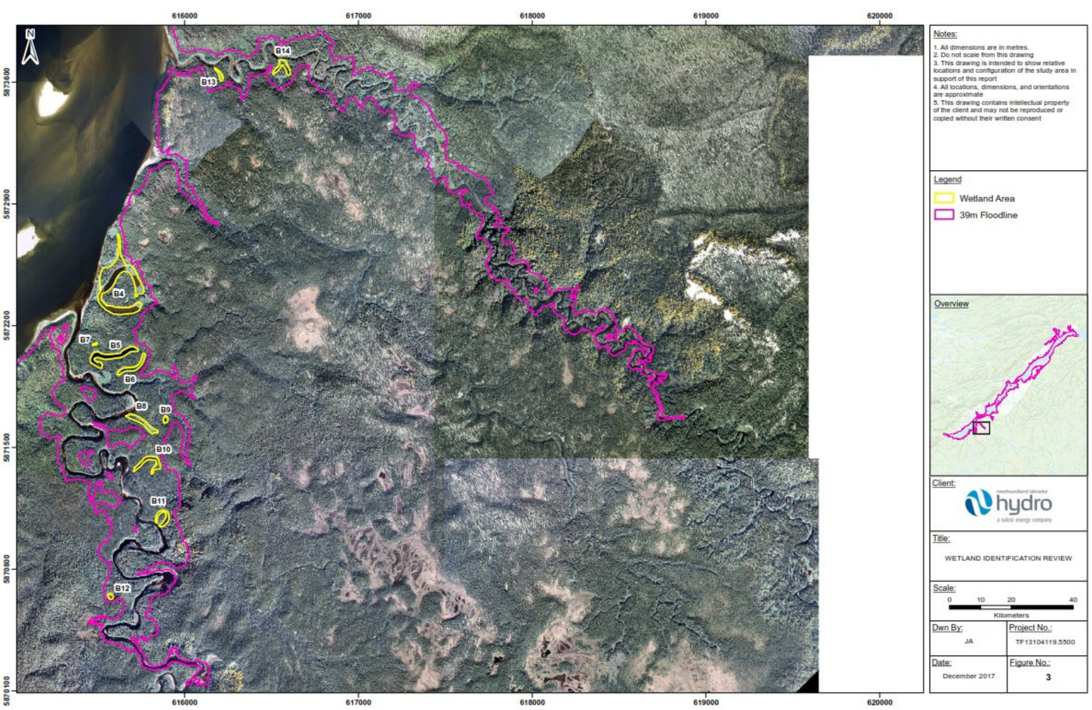
15 APPENDICIES

15.1 Muskrat Falls Wetland and Riparian Quantification Mapping

Distribution of Wetlands Habitats within the Muskrat Falls Reservoir (<39 m)





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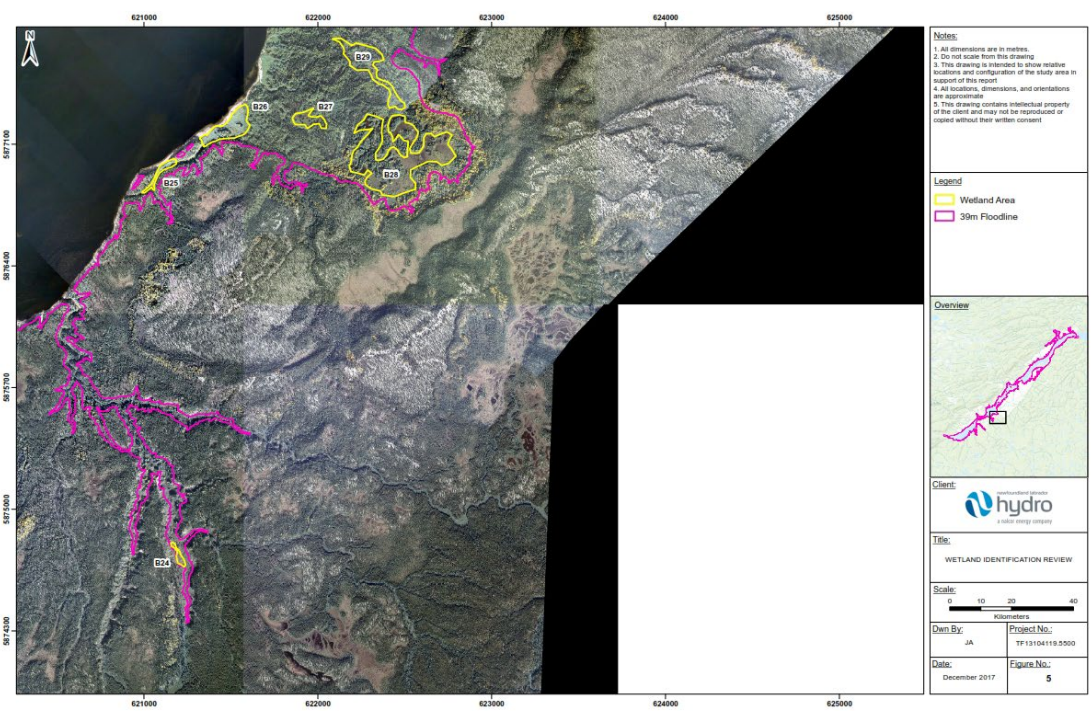

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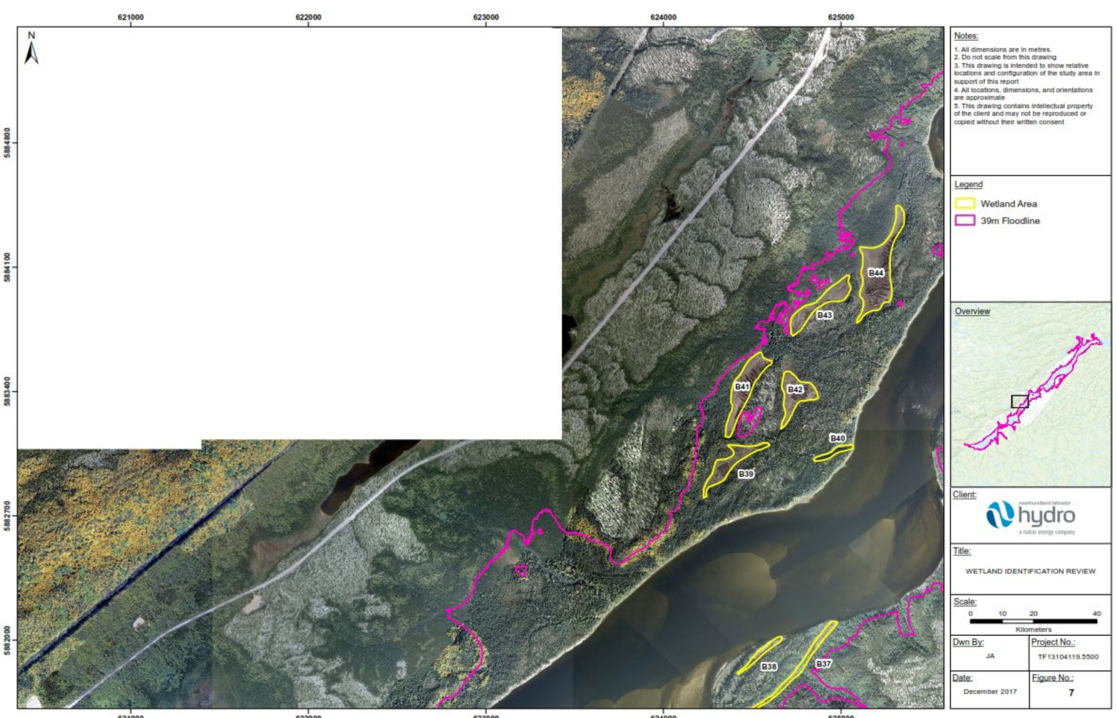

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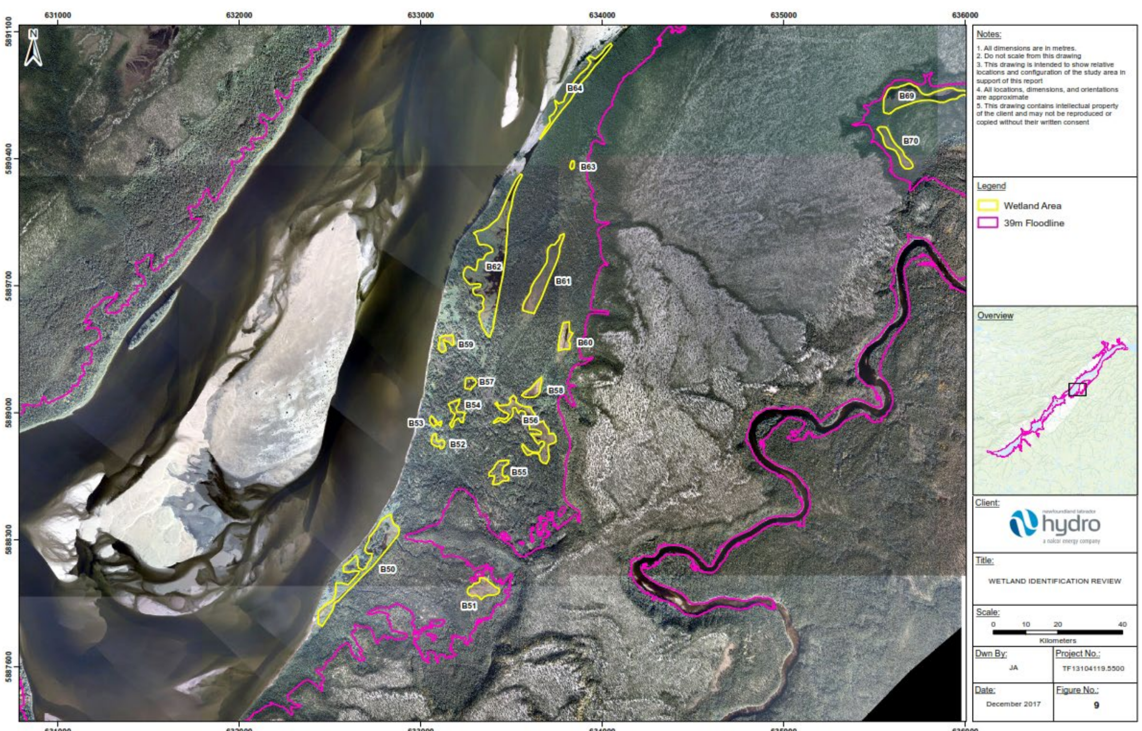

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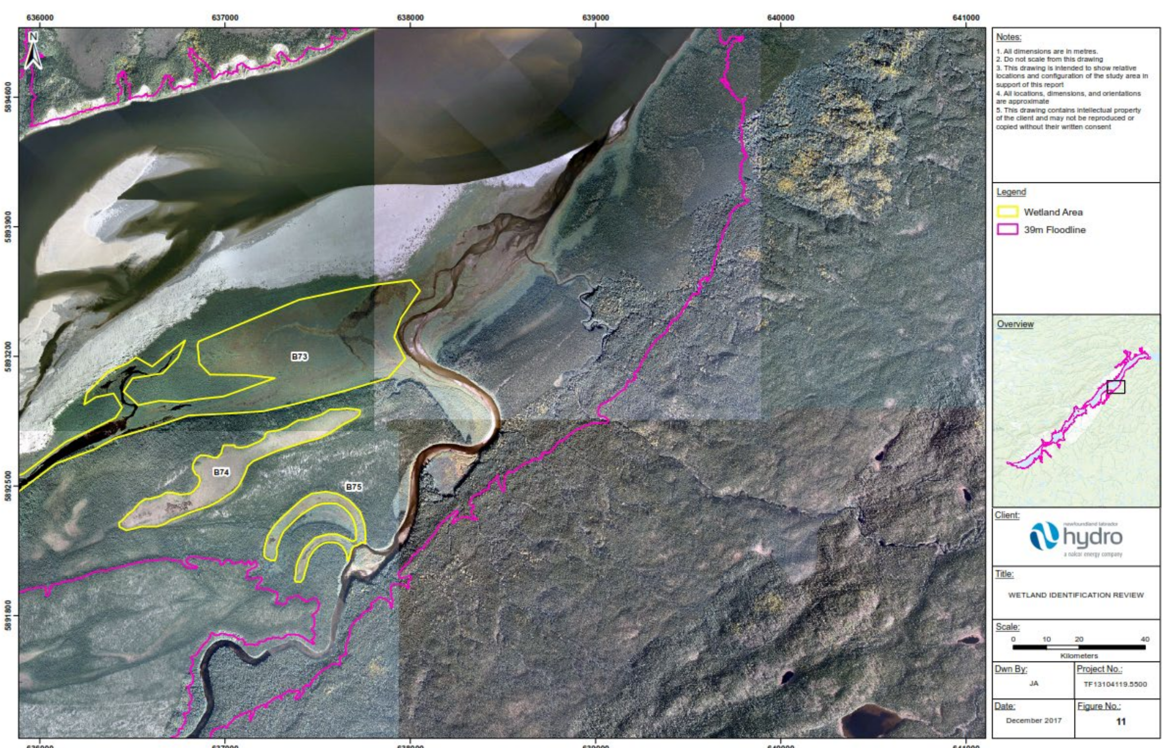

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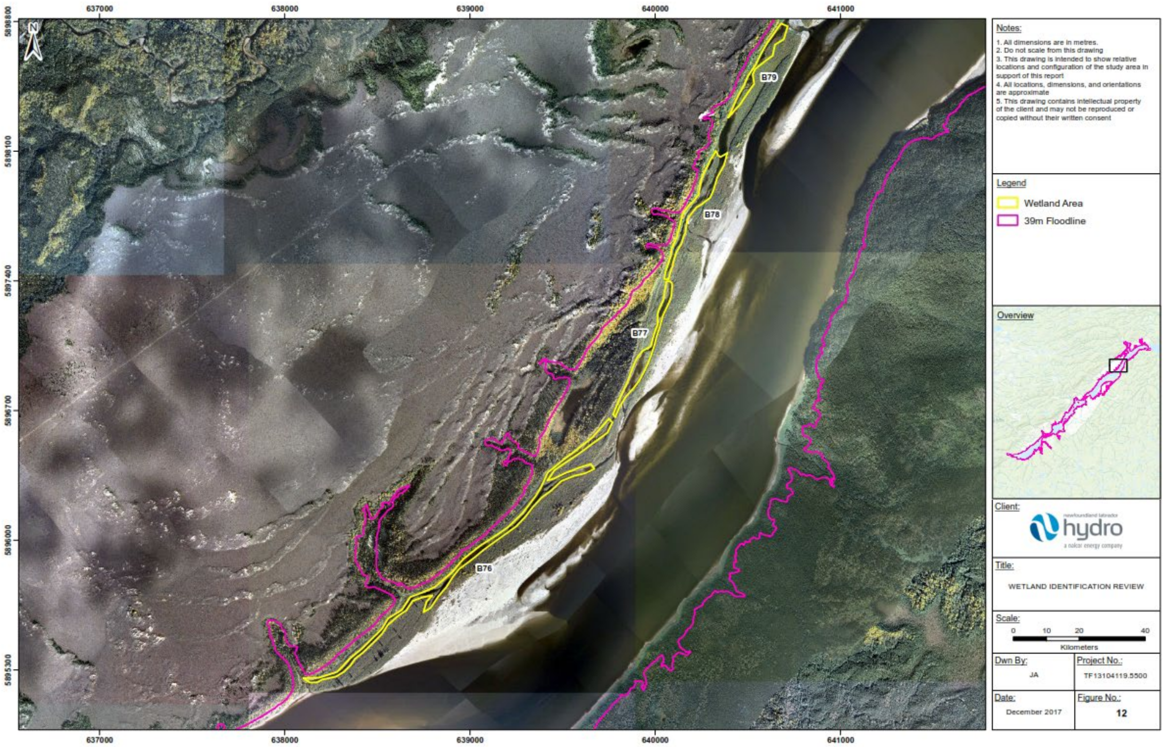

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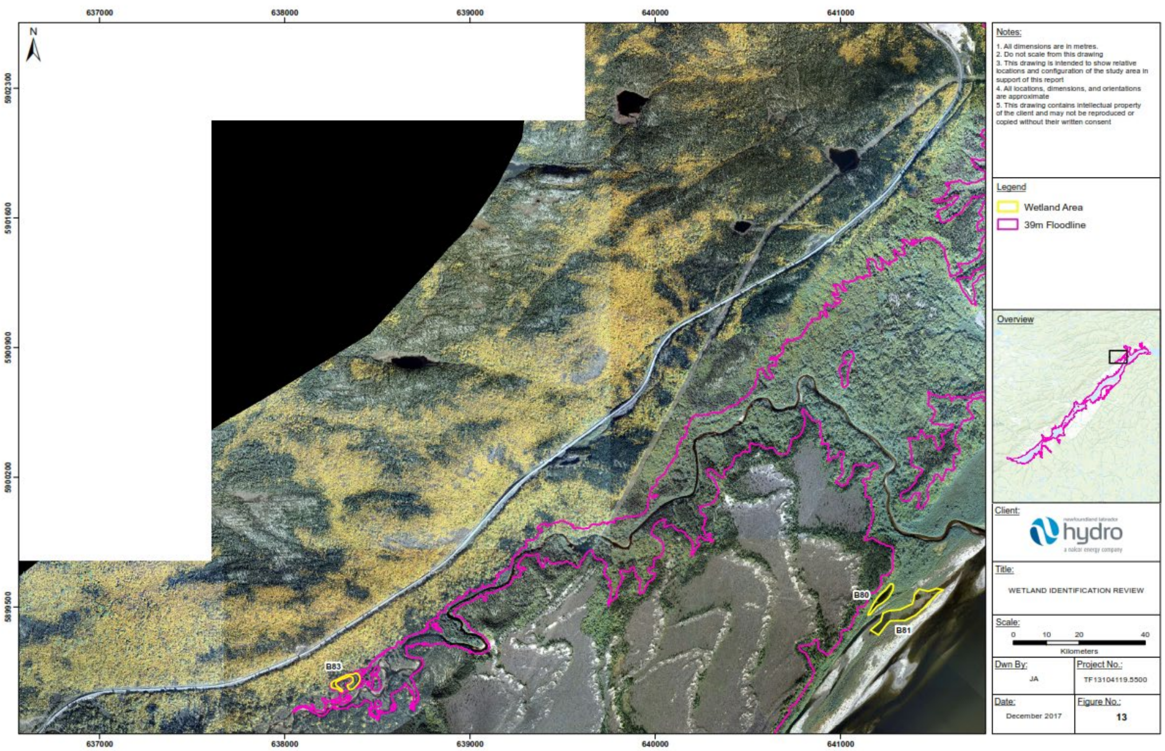

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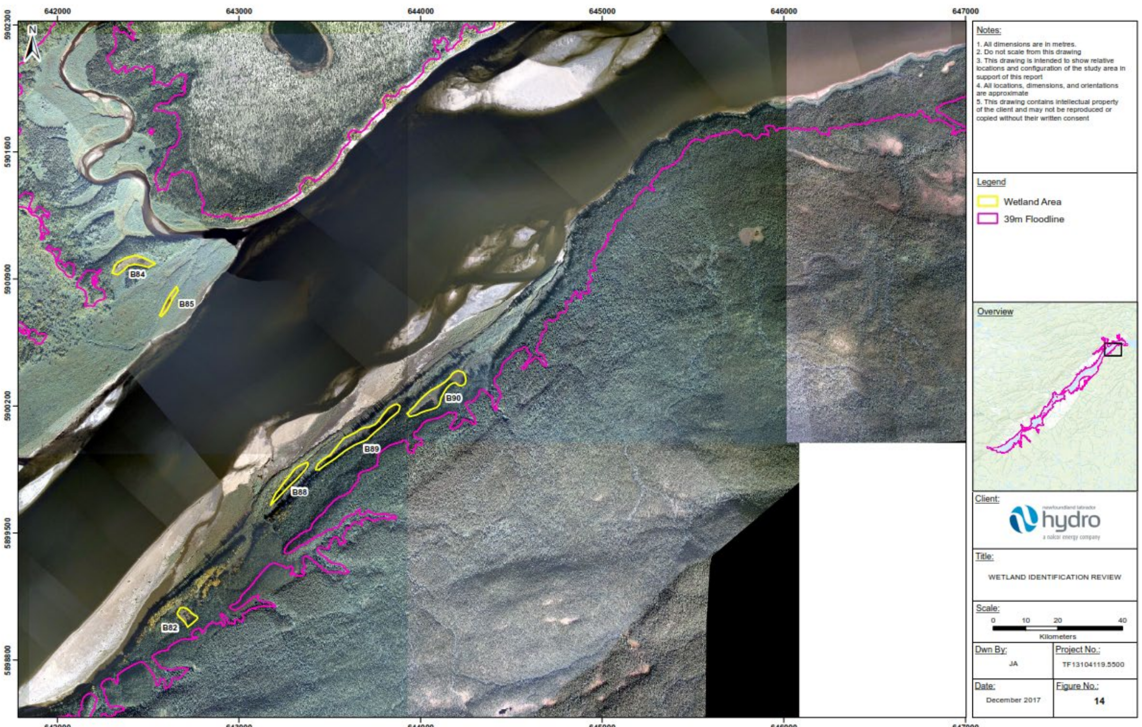

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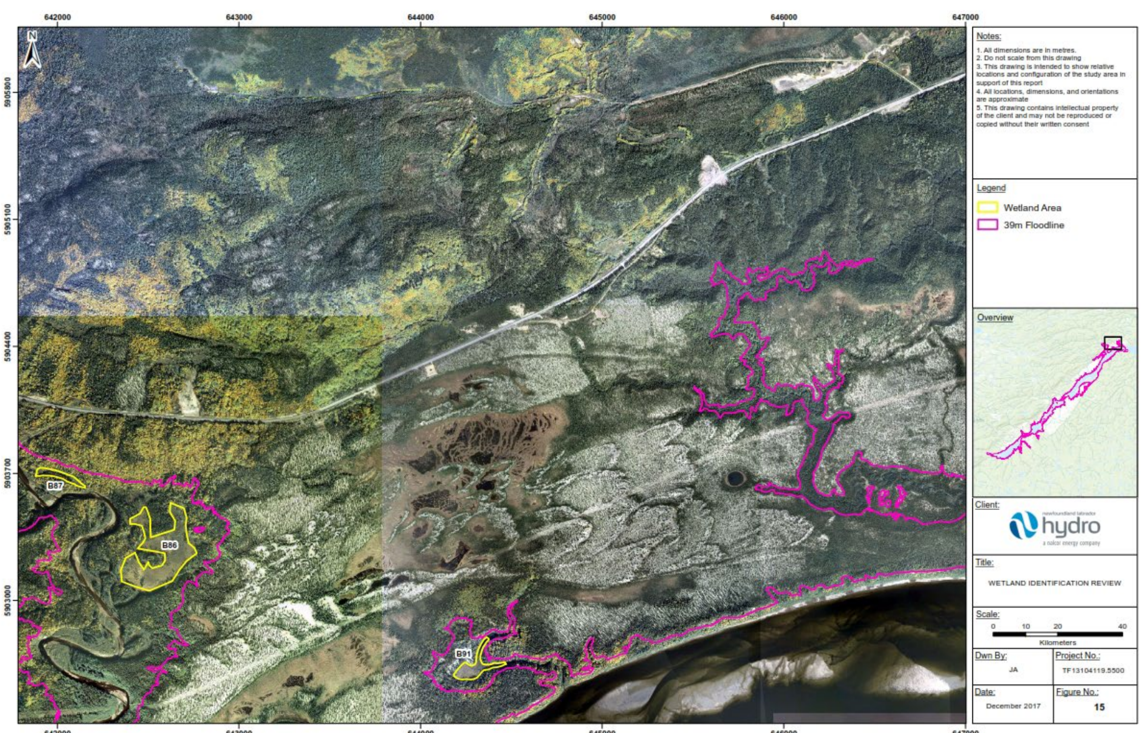
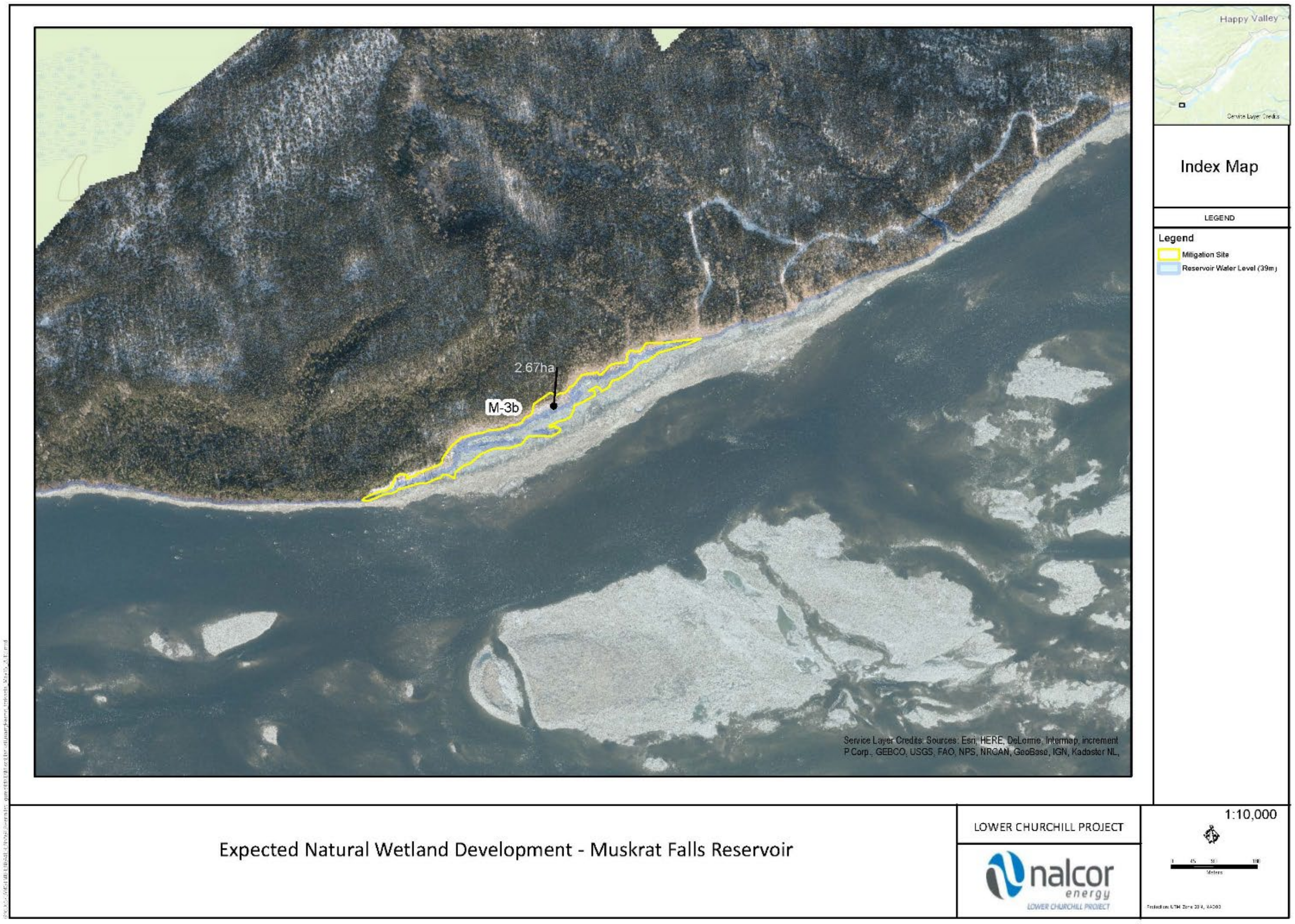
Date: December 2017
Figure No.: 14



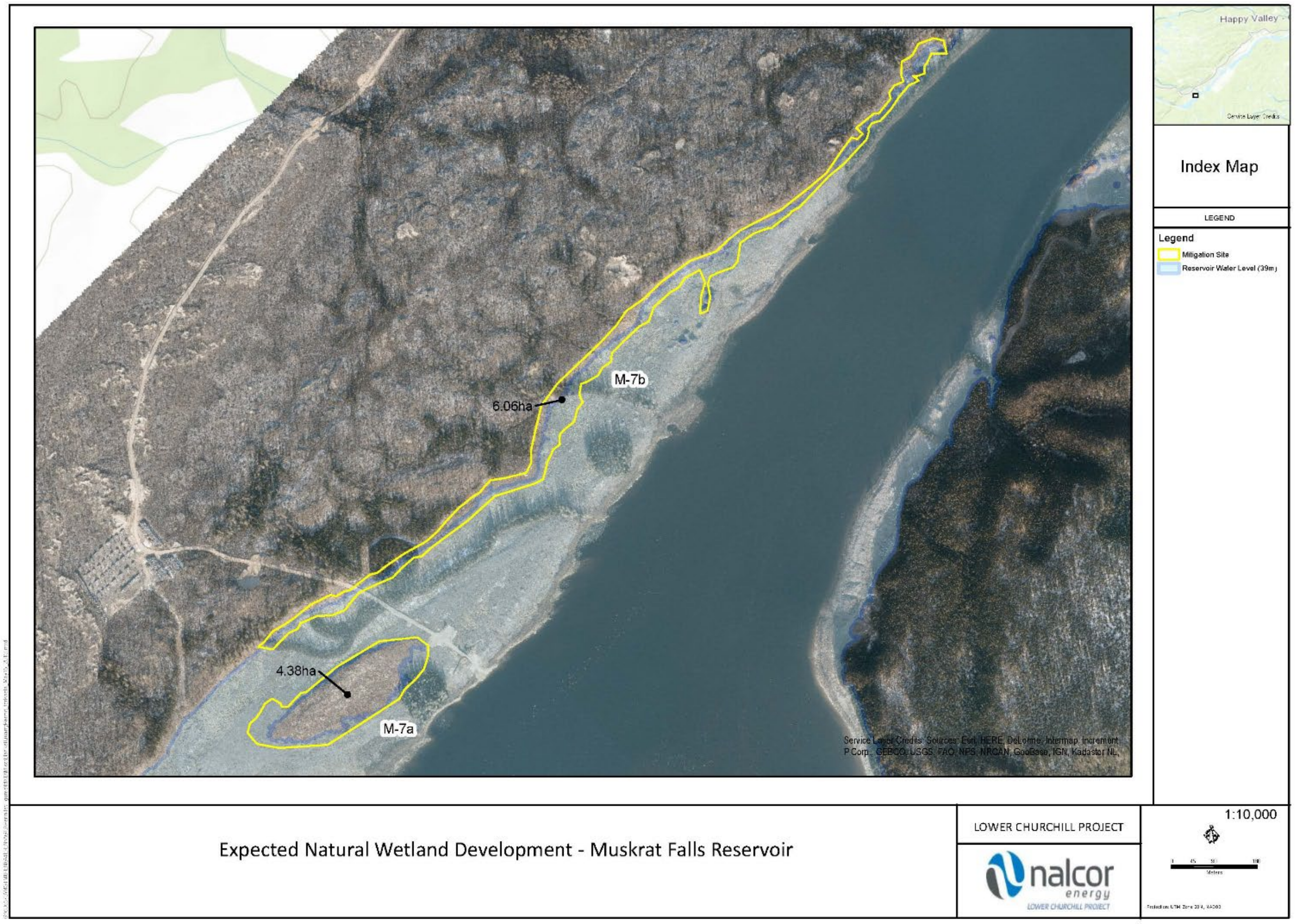
B87
B86
B91
Notes:
1. All dimensions are in metres.
2. Do not scale from this drawing
3. This drawing is intended to show relative locations and configuration of the study area in support of this report
4. All locations, dimensions, and orientations are approximate
5. This drawing contains intellectual property of the client and may not be reproduced or copied without their written consent
Legend
Wetland Area
39m Floodline
Overview
Client:
hydro
Title:
WETLAND IDENTIFICATION REVIEW
Scale:
0 10 20 40
Kilometers
Dwn By: JA
Project No.: TF13104119.5500
Date: December 2017
Figure No.: 15

15.2 Distribution of Wetlands Expected to Naturally Develop within the Muskrat Falls Reservoir.

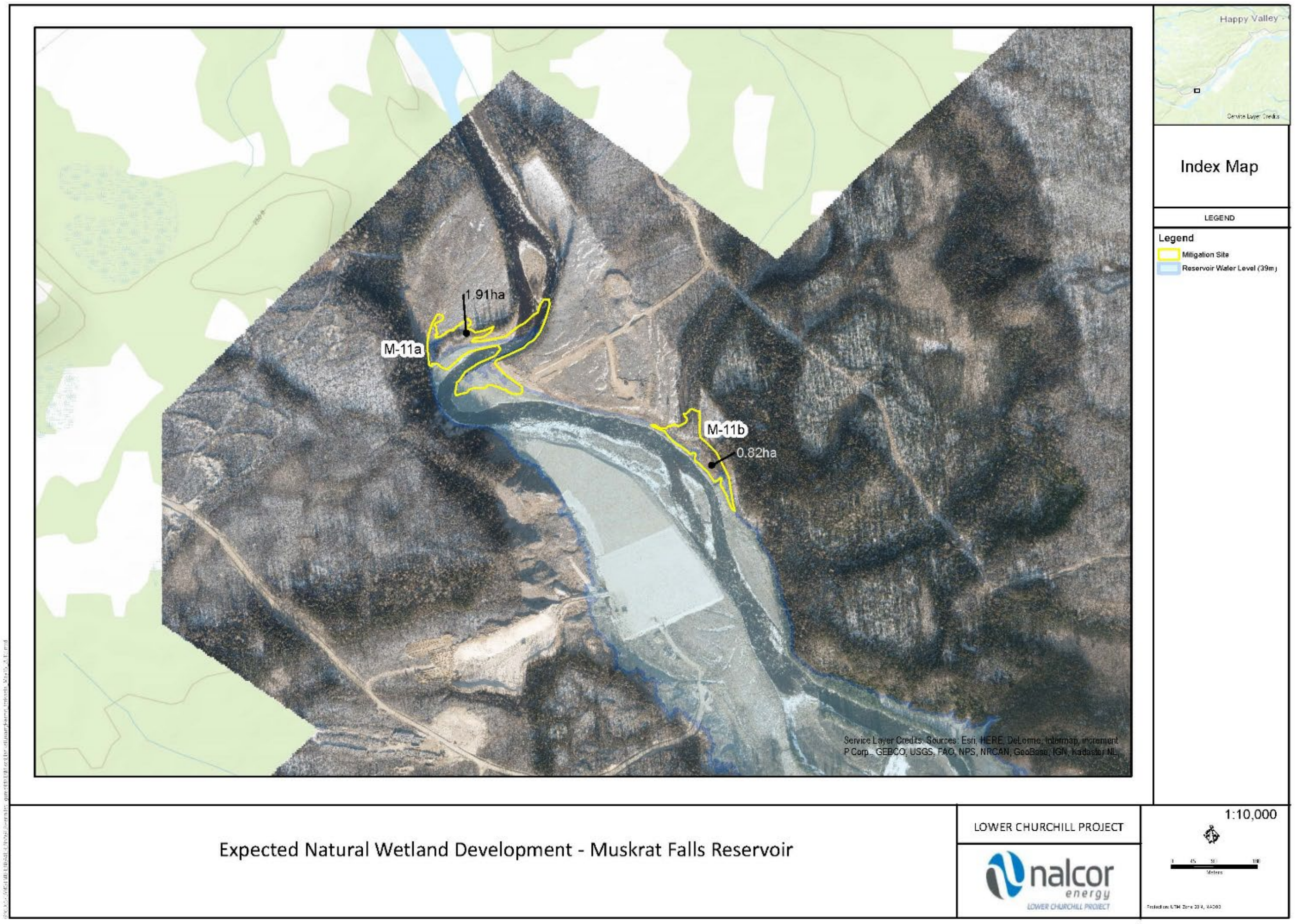
Expected Natural Wetland Development - Muskrat Falls Reservoir



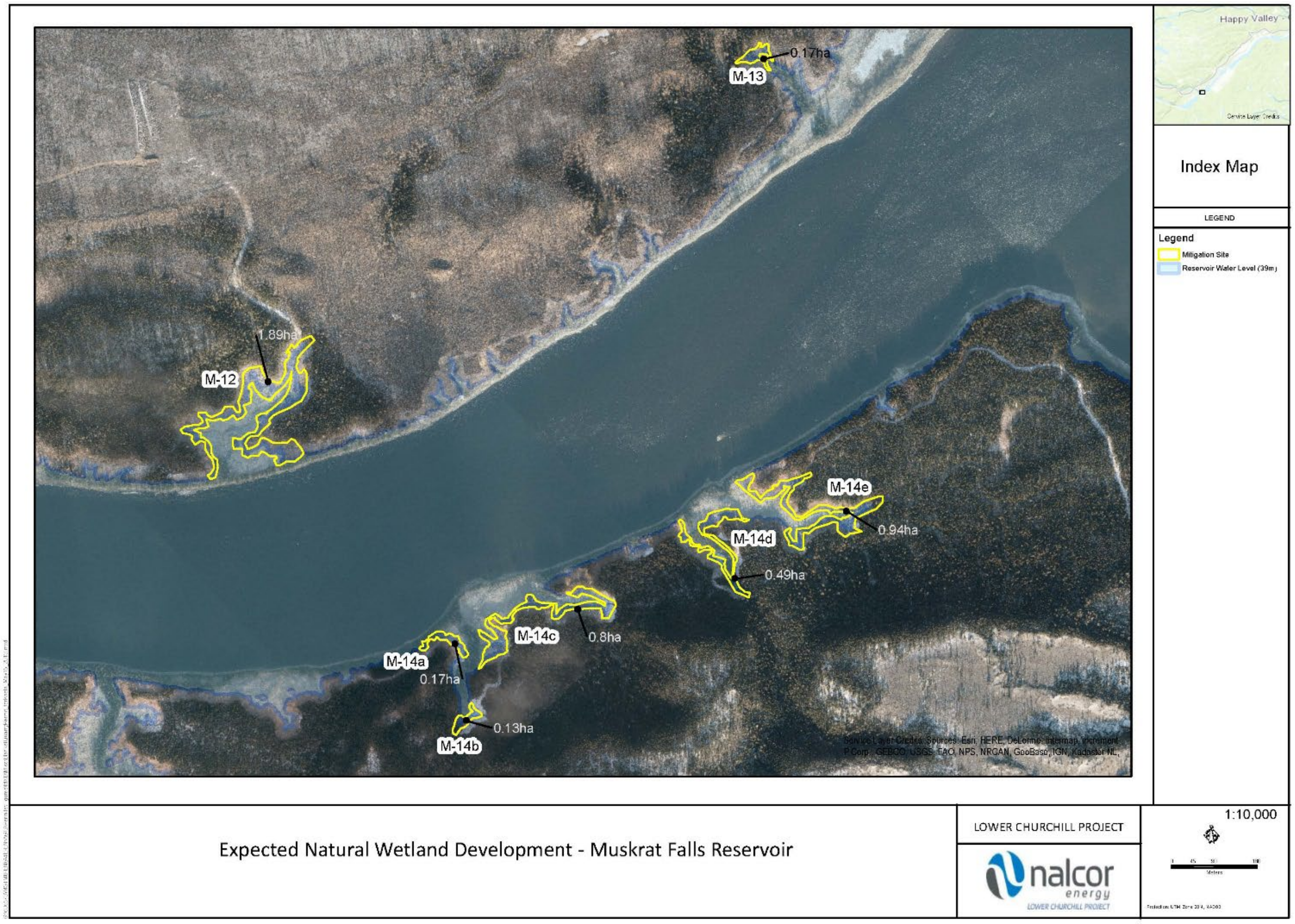
Happy Valley
Index Map
LEGEND
Legend
Mitigation Site
Reservoir Water Level (39m)
2.67ha
M-3b
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,
Expected Natural Wetland Development - Muskrat Falls Reservoir
LOWER CHURCHILL PROJECT
1:10,000



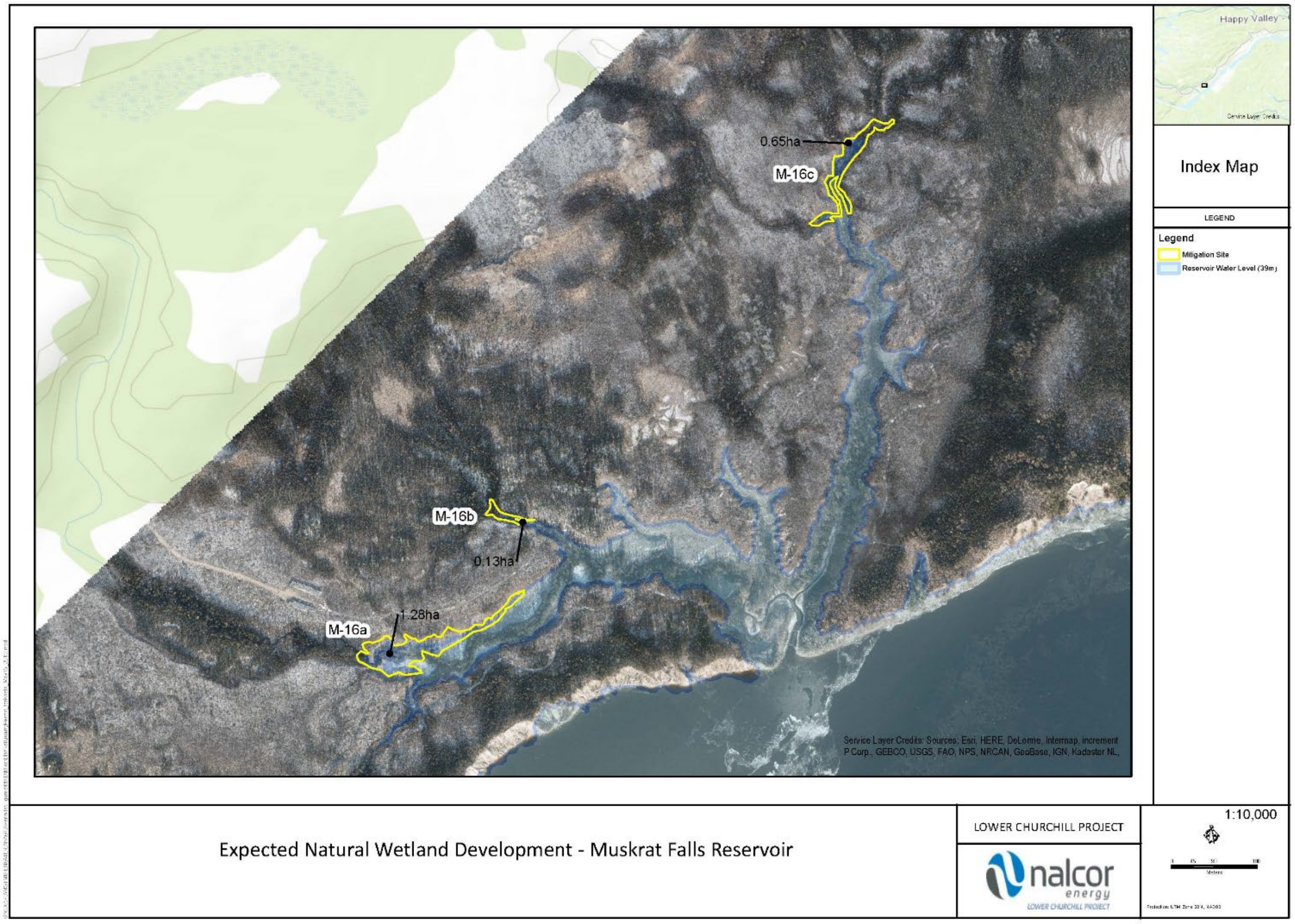
Expected Natural Wetland Development - Muskrat Falls Reservoir



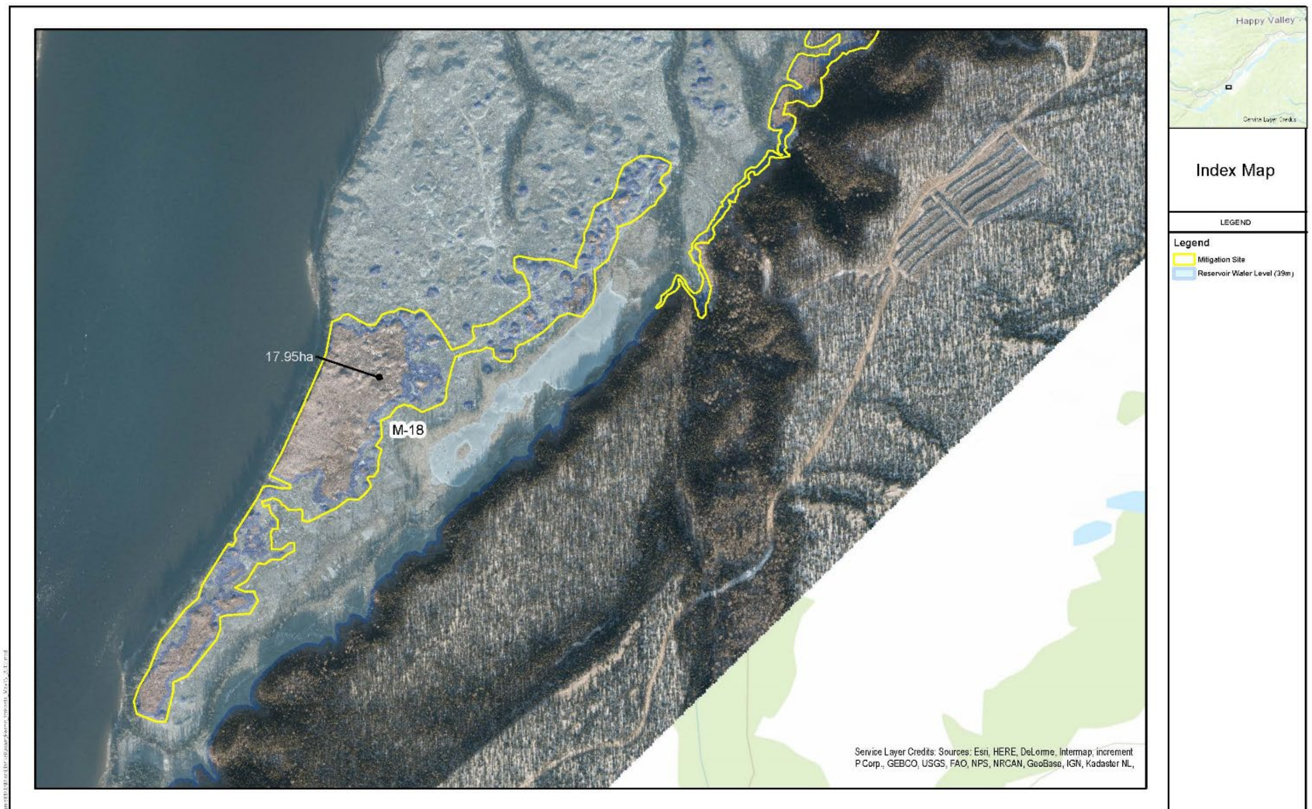
M-11a
1.91ha
M-11b
0.82ha
Happy Valley
Index Map
LEGEND
Legend
Mitigation Site
Reservoir Water Level (39m)
Expected Natural Wetland Development - Muskrat Falls Reservoir
LOWER CHURCHILL PROJECT
1:10,000



M-13
0.17ha
1.89ha
M-12
M-14e
0.94ha
M-14d
0.49ha
M-14c
0.8ha
M-14a
0.17ha
0.13ha
M-14b
Happy Valley
Index Map
LEGEND
Legend
Mitigation Site
Reservoir Water Level (39m)
Expected Natural Wetland Development - Muskrat Falls Reservoir
LOWER CHURCHILL PROJECT
1:10,000


0.65ha
M-16c
M-16b
0.13ha
1.28ha
M-16a
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,
Happy Valley
Index Map
LEGEND
Legend
Mitigation Site
Reservoir Water Level (39m)
Expected Natural Wetland Development - Muskrat Falls Reservoir
LOWER CHURCHILL PROJECT
nalcor energy
LOWER CHURCHILL PROJECT
1:10,000

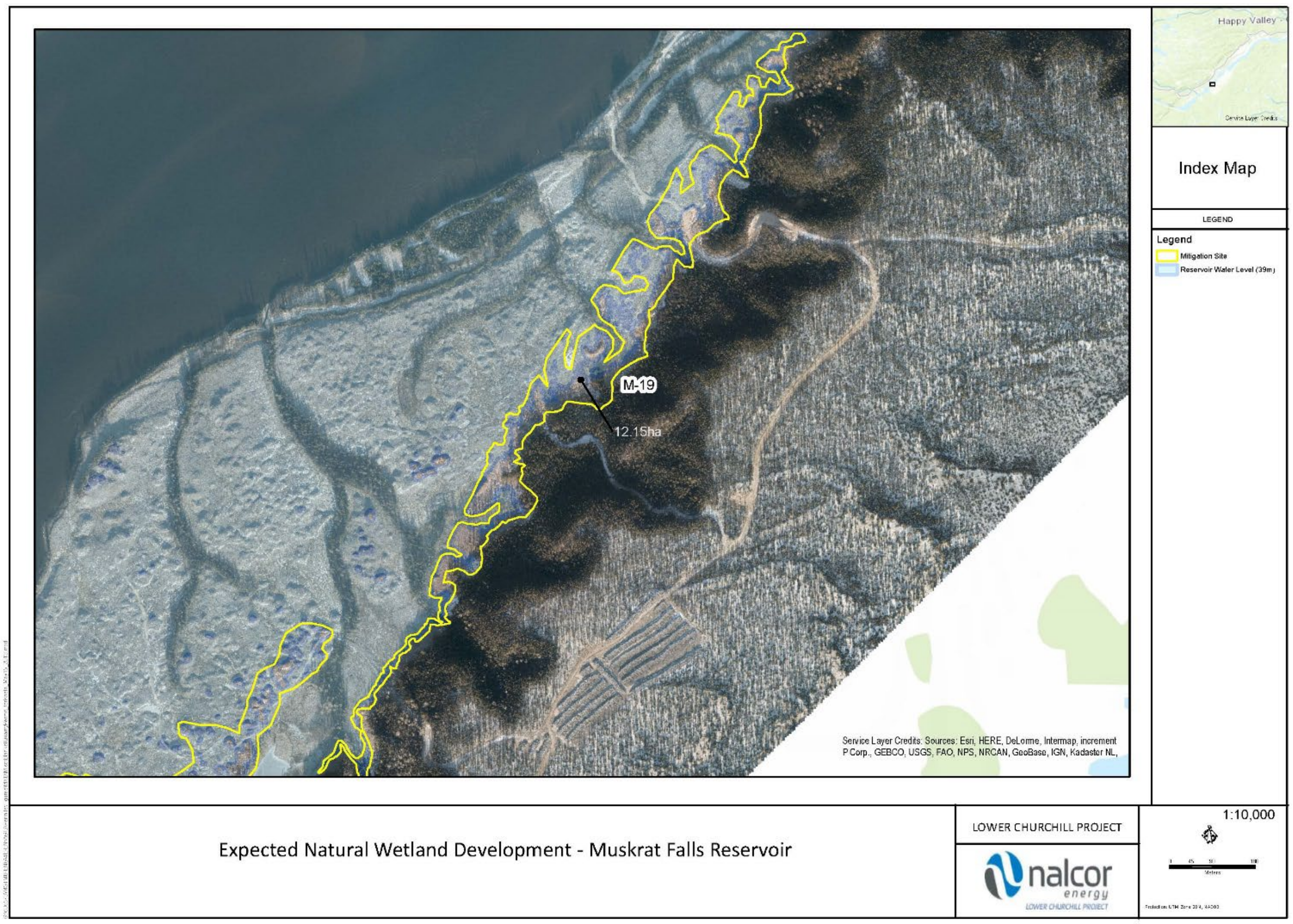
0.74ha
M-17c
0.75ha
M-17b
M-17a
0.71ha
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,
Happy Valley
Index Map
LEGEND
Legend
Mitigation Site
Reservoir Water Level (39m)
Expected Natural Wetland Development - Muskrat Falls Reservoir
LOWER CHURCHILL PROJECT
nalcor energy
LOWER CHURCHILL PROJECT
1:10,000



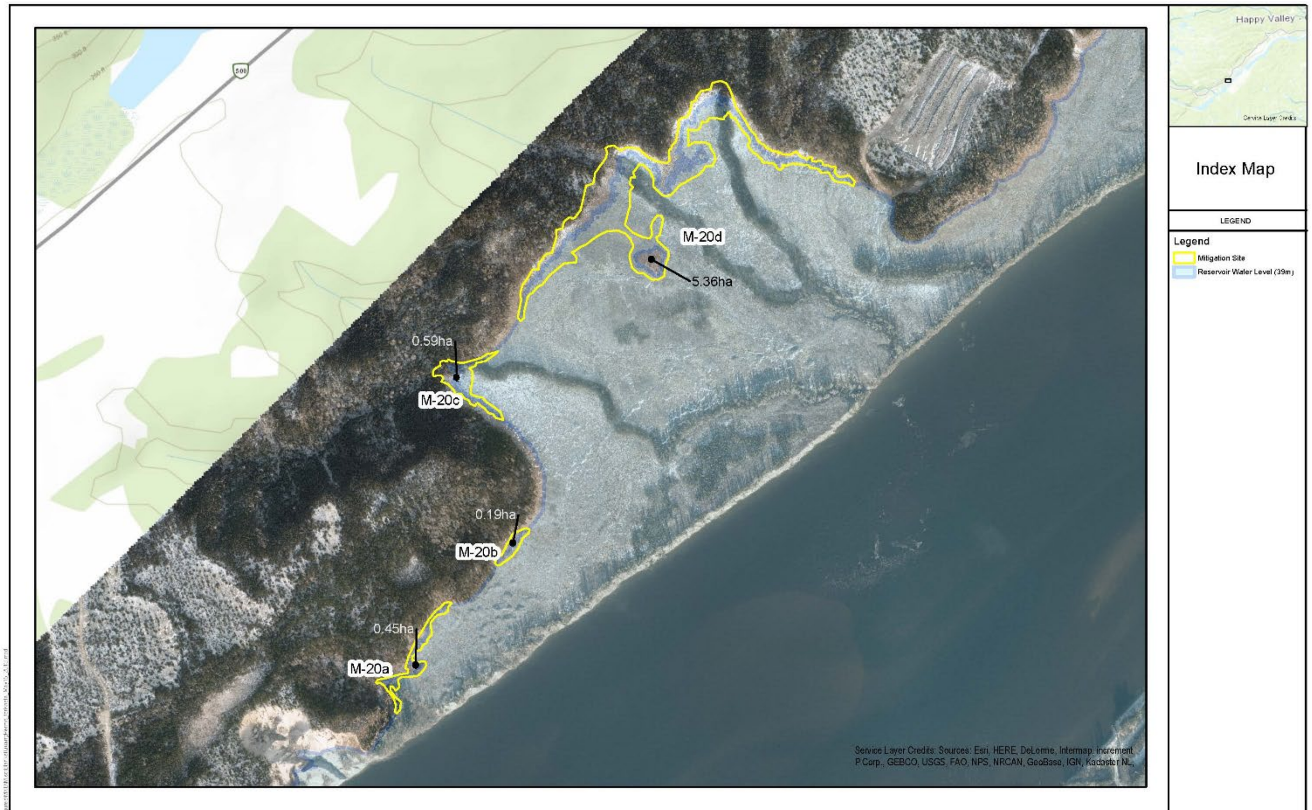
Expected Natural Wetland Development - Muskrat Falls Reservoir

LOWER CHURCHILL PROJECT

1:10,000



Happy Valley
Index Map
LEGEND
Legend
Mitigation Site
Reservoir Water Level (39m)
M-19
12.15ha
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,
Expected Natural Wetland Development - Muskrat Falls Reservoir
LOWER CHURCHILL PROJECT
nalcor energy
LOWER CHURCHILL PROJECT
1:10,000



Expected Natural Wetland Development - Muskrat Falls Reservoir

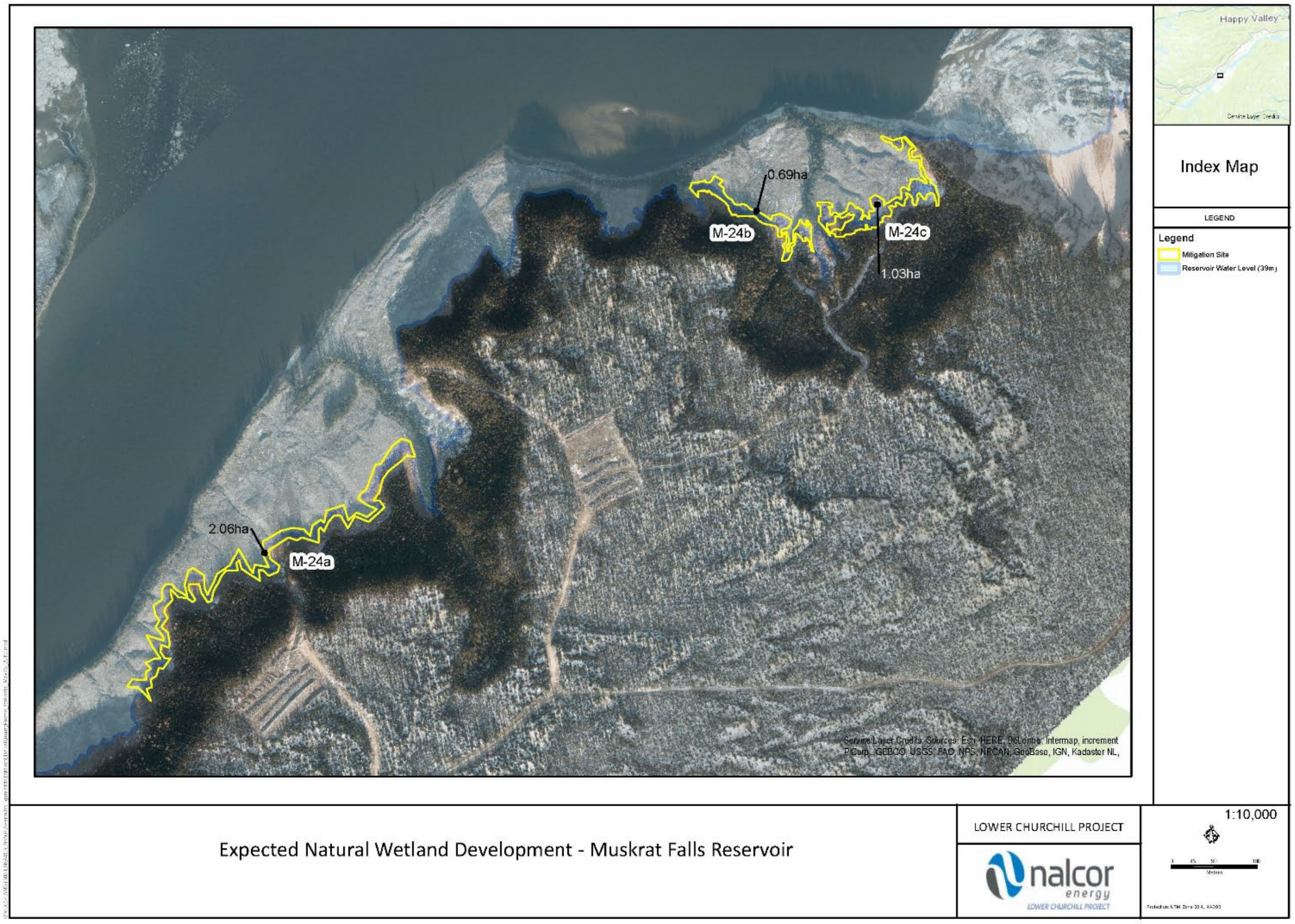
LOWER CHURCHILL PROJECT

1:10,000

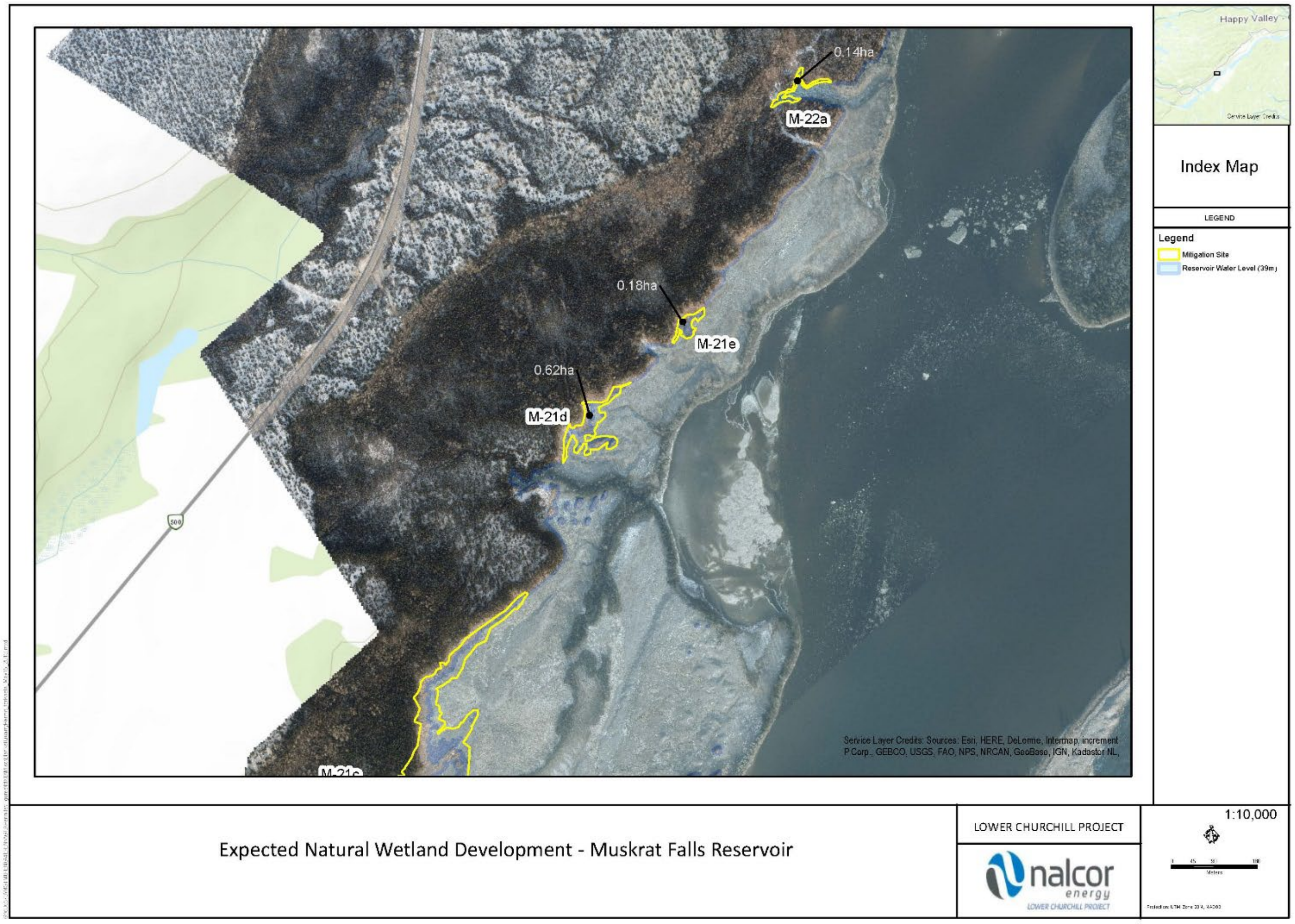
Expected Natural Wetland Development - Muskrat Falls Reservoir

LOWER CHURCHILL PROJECT

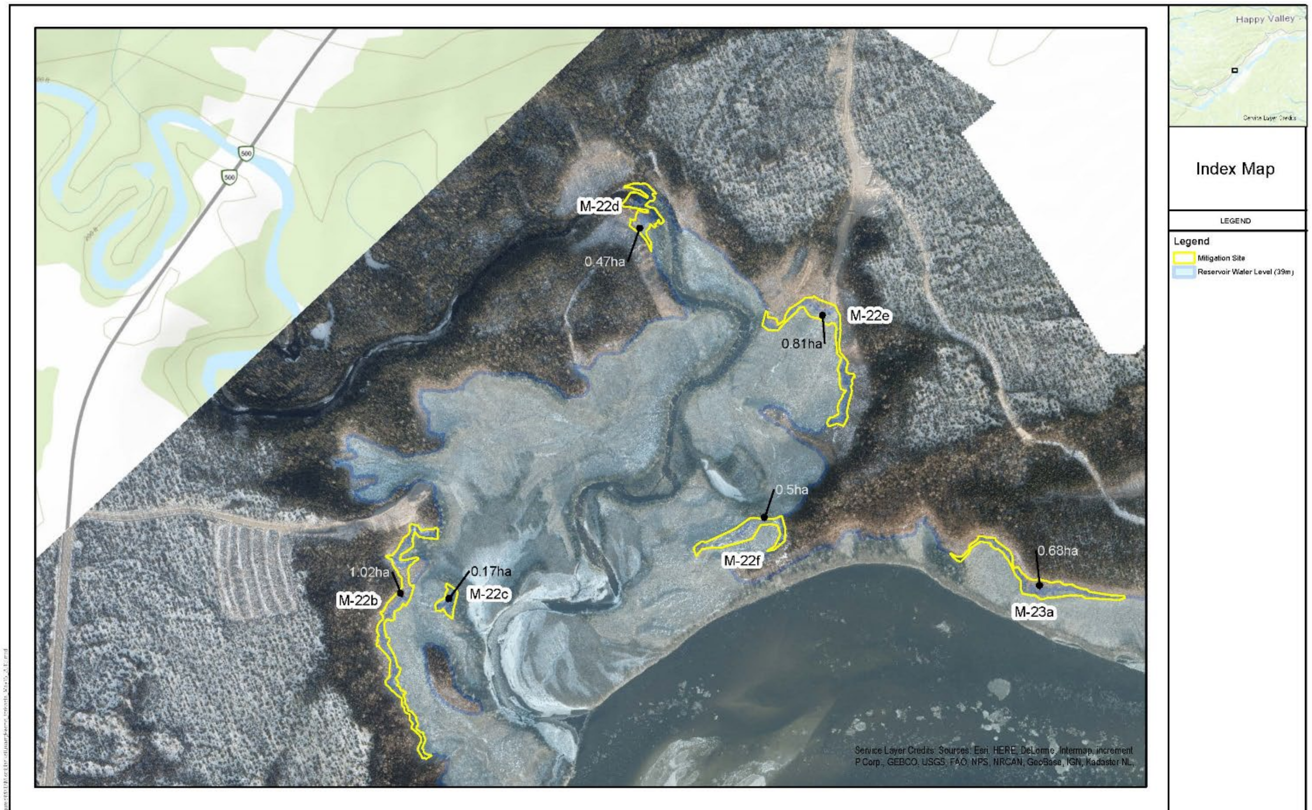
1:10,000



Expected Natural Wetland Development - Muskrat Falls Reservoir



Expected Natural Wetland Development - Muskrat Falls Reservoir

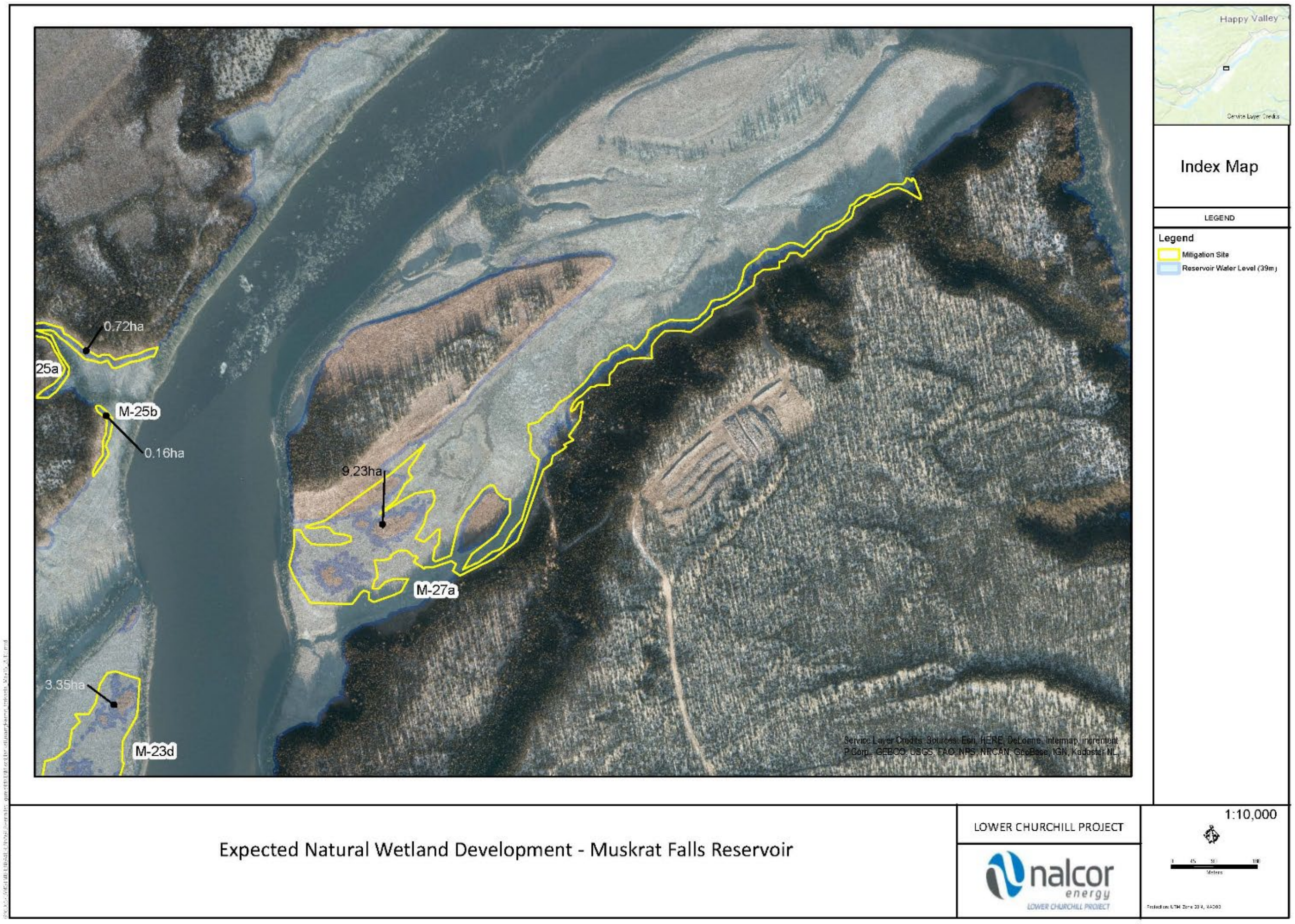


Expected Natural Wetland Development - Muskrat Falls Reservoir

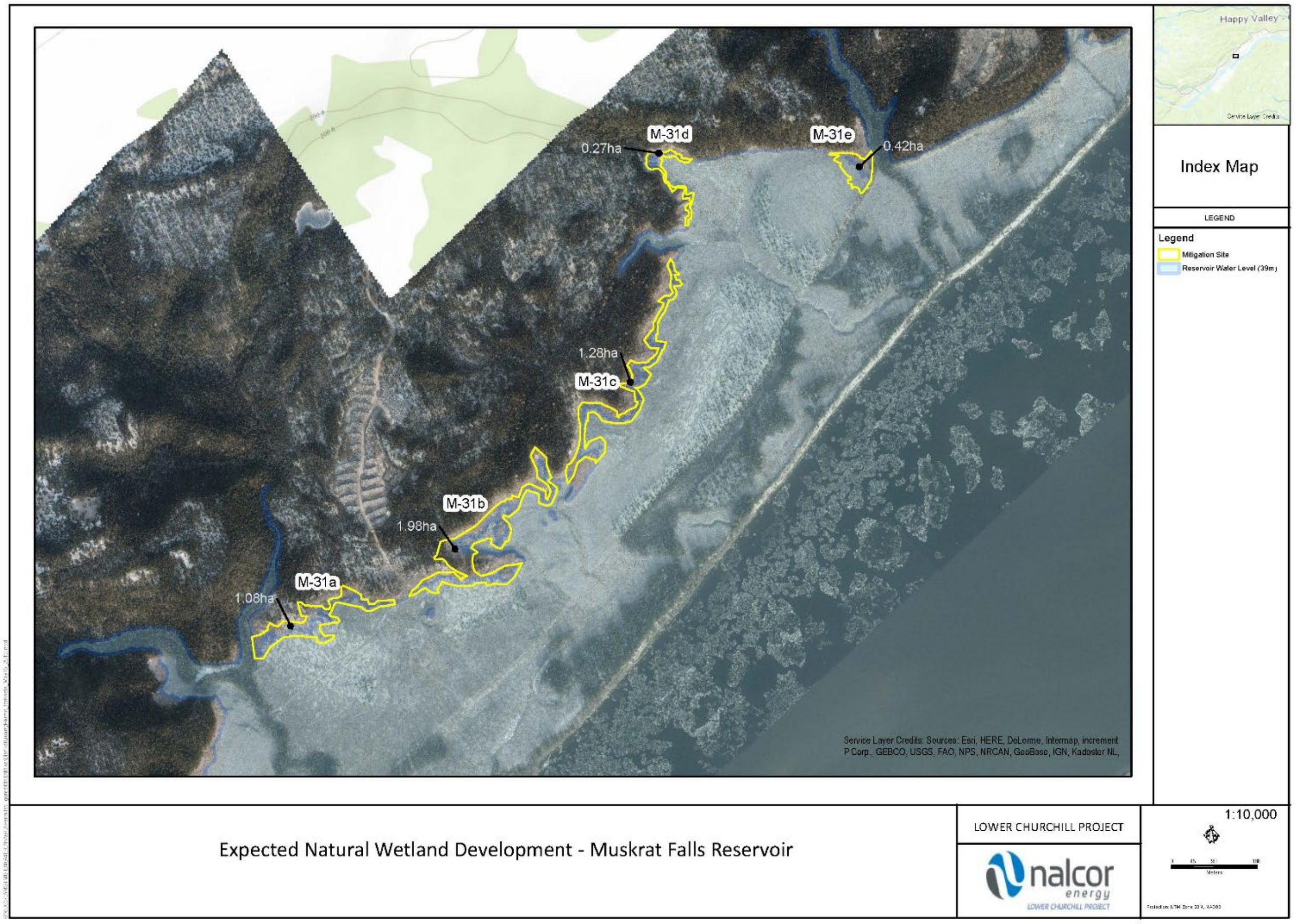
Expected Natural Wetland Development - Muskrat Falls Reservoir

LOWER CHURCHILL PROJECT

1:10,000

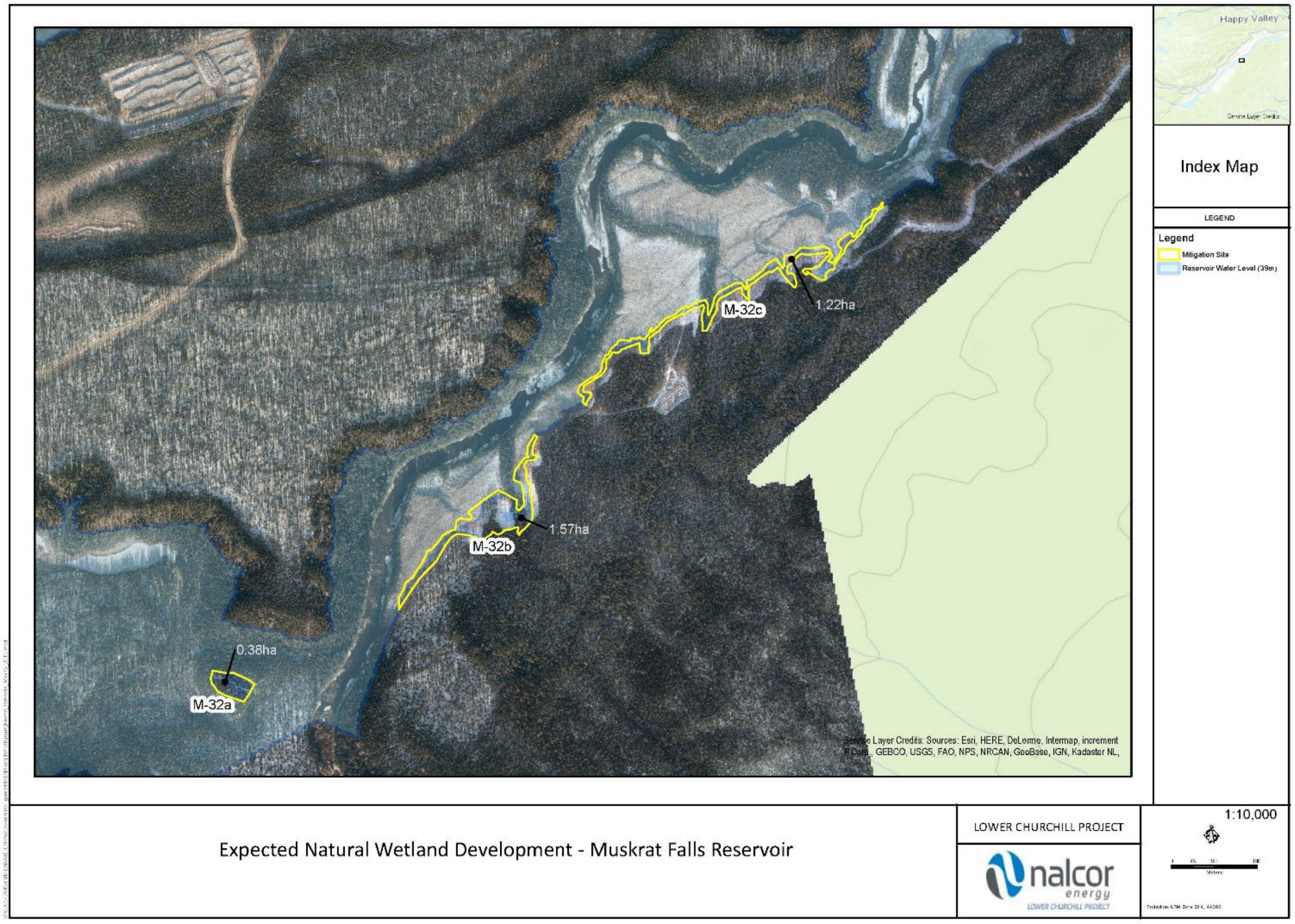


Happy Valley
Index Map
LEGEND
Legend
Mitigation Site
Reservoir Water Level (39m)
0.72ha
25a
M-25b
0.16ha
9.23ha
M-27a
3.35ha
M-23d
Expected Natural Wetland Development - Muskrat Falls Reservoir
LOWER CHURCHILL PROJECT
nalcor energy
LOWER CHURCHILL PROJECT
1:10,000

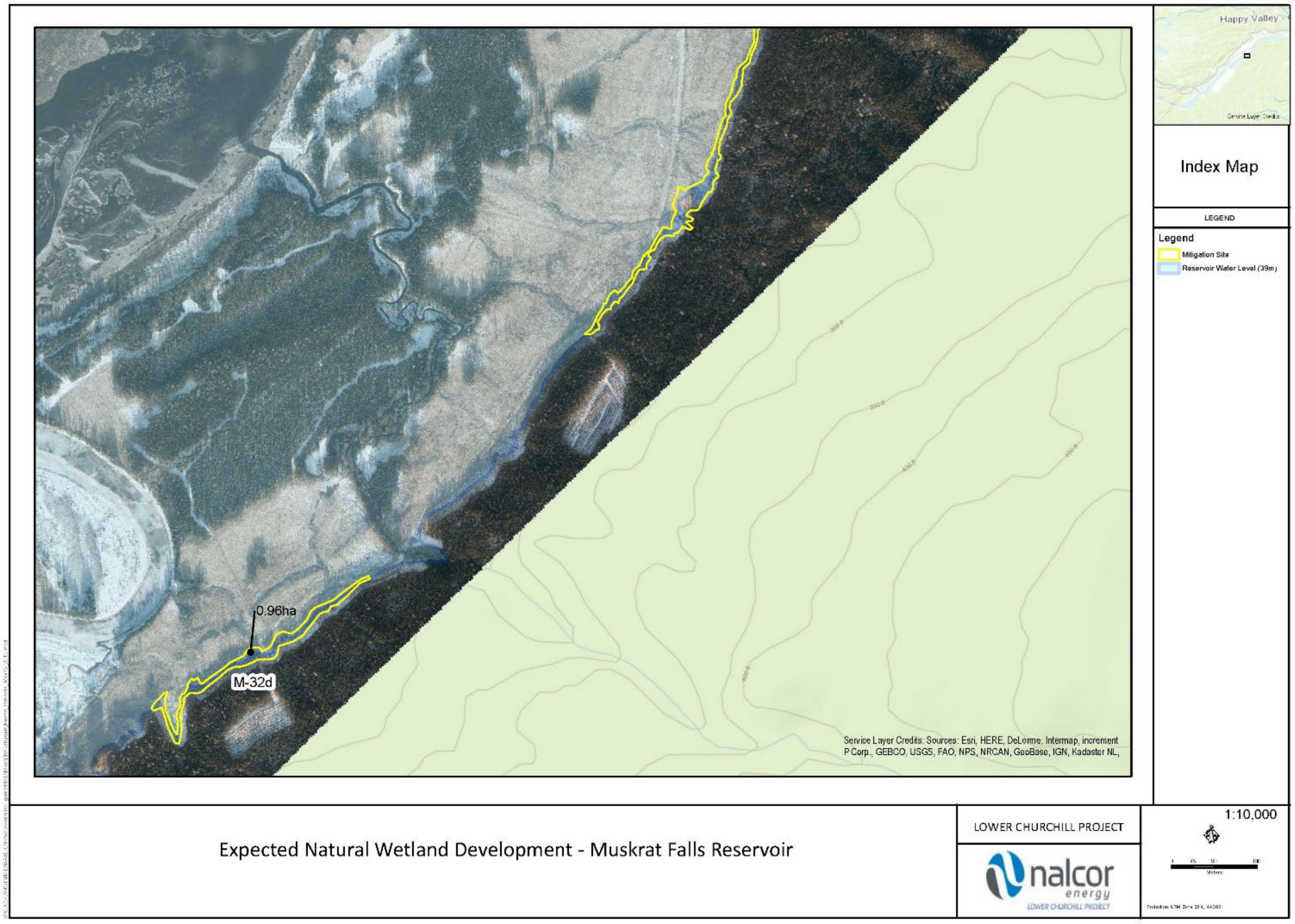


M-31d
0.27ha
M-31e
0.42ha
1.28ha
M-31c
M-31b
1.98ha
M-31a
1.08ha
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,
Happy Valley
Index Map
LEGEND
Legend
Mitigation Site
Reservoir Water Level (39m)
Expected Natural Wetland Development - Muskrat Falls Reservoir
LOWER CHURCHILL PROJECT
1:10,000

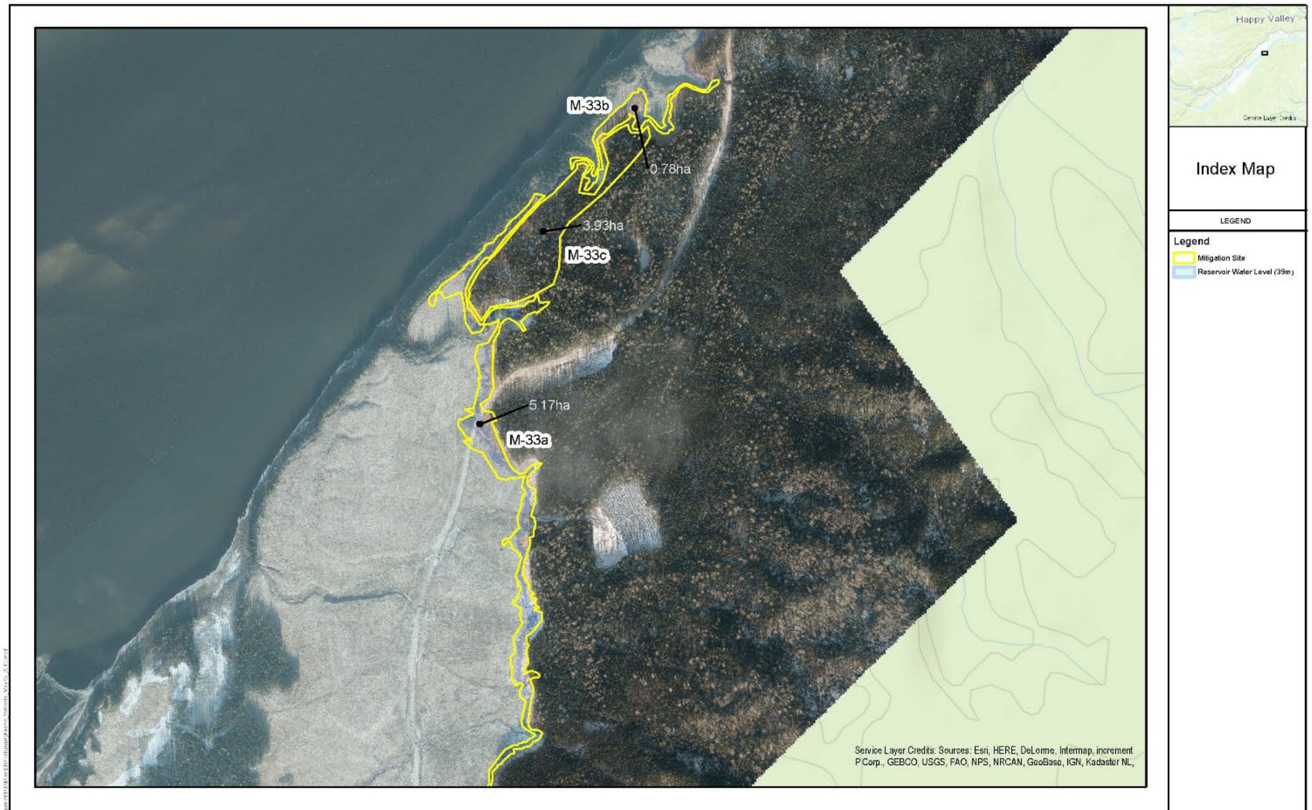
Expected Natural Wetland Development - Muskrat Falls Reservoir



Expected Natural Wetland Development - Muskrat Falls Reservoir



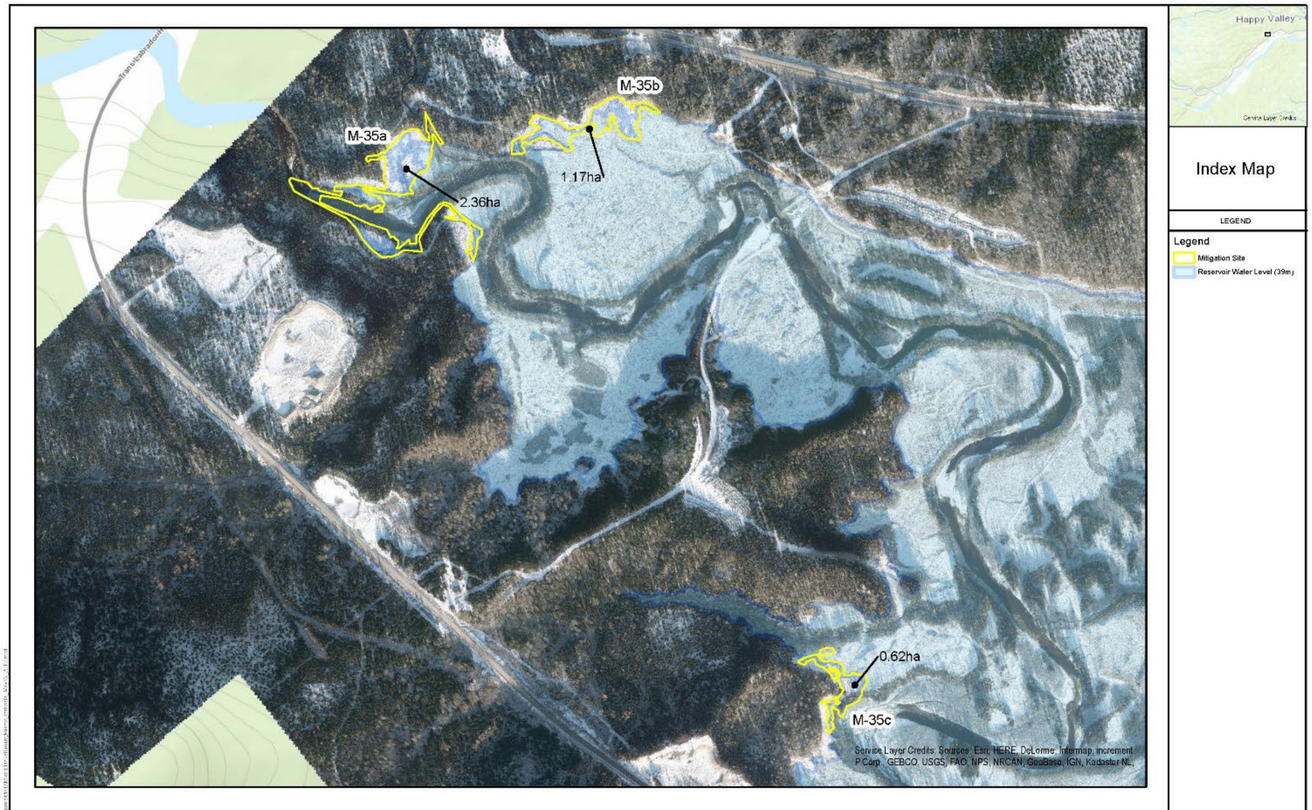
Expected Natural Wetland Development - Muskrat Falls Reservoir



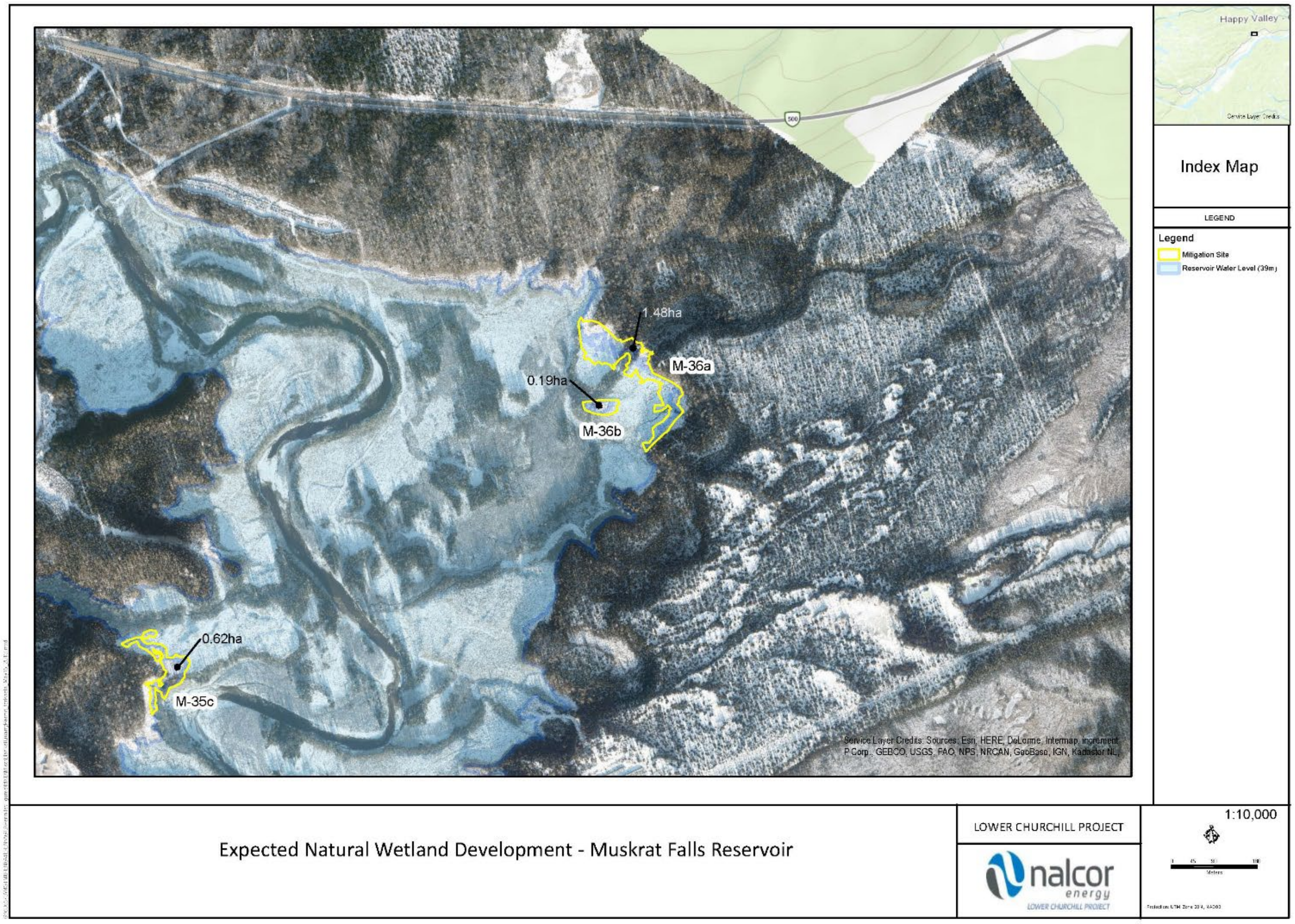
Expected Natural Wetland Development - Muskrat Falls Reservoir

LOWER CHURCHILL PROJECT

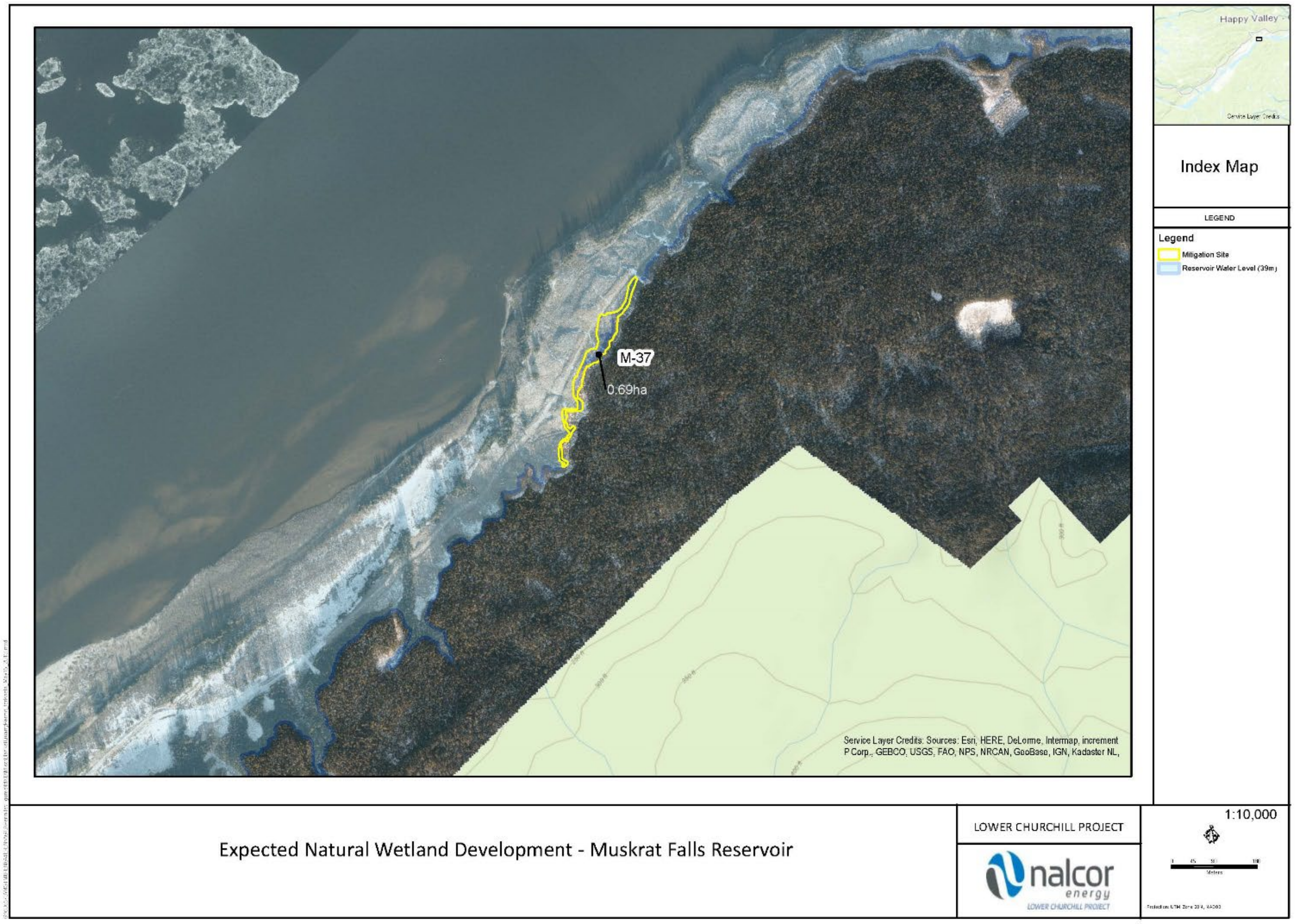
1:10,000



Expected Natural Wetland Development - Muskrat Falls Reservoir

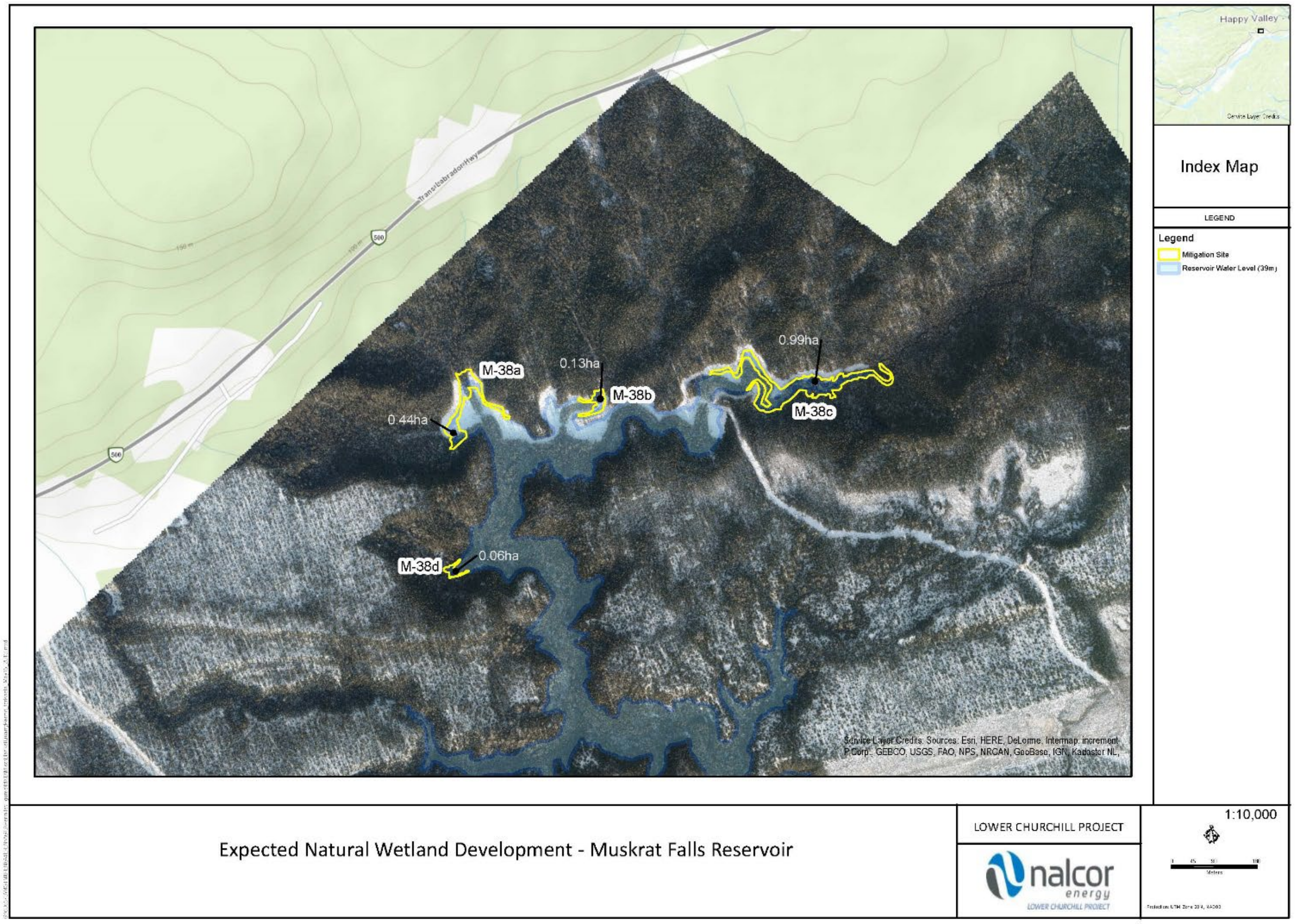


Happy Valley
Index Map
LEGEND
Legend
Mitigation Site
Reservoir Water Level (39m)
1.48ha
M-36a
0.19ha
M-36b
0.62ha
M-35c
500
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,
Expected Natural Wetland Development - Muskrat Falls Reservoir
LOWER CHURCHILL PROJECT
nalcor energy
LOWER CHURCHILL PROJECT
1:10,000



Expected Natural Wetland Development - Muskrat Falls Reservoir

Expected Natural Wetland Development - Muskrat Falls Reservoir



M-38a
0.44ha
0.13ha
M-38b
0.99ha
M-38c
M-38d
0.06ha
Index Map
Happy Valley
LEGEND
Legend
Mitigation Site
Reservoir Water Level (39m)
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,
Expected Natural Wetland Development - Muskrat Falls Reservoir
LOWER CHURCHILL PROJECT
nalcor energy
LOWER CHURCHILL PROJECT
1:10,000

15.3 Deficiency letter on B3 version of Wetland and Riparian Plan from the provincial Department of Environment, Climate Change and Municipalities

Newfoundland Labrador

Government of Newfoundland and Labrador
Environment, Climate Change and Municipalities
Environmental Assessment Division

COR/2021/00248

February 5, 2021

Ms. Jackie Wells
Nalcor Energy
500 Columbus Drive
St. John's NL A1B 0C9
e. jackiewells@nalcorenergy.com

Dear Ms. Wells:

Re: Muskrat Falls Wetland and Riparian Plan: Compensation and Monitoring (B3)

Nalcor Energy has submitted a Wetland and Riparian Plan: Compensation and Monitoring, version B3 (the Plan), for the Lower Churchill Hydroelectric Generation Project (the Project) to the Department of Environment, Climate Change and Municipalities (former Department of Environment and Conservation). A comprehensive review of the Plan has been undertaken and the Department of Environment, Climate Change and Municipalities (ECCM) finds the Plan to be deficient. Nalcor Energy is therefore required to submit a revised Wetland and Riparian Compensation and Monitoring Plan for the Minister's approval.

The Plan was submitted to fulfill conditions of release of the Project from environmental assessment, as set out in an Order of Council, O.C. 2012-06. The Order was filed on March 15, 2012, and is found on the Government of Newfoundland and Labrador web site at https://www.assembly.nl.ca/Legislation/sr/Regulations/rc120018.htm. Sections 4 (d) (iv) and (v), and (e) (viii) of the Order are require Nalcor Energy to prepare and abide by the requirements of wetland and riparian compensation plans, and to prepare and abide by the requirements of environmental effects monitoring plans for wetland and riparian habitats for all phases of the project.

O.C. 2012-061 was informed by recommendations of a Joint Review Panel (JRP) appointed by the federal and provincial Environment Ministers and the provincial Minister of Intergovernmental Affairs to assess the environmental effects of the Project. The JRP recommendations were issued in August 2011 and are found at https://www.gov.nl.ca/eccm/files/env-assessment-projects-y2010-1305-lower-churchill-panel-report.pdf.

The Government of Newfoundland and Labrador accepted the recommendations of the JRP and informed that ECCM will work with Environment and Climate Change Canada (ECCC), Aboriginal organizations and appropriate stakeholders to advise Nalcor Energy on the development and implementation of a detailed wetland compensation plan in accordance with the Federal Policy on Wetland Conservation. The Federal Policy on Wetland Conservation, is found at http://publications.gc.ca/collections/Collection/CW66-116-1991E.pdf, and has a goal of "no net loss" of wetlands. Guidance for the Federal Policy on Wetland Conservation advises project proponents to apply the following sequence of mitigation alternatives:

- avoidance of impacts;
- minimization of unavoidable impacts; and,
- compensation for unavoidable impacts.

In light of our review, we acknowledge that the Plan:

- consolidates the requirements of O.C. 2012-061 by combining the wetland compensation plan, riparian compensation plan and environmental effects monitoring plan into a single plan;
- informs that the Project will result in the loss of 270.13 hectares of wetland;
- describes measures to be undertaken by Nalcor Energy to re-stablish and create 159 hectares of wetlands to compensate for wetland loss;
- identifies a net loss of 111.13 hectares of wetlands as a result of the Project;
- proposes to fund restoration projects in the province by providing $100,000 per year for 5 years to community wetland conservation and rehabilitation programs;
- advises of education initiatives that will be undertaken, such as sponsoring school field trips, scholarships and bursaries for post-secondary education;
- commits to monitoring the success of wetland habitat development, and will adjust methods through adaptive management to improve their effectiveness; and,
- considers water levels and variations in the levels needed to ensure healthy and resilient riparian habitat.

We have considered Nalcor Energy's proposal to re-establish and develop wetlands and to fund restoration projects and education initiatives. We conclude that the Plan, as proposed, does not fulfill the requirements of the conditions of release in O.C. 2012-061. We advise Nalcor Energy to submit a revised plan that upholds the goal of the Federal Policy on Wetland

Conservation of "no net loss" of wetlands, and to propose enhanced compensation efforts that more closely align with guidance on wetland compensation.

Please contact me at (709) 729-0673 or email joannesweeney@gov.nl.ca if you have any questions or would like to discuss.

Sincerely,

Joanne Sweeney, Director (A)
Environmental Assessment Division
Department of Environment, Climate Change and Municipalities