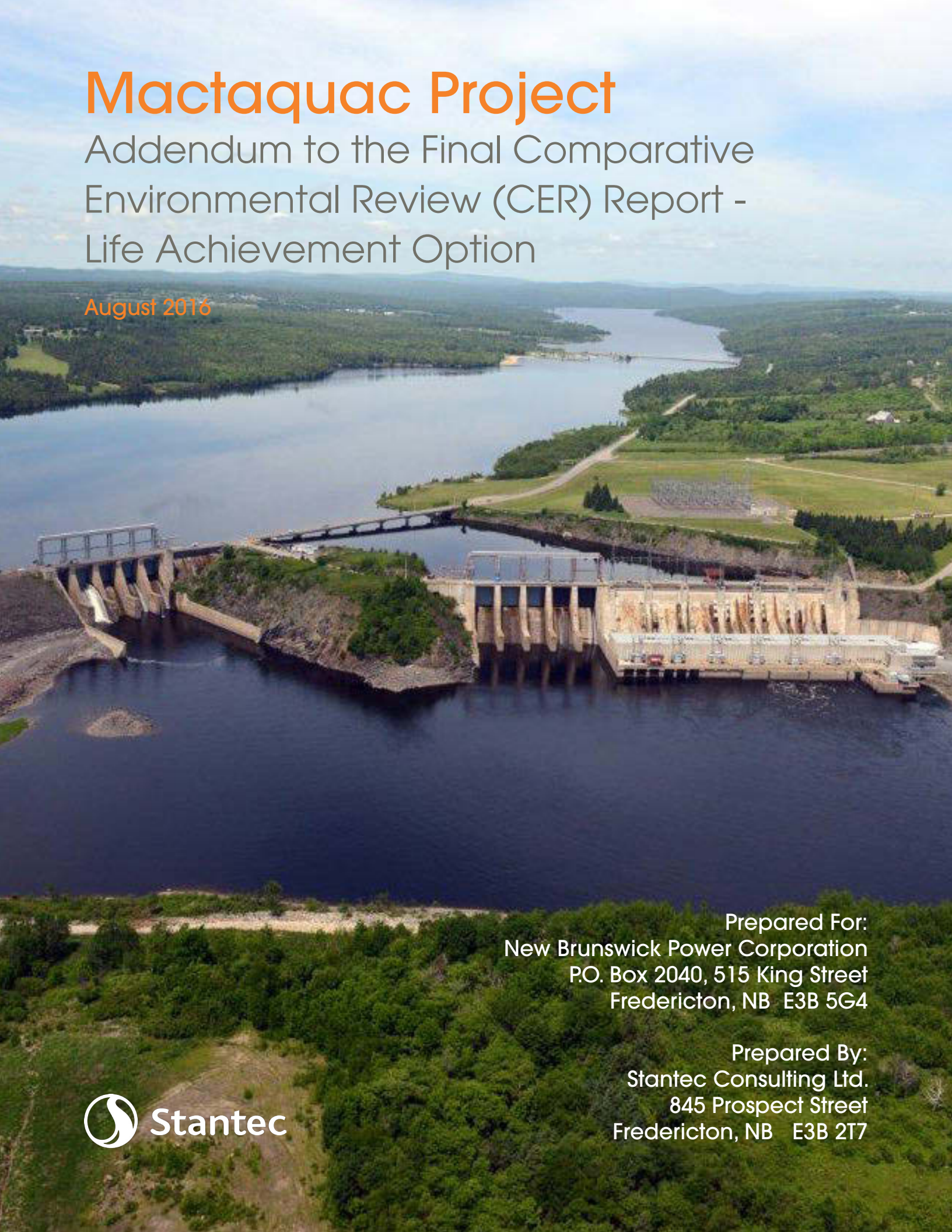
APPENDIX A
MACTAQUAC PROJECT: ADDENDUM TO THE FINAL COMPARATIVE ENVIRONMENTAL REVIEW (CER) REPORT – LIFE ACHIEVEMENT OPTION

August 2016

Mactaquac Project

Addendum to the Final Comparative Environmental Review (CER) Report - Life Achievement Option

August 2016



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EXECUTIVE SUMMARY

This document is an Addendum to the Final Comparative Environmental Review (CER) Report of options being considered for the Mactaquac Generating Station in Mactaquac, New Brunswick.

This Addendum should be read in concert with the draft document entitled "Mactaquac Project: Final Comparative Environmental Review (CER) Report" prepared by Stantec Consulting Ltd. (Stantec) on behalf of the New Brunswick Power Corporation (NB Power), dated August 2016 (Stantec 2016). That document supersedes the draft CER Report, dated September 2015 (Stantec 2015).

As described in the CER Report which reviewed the end-of-life options (described below), concurrent to the development and public review of the CER Report, NB Power has continued to study and explore ways to carry on operations of the Mactaquac Generating Station (the Station) within the current footprint beyond 2030. This Addendum has been developed in light of advancements in those ongoing studies.

Background

Modelling and maintenance work conducted at the Station indicate that the Station is experiencing a premature end to its service life as a result of an alkali-aggregate reaction (AAR) within the Station's existing concrete structures that is causing the concrete to expand. The Mactaquac Project consists of an evaluation of several potential options to address the future of the Station beyond its projected premature end of service life in 2030. As detailed in the Final CER Report (Stantec 2016), the three end-of-life options being considered by NB Power are:

- Option 1, Repowering: Refurbish the Station by constructing a new powerhouse, spillway, and other components, followed by the removal of the existing concrete structures at the Station;
- Option 2, Retain the Headpond (No Power Generation): Build a new concrete spillway and maintain the dam as a water control structure without power generation, followed by the removal of the existing concrete structures at the Station; or
- Option 3, River Restoration: Remove the Station and enable the river to return to a free-flowing state.

The end-of-life options were evaluated in the CER Report because they were determined to be technically achievable at the time the CER was being developed, and they would provide a long-term solution to the current problems facing the Station.

The CER Report provides a means to better understand the environmental, social, and socio-economic issues that could arise from each of the end-of-life options. The CER Report is a high-level evaluation of the likely ways that each of the end-of-life options may interact with, or affect, the surrounding environment. It also provides a means by which potential mitigation measures can be identified at an early planning stage to make each option environmentally acceptable. The information collected as part of the CER will be considered by NB Power, along with other information, in its decision-making regarding the Station.

Why This Addendum?

In addition to the three end-of-life options discussed above, NB Power has continued to review the projected 2030 end of service life for the Station, including exploring ways to continue operations within the current footprint beyond 2030 (*i.e.*, due diligence studies). A range of approaches have been considered as part of that examination, which we collectively refer to as the Life Achievement Option. These potential approaches were not evaluated in the CER process because their development was not as advanced as the three end-of-life options, and they had not yet been determined to be technically feasible at that time.

Recent studies on the Life Achievement Option have provided promising results relating to the structural integrity of the concrete structures, which is critically important to the operation of the Station. Recent modelling has shown that, despite an ongoing growth of the concrete due to AAR, known issues may be mitigated with extensive ongoing maintenance, repair or refurbishment. With this work, the structural integrity of the concrete is anticipated to remain within acceptable limits until at least 2068. Also, further engineering studies have been carried out on the Life Achievement Option to evaluate how it might be carried out to maintain the Station operational for the remainder of its original intended service life. The results of studies suggest that it may be possible to maintain or partially refurbish the existing Station components to extend their life beyond 2030.

In light of these advancements, NB Power has decided to further consider the Life Achievement Option in its decision-making regarding the fate of Mactaquac beyond 2030. As such, this Addendum has been developed to provide further information to NB Power on the possible environmental issues associated with the Life Achievement Option, and how it could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report.

How Would the Life Achievement Option Work?

The Life Achievement Option would consist of one of various approaches that are being considered to maintain/repair/refurbish existing structures and power generating infrastructure at the Station (*e.g.*, intake channel, powerhouse, main spillway, diversion sluiceway). The specific approach will be further developed based on results of ongoing studies and detailed planning to define how existing concrete structures and their associated mechanical components could be maintained as operational, repaired as necessary, or partially or fully refurbished in place. Possible approaches could range from maintenance and repair activities so that units are operational for as long as possible until their mechanical failure, to partially demolishing components and rebuilding them with refurbished or new components in the same footprint. Provisions for additional spilling capacity for extreme weather events and for replacing or supplementing fish passage facilities are also being evaluated.

All approaches being considered are being devised with the goal of achieving the original intended 100-year service life of the Station (*i.e.*, to the year 2068), or as close as possible to it.

What Does this CER Addendum Conclude?

In this Addendum, the Life Achievement Option is evaluated to determine if activities would interact with the thirteen valued components (VCs) identified in the CER Report, in the same way that was completed for the end-of-life options. If the Life Achievement Option is determined to interact highly with a particular VC, additional mitigation or other measures to further reduce changes to the VC may be identified. The focus of this Addendum was to identify interactions that are similar to or different from the end-of-life options, discuss those interactions, and provide recommendations for new additional mitigation or further information requirements/data collection where new concerns are identified.

Overall, this CER Addendum demonstrates that the Life Achievement Option itself (in the absence of other possible components such as an additional auxiliary spillway and fish passage facilities that may be considered by NB Power as part of this option) has very limited interactions with the environment, since most construction activities would take place within existing footprints of the Station. The interactions of the Life Achievement Option with the environment would be largely focused on the immediate area surrounding the Station (e.g., noise, dust, clearing of vegetation/habitat). The new auxiliary spillway and fish passage facilities, should NB Power decide to proceed with them as part of Life Achievement, would have an additional footprint (similar to Option 2) that would interact with the environment in a manner that is largely similar in nature and magnitude but shorter in duration to Option 1 or Option 2, which are discussed in the CER Report. The Life Achievement Option would not be expected to result in any changes to the surface water flow regime upstream or downstream of the Station, and therefore the interactions discussed in the CER Report associated with dewatering the headpond are not anticipated. As with the end-of-life options, the Life Achievement Option may have both some positive and negative attributes from an environmental, social, or socio-economic standpoint. Any option selected by NB Power will require careful planning, management, and execution to achieve acceptable environmental results and enhance positive attributes.

The CER Addendum is an integral part of the early planning process to assist NB Power in its decision making regarding the Station and to consider environmental, social and economic opportunities and constraints. It will be important for NB Power to continue this ongoing planning, consultation, issues management, and mitigation so that which Option is ultimately selected is carried out in a progressive, systematic, and environmentally responsible manner.

SOMMAIRE DE GESTION

Ce document constitue un addenda au rapport final de revue environnementale comparative portant sur les options envisagées pour la centrale électrique de Mactaquac, située à Mactaquac, au Nouveau-Brunswick.

Cet addenda doit être consulté de pair avec le document provisoire intitulé *« Mactaquac Project : Final Comparative Environmental Review (CER) Report »*, préparé par Stantec Consulting Ltd. (Stantec) au nom de la Société d'Énergie du Nouveau-Brunswick (Énergie NB) et daté d'août 2016 (Stantec 2016). Ce document remplace l'ébauche du rapport de la revue environnementale comparative, datée de septembre 2015 (Stantec 2015).

Tel qu'il est énoncé dans le rapport qui a évalué les options de fin de durée de vie utile (décrit ci-dessous), parallèlement à l'élaboration du rapport et aux revues publiques menées à ce sujet, Énergie NB a continué d'étudier et d'explorer différentes avenues afin de poursuivre l'exploitation de la centrale électrique de Mactaquac (la centrale) à l'emplacement actuel après 2030. Cet addenda a été rédigé à la lumière du progrès obtenu à la suite de la réalisation de ces études.

Contexte

Les travaux de modélisation et d'entretien effectués à la centrale montrent que celle-ci est confrontée à une fin prématurée de sa vie utile en raison de la réaction alcaline des agrégats à l'intérieur des structures de béton existantes, ce qui cause l'expansion du béton. Le projet Mactaquac consiste en une évaluation de plusieurs options permettant d'envisager l'avenir de la centrale au-delà de la fin prématurée de sa vie utile, prévue pour 2030. Tel qu'il est indiqué de façon détaillée dans le rapport final de la revue environnementale comparative (Stantec 2016), les trois options de fin de durée de vie utile qui sont sujet à l'examen par Énergie NB pour la centrale sont les suivantes :

- Option 1 – Rééquipement : remise à neuf de la centrale électrique par la construction d'une nouvelle centrale, d'un nouvel évacuateur de crue et d'autres composants, puis démantèlement des structures en béton existantes à la centrale électrique.

- Option 2 – Retenue du bassin d'amont (sans production d'énergie) : construction d'un nouvel évacuateur de crue en béton et conservation du barrage comme installation de régulation des eaux, mais sans production d'énergie, puis enlèvement des structures en béton existantes à la centrale électrique.

- Option 3 – Réhabilitation de la rivière : démantèlement de la centrale électrique pour permettre l'écoulement libre de l'eau de la rivière.

Ces options ont été analysées dans le rapport puisqu'elles ont été présentées comme étant techniquement réalisables au moment où la revue environnementale comparative était en cours. Elles permettraient également d'offrir une solution à long terme aux problèmes auxquels la centrale est actuellement confrontée.

Le rapport de de revue environnementale comparative permet une meilleure compréhension des enjeux environnementaux, sociaux et socio-économiques qui pourraient découler de chacune des trois options de fin de durée de vie utile. Le rapport évalue sommairement la façon dont chacune des options pourrait potentiellement interagir avec le milieu environnant ou l'affecter. Le rapport fournit également une méthode pour déterminer laquelle des mesures d'atténuation envisageables peut être retenue à un stade précoce de la planification, et ce, de façon à faire de chaque option une option environnementalement acceptable. Au cours de son processus de prise de décisions concernant la centrale, Énergie NB tiendra compte des données recueillies lors de la revue environnementale comparative, de même que d'autres informations.

Quelle est la raison d'être de cet addenda?

En plus de s'intéresser aux trois options dont il a été question précédemment, Énergie NB a continué d'examiner la fin de la vie utile de la centrale, prévue pour 2030, ce qui signifie qu'elle a notamment envisagé différentes façons permettant de poursuivre l'exploitation de la centrale à l'emplacement actuel après 2030 (c.-à-d., études de diligence raisonnable). Plusieurs approches ont été prises en compte dans cette analyse, des approches que nous nommons collectivement *option pour l'atteinte de la durée de vie utile*. Ces approches envisageables n'ont pas été évaluées dans le cadre du processus de la revue environnementale comparative puisque leur élaboration n'était pas aussi avancée que celle des trois options de fin de durée de vie utile présentées précédemment et qu'à ce moment, il n'avait pas été démontré qu'elles pouvaient être techniquement réalisables.

De récentes études portant sur l'option pour l'atteinte de la durée de vie utile ont fourni des résultats prometteurs concernant l'intégrité structurale des structures de béton, qui sont d'une importance capitale à l'exploitation de la centrale. La plus récente modélisation a montré qu'en dépit de l'expansion continue du béton causée par la réaction alcaline des agrégats, les problèmes connus peuvent vraisemblablement être atténués à l'aide d'importants travaux d'entretien continu, de réparation et de remise à neuf. Grâce à ces travaux, il est prévu que l'intégrité structurale du béton demeure dans des limites acceptables au moins jusqu'en 2068. De plus, d'autres études techniques ont porté sur l'option pour l'atteinte de la durée de vie utile : elles visaient à évaluer de quelle façon cette option pourrait être mise en application afin de maintenir la centrale en fonctionnement pour le reste de sa durée de vie initialement prévue. Les résultats de ces études suggèrent qu'il pourrait être possible de préserver les composants existants de la centrale ou de les remettre à neuf en partie, et ce, pour prolonger leur durée de vie après 2030.

À la lumière de ces résultats, Énergie NB a décidé d'étudier plus en détail l'option pour l'atteinte de la durée de vie utile dans le cadre de son processus de prise de décisions concernant le sort de la centrale de Mactaquac après 2030. Ainsi, cet addenda a été rédigé afin de fournir à Énergie NB de plus amples informations à propos des potentielles questions environnementales associées à l'option pour l'atteinte de la durée de vie utile. Cet addenda vise également à montrer de quelle façon cette option pourrait être acceptable si l'on adopte une approche similaire à celle employée pour les trois options de fin de durée de vie utile, présentées dans le rapport de revue environnementale comparative.

De quelle façon l'option pour l'atteinte de la durée de vie utile fonctionnerait-elle?

L'option pour l'atteinte de la durée de vie utile serait l'une des différentes approches envisagées afin d'assurer l'entretien, la réparation et la remise à neuf des structures existantes et de l'infrastructure génératrice d'énergie de la centrale (par exemple, la conduite d'amenée, la centrale électrique, l'évacuateur de crue principal, le pertuis de détournement). L'approche qui sera retenue plus précisément sera étoffée en fonction des résultats des études en cours de réalisation et de la planification détaillée afin d'établir de quelle façon les structures de béton existantes et les composants mécaniques qui y sont associés peuvent être maintenus en état de fonctionner, réparés, le cas échéant, ou encore partiellement ou complètement remis à neuf sur place (remise à neuf sur le chantier). L'étendue des approches potentielles est vaste : il pourrait s'agir d'activités d'entretien et de réparation visant à garder les appareils en état de fonctionner aussi longtemps que possible, jusqu'à ce qu'un bris mécanique survienne, mais également de la démolition partielle des composants et de leur reconstruction, sur le même emplacement, à partir de composants neufs ou réusinés. Des mesures visant à accroître la capacité de déversement en cas de phénomènes météorologiques extrêmes et à remplacer ou à compléter les dispositifs de passage des poissons sont également en cours d'évaluation.

Toutes les approches prises en considération sont élaborées dans le but d'atteindre la durée de vie de 100 ans prévue au départ pour la centrale (soit jusqu'en 2068) ou pour s'en approcher autant que faire se peut. D'importantes études et évaluations sont en cours afin de déterminer la meilleure approche à adopter pour chaque composant ou chaque appareil.

Quelle est la conclusion de cet addenda à la revue environnementale comparative?

Dans cet addenda, l'option pour l'atteinte de la durée de vie utile a été évaluée pour déterminer si les activités pourraient interagir avec les 13 composantes valorisées identifiées dans le rapport de revue environnementale comparative, et ce, de la même façon qu'ont été évaluées les trois options présentées dans le rapport de la revue environnementale comparative. S'il est établi que l'option pour l'atteinte de la durée de vie utile pourrait fortement interagir avec une composante valorisée en particulier, des mesures d'atténuation supplémentaires ou d'autres mesures visant à minimiser les changements de cette composante pourraient être proposées. Le principal objectif de cet addenda était de mettre au jour les interactions semblables à celles des trois options et différentes d'elles, d'examiner ces interactions et de proposer des recommandations en vue d'établir de nouvelles mesures d'atténuation. Il a également été question des exigences en matière d'information et de la collecte de données lorsque de nouvelles préoccupations surviennent.

De façon générale, cet addenda à la revue environnementale comparative indique que l'option pour l'atteinte de la durée de vie utile pourrait interagir avec l'environnement d'une façon essentiellement comparable à l'option 1 ou à l'option 2. Les interactions de ces deux options sont présentées dans le rapport. Tout comme les options 1 et 2, l'option pour l'atteinte de la durée de vie utile consisterait en un projet de construction qui se déroulerait à la centrale, principalement dans les limites de l'emplacement actuel, malgré que celle-ci occuperait un espace plus compact qu'actuellement sauf si de la capacité de reversement additionnelle ou des installations additionnelles pour le passage des poissons sont incluses dans la conception de cette option. Il s'agit d'une option dont les interactions sont principalement axées sur le milieu entourant la centrale (par exemple, le bruit, la poussière, le défrichement de la végétation et le retrait de l'habitat). Il n'est pas prévu que l'option pour l'atteinte

de la durée de vie utile ait comme résultat quelque changement que ce soit concernant le régime d'écoulement des eaux de surface en amont ou en aval de la centrale. Conséquemment, les interactions analysées dans le rapport et concernant l'assèchement du bassin d'amont ne devraient pas se produire. Tout comme les trois options de fin de durée de vie utile, l'option pour l'atteinte de la durée de vie utile pourrait présenter à la fois des aspects positifs et négatifs, selon le point de vue à partir duquel elle est envisagée (environnemental, social ou socio-économique). Toute option retenue par Énergie NB nécessitera une planification, une gestion et une mise en œuvre minutieuses afin d'obtenir des résultats acceptables sur le plan environnemental et de compter le plus grand nombre possible d'aspects positifs.

L'addenda à la revue environnementale comparative fait partie intégrante du stade précoce de la planification; il vise à soutenir Énergie NB dans le cadre de son processus de prise de décisions concernant la centrale et à examiner les contraintes environnementales, sociales et économiques, de même que les conditions favorables. Il sera important qu'Énergie NB continue de mener cette planification, de consulter des intervenants, de gérer les enjeux et de mettre au point des mesures d'atténuation; de cette façon, l'option choisie en bout de piste sera mise en œuvre de façon progressive, systématique et environnementalement responsable.

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1.0 INTRODUCTION

This document is an Addendum to the Final Comparative Environmental Review (CER) Report of options being considered for the Mactaquac Generating Station in Mactaquac, New Brunswick.

This Addendum should be read in concert with the draft document entitled "Mactaquac Project: Final Comparative Environmental Review (CER) Report" prepared by Stantec Consulting Ltd. (Stantec) on behalf of the New Brunswick Power Corporation (NB Power), dated August 2016 (Stantec 2016). That document supersedes the draft CER Report, dated September 2015 (Stantec 2015).

As described in the CER Report, concurrent to the development and public review of the CER Report, NB Power has continued to study and explore ways to continue operations of the Mactaquac Generating Station (the Station) within the current footprint beyond 2030. This Addendum has been developed in light of the recent results from these ongoing studies.

1.1 BACKGROUND

The Station is a hydroelectric generating station with a capacity of approximately 670 megawatts (MW) that provides renewable electricity and reliability services to New Brunswickers. It is owned and operated by the New Brunswick Power Corporation (NB Power), and is located on the Saint John River approximately 19 km west of the city of Fredericton (Figure 1.1). It was commissioned in 1968, with a life expectancy of about 100 years (*i.e.*, until approximately the year 2068).

As described in the CER Report (Stantec 2016), early modelling indicated that the Station would likely have a premature end of service life as a result of an alkali-aggregate reaction (AAR) within the existing concrete structures at the Station, including the intake structure, the main spillway, the powerhouse, and the diversion sluiceway (Figure 1.2). AAR is a concern because the expanding concrete results in a slow deterioration of the mechanical properties of the concrete and also causes difficulties with various structural, mechanical, and electrical components associated with the Station (*e.g.*, turbines, gates). It was estimated that AAR had reduced the life expectancy of the Station to approximately the year 2030, instead of its original expected 100-year design life. The earthen dam at the Station is unaffected by AAR and will remain suitable for continued use beyond 2030 if needed. Since the mid-1980s, NB Power has been monitoring the AAR issue and carrying out extensive maintenance work, including cutting slots to allow the concrete expansion to occur while maintaining the functionality of equipment at the Station.

The Mactaquac Project (the Project) consists of an evaluation of several potential options to address the future of the Station beyond its projected premature end of service life in 2030. As detailed in the final CER Report (Stantec 2016), the three end-of-life Project Options considered by NB Power are:

- Option 1, Repowering: Refurbish the Station by constructing a new powerhouse, spillway, and other components, followed by the removal of the existing concrete structures at the Station;
- Option 2, Retain the Headpond (No Power Generation): Build a new concrete spillway and maintain the dam as a water control structure without power generation, followed by the removal of the existing concrete structures at the Station; and

- Option 3, River Restoration: Remove the Station and enable the river to return to a free-flowing state.

For brevity and clarity, this CER Addendum collectively refers to these three options as the end-of-life options.

The end-of-life options were chosen for consideration in the CER because they were determined to be technically achievable, and they would provide a long-term solution to problems facing the current Station.

Following NB Power's evaluation, the Preferred Option will be selected by NB Power based on a review of engineering, constructability, environmental, Aboriginal, social, and economic considerations. NB Power plans to recommend a Preferred Option in 2016 and begin to prepare for the environmental regulatory approval processes for the Preferred Option, in order to allow sufficient time to secure approvals, and finalize design decisions.

1.2 ABOUT THE CER

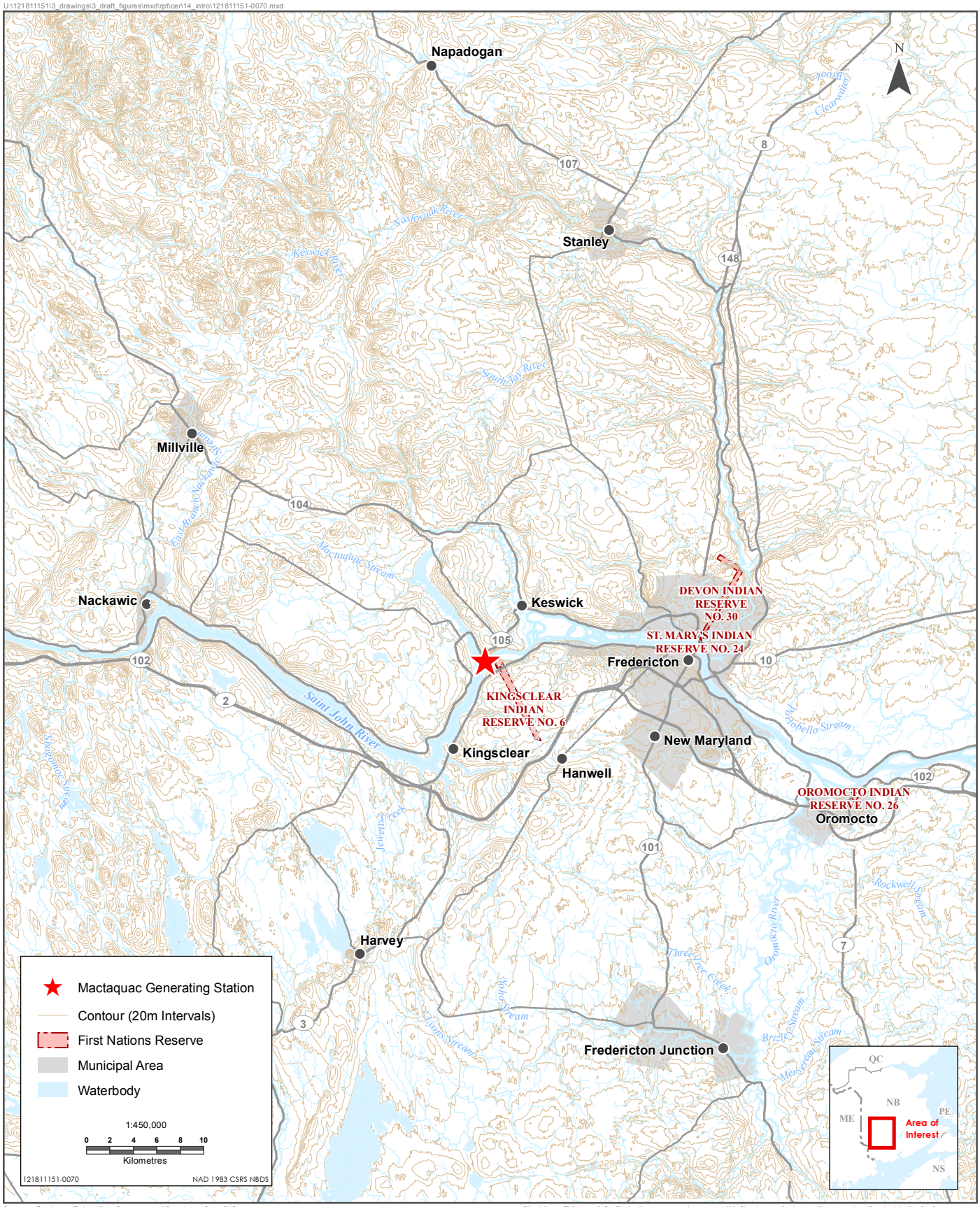
To assist in the understanding of environmental, social, and socio-economic issues potentially associated with each of the options, NB Power conducted a Comparative Environmental Review (CER) of the above three end-of-life options (Stantec 2016). The purpose of the CER was:

- to evaluate (at a high-level) the likely potential environmental effects of each Option;
- identify the key mitigation measures to make each Option environmentally acceptable, if it was selected; and
- support NB Power's selection of a Preferred Option in 2016.

The information collected as part of the CER will be considered by NB Power, along with other information (*e.g.*, business case, engineering, other considerations), in its decision-making regarding the Station. The CER will also support the scoping and conduct of any future environmental impact assessment and/or environmental assessment (EIA/EA) that might be required for the Preferred Option.

1.3 WHY THIS ADDENDUM?

In addition to the three end-of-life options discussed above, the CER Report identified that NB Power is continuing to review the projected 2030 end of service life for the Station. That work includes exploring ways to continue operations within the current footprint beyond 2030 (*i.e.*, due diligence studies). The work done on the Station as part of these other possible approaches would not likely require a material change from current operations; if this were the case, there would also likely be minimal incremental upstream or downstream effects compared to current operations at the Station. These potential approaches for continuing operations within the current footprint were not evaluated in the CER process because their evaluation and development was not as advanced as the three end-of-life options, and they had not yet been determined to be technically feasible at that time.



Sources: Contours, First Nations Reserve, and Roads are from SNB, Waterbodies and Watercourses from NBDNR, All data downloaded from GeoNB.

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

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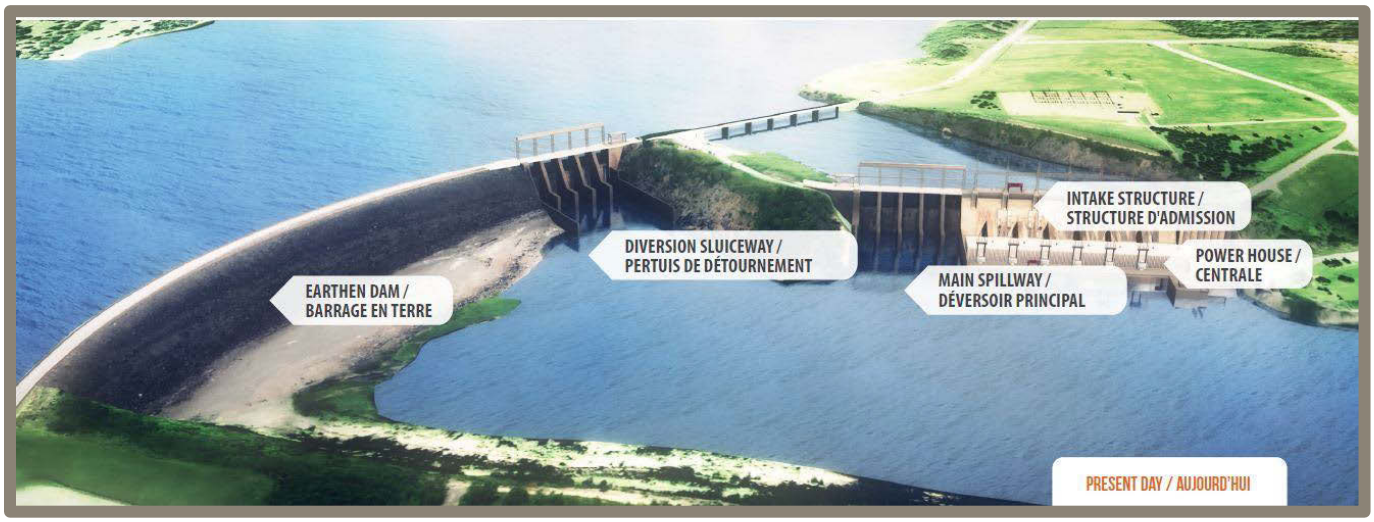
1218111511 - Mactaquac Project - NB Power

Project Location

Figure 1.1



Source: NB Power

Figure 1.2 Conceptual Rendering of the Existing Mactaquac Generating Station

The due diligence studies related to the Life Achievement Option, include:

- a review of the structural integrity of the existing concrete structures at the Station, including the development of sophisticated finite element models to simulate the AAR expansion and the anticipated effect of AAR on the integrity of the concrete structures over time;
- an evaluation of possible partial refurbishment, whereby the existing components of the powerhouse and other concrete and mechanical components at the Station would be demolished in their current footprint, and rebuilt with new components; and
- an evaluation of a possible maintenance, repair, and/or refurbishment activities on existing Station components to maintain those units as operational for as long as possible, within the current footprint and with minimal new components.

Recent results from these studies have shown promising results relating to the structural integrity of the concrete structures. Modelling has shown that known issues may be mitigated with ongoing maintenance, repair or refurbishment. With this work, the structural integrity of the concrete is anticipated to remain within acceptable limits until at least the year 2068. Also, further engineering studies have been carried out on the Life Achievement Option to evaluate how it might be carried out to maintain the Station as operational for the remainder of its original intended service life. The results of studies suggest that it may be possible to maintain or partially refurbish the existing Station components to extend their life beyond 2030.

In light of these advancements, NB Power has decided to further consider the Life Achievement Option in its decision-making regarding the fate of Mactaquac beyond 2030. As such, this Addendum has been developed to provide further information to NB Power on the possible environmental issues associated with the Life Achievement Option, and how it could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report.

1.4 WHAT DOES THIS MEAN TO NB POWER'S DECISION REGARDING THE PREFERRED OPTION?

NB Power remains committed to making a decision regarding which option it will recommend to the Government of New Brunswick for Mactaquac, before the end of 2016. As evidenced in the CER Report, the "status quo" or "do nothing" approach is not an option for Mactaquac. The results of recent studies suggest that the Station can continue to operate safely and reliably for a number of years; however, considerable effort aimed at addressing key vulnerabilities that would otherwise limit its operation would be required.

As such, the information presented in this CER Addendum, and the related engineering, environmental, feasibility and other studies being conducted in parallel to it, provides an alternative option for NB Power to consider in its decision-making regarding the Station, by the end of 2016.

1.5 ORGANIZATION OF THIS ADDENDUM

This CER Addendum is presented in 18 sections, as follows.

- Following this introduction, Chapter 2 provides a description of the components and elements of the Life Achievement Option and other possible related components as they are currently conceived, including a brief description of the activities that could be carried out and a discussion of mitigation measures that could be employed.

- Chapter 3 provides a high-level summary of the CER Report, an overview of methodology used in the CER Addendum, and a high-level discussion of the anticipated potential interactions between the Life Achievement Option and the environment, which are further elaborated in subsequent chapters.

- Chapters 4 to 16 provide a discussion of the results of the Comparative Environmental Review of the Life Achievement Option for each Valued Component (VC).

- Chapter 17 provides a summary and concluding remarks associated with this CER Addendum.

- Chapter 18 provides the references cited or consulted in the preparation of the CER Addendum.

The report entitled "Mactaquac Project: Final Comparative Environmental Review (CER) Report" (Stantec 2016), provides additional information on the Mactaquac Generating Station, other options being considered, more in-depth discussion of the environmental attributes of each VC, scoping considerations, methods that were used to conduct the CER, information on existing conditions, environmental interactions, and other related information.

For complete clarity, where reference is made in this Addendum to the "CER Report", the reference relates to the Final CER Report dated August 2016 (Stantec 2016) instead of the draft CER Report dated September 2015 (Stantec 2015), unless otherwise explicitly stated.

2.0 DESCRIPTION OF THE LIFE ACHIEVEMENT OPTION

This section describes the Life Achievement Option and possible related components that are being considered in concert with this range of options being considered. This information is preliminary and subject to change as engineering design and other aspects of Project planning proceeds. This section describes the components, phases, activities, and the anticipated schedule of the Life Achievement Option and Possible Related Components, along with key mitigation measures that could be employed to minimize interactions with the surrounding environment.

2.1 THE LIFE ACHIEVEMENT OPTION

The major components being considered for the Life Achievement Option are summarized in Table 2.1.

Table 2.1 The Life Achievement Option

Component	Planned as Part of the Life Achievement Option	Possible Related Components being Considered
Maintenance, repair, or refurbishment of existing structures and power generating infrastructure (*i.e.*, intake structure, powerhouse, main spillway, diversion sluiceway)	✓	
Temporary ancillary facilities	✓	

Further details on these components, as they are currently conceived at this early design stage, are provided in the sub-sections that follow.

2.1.1 Maintenance, Repair, or Refurbishment of Existing Structures and Power Generating Infrastructure

Various approaches to maintain/repair/refurbish existing structures and power generating infrastructure at the Station (*e.g.*, intake channel, powerhouse, main spillway, diversion sluiceway) could be followed. The specific approach to be taken will be further developed based on results of ongoing studies and detailed planning to define how existing concrete structures and their associated mechanical components could be maintained as operational, repaired as necessary, or partially or fully refurbished in place. Approaches could range from maintenance and repair activities, to partially demolishing components and rebuilding them with refurbished or new components. All approaches being considered are being devised with the goal of achieving the original intended 100-year service life of the Station (*i.e.*, to the year 2068), or as close as possible to it. Considerable study and evaluation is ongoing to determine the best approach for component or units.

Depending on the approach selected, components and activities could involve the partial demolition of existing concrete, removal and repair or replacement of mechanical components (*e.g.*, gates), placing of new concrete, repair or replacement of turbine-generators, replacement of superstructures, repair or replacement of transformers and other electrical and mechanical equipment, and other possible modifications.

These and other conceptual approaches to achieving maintenance/repair/refurbishment of these structures will be developed as further engineering study progresses.

2.1.2 Temporary Ancillary Facilities

Temporary ancillary facilities needed to carry out the Life Achievement Option would be similar to, but relatively more modest than, those that would be required under the end-of-life options. These may include:

- concrete mixing (batch) plant(s);
- rock crushing and storage area;
- aggregate storage area;
- site buildings (*e.g.*, offices, washrooms, infirmary);
- material laydown areas (on right bank and on left bank, near existing facilities);
- temporary roads and gravel parking areas; and
- security office and gate houses.

A permanent material disposal area will also be required for any concrete removed during repair/refurbishment activities, and for any potential material excavated for a new approach/discharge channel for a new auxiliary spillway (discussed in Section 2.2.1 below), should NB Power wish to proceed with that component. All of the necessary permits and approvals will be obtained for this site. Permanent material stockpiles will not be located within watercourse or wetlands, and permits would be obtained for any stockpiles located within 30 m of watercourses and wetlands. Stockpiles will use erosion and sedimentation control structures.

2.2 POSSIBLE RELATED COMPONENTS

Possible related components that will be considered in concert with the Life Achievement Option are summarized in Table 2.2. It is important to note that NB Power has not decided whether or not these components will be constructed along with the Life Achievement Option (should that option be selected), but they are nonetheless discussed in this CER Addendum in the event that NB Power decides to proceed with them. If NB Power decides to construct either of these possible related components, they may be undertaken as projects separate from the Life Achievement Option.

Table 2.2 Possible Related Components

Component	Planned as Part of the Life Achievement Option	Possible Related Components being Considered
New auxiliary spillway, with approach and discharge channel		✓
Fish passage facilities		✓

Further details on these components, as they are currently conceived at this early design stage, are provided in the sub-sections that follow.

2.2.1 New Auxiliary Spillway, with Approach and Discharge Channel

With the Life Achievement Option, it could be determined that a new auxiliary spillway will be constructed to augment existing spilling capacity at the Station during extreme and unlikely weather events. Studies are ongoing to determine the appropriate spilling capacity at the Station. Should it be determined that a new auxiliary spillway is required, it would likely be located in a new approach/discharge channel on the right (south) bank of the Saint John River, roughly in the location of the planned main spillway that was identified in the CER Report (Stantec 2016) for Option 2 (see Section 2.3.1 of the CER Report). The channel will be excavated mainly in rock and will be far enough away from the existing dam that it will not compromise its structural integrity during construction. The channel will be curved in such a way as to limit excavation while promoting stable and efficient water flow regimes.

Current indications are that the auxiliary spillway would be constructed in the excavated approach/discharge channel, mainly of reinforced concrete with steel mechanical components. It would have six identical waterways. Each waterway would be equipped with vertical metal gates and rollers, and would be heated during winter operation. Each waterway would also be equipped with stop-logs upstream of the vertical gates to block water and allow for maintenance. It would be constructed to meet the spilling and seismic requirements of the Canadian Dam Association's dam safety guidelines (CDA 2007).

In addition to ongoing consideration of the appropriate spilling capacity, NB Power will also investigate other spilling technologies that may be more suited to this particular application.

Should NB Power decide to proceed with a new auxiliary spillway along with the Life Achievement Option, its potential interactions with the environment would be expected to be largely similar to those associated with Option 2, as discussed in the CER Report. As such, except for minor interactions that might be expected to be somewhat different than those associated with Option 2, the environmental interactions of the new auxiliary spillway are not discussed in substantive detail in this CER Addendum.

2.2.2 Fish Passage Facilities

As outlined in Section 2.3.5 of the CER Report, upstream fish passage at the Station is currently managed for the passage of Atlantic salmon and gaspereau only. The existing fish collection facilities are on the downstream side of the powerhouse, where fish are trapped and targeted species of fish trucked upstream. Existing Units 1 and 2 (*i.e.*, the two units closest to the left or north bank of the river) provide attraction flows for fish to be led to the fish collection facilities. For downstream passage, fish must pass through the turbines, the main spillway, or the diversion sluiceway. There is also a hatchery downstream of the Station, which is operated by Fisheries and Oceans Canada. It was built in 1968 to compensate for the possible losses in natural Atlantic salmon production associated with NB Power's operations on the Saint John River. These existing fish passage facilities and approaches were consistent with current industry approaches used at the time that the Station was constructed.

The various means of potentially improving/expanding fish passage as part of the Project were outlined in Section 2.3.5 of the CER Report. NB Power is committed to studying fish passage alternatives, defining fish passage goals, and achieving effective fish passage at Mactaquac for the targeted fish species based on good science, regardless of the option that is ultimately selected. As such, NB Power will

provide for sufficient fish passage facilities as part of the Life Achievement Option (should it be selected) to achieve targeted fish passage goals, as informed by science, ongoing studies, and regulatory decisions.

As part of the Mactaquac Aquatic Ecosystem Study (MAES), the Canadian Rivers Institute (CRI) has been gathering detailed scientific information about the various species in the Saint John River upstream and downstream of the Station since 2013. This information is furthering an understanding of species' populations, distribution patterns, habitats, and stressors to their survival. A primary goal of these studies is to help determine which fish species should be passed at Mactaquac, and using what methods. At this time, it is not yet known which fish species will be a management priority. This will be informed by the ongoing MAES work and subsequently determined by the applicable government regulatory agencies (*i.e.,* Fisheries and Oceans Canada, New Brunswick Department of Natural Resources), and considering the input of Aboriginal groups and stakeholders.

While the CRI work will determine needs, goals, and methods for achieving long-term fish passage following completion of the Project, it is understood that additional measures will need to be considered during construction of the Life Achievement Option, if it is ultimately selected by NB Power. The maintenance/repair/refurbishment work for the Life Achievement Option would likely be carried out on individual units at a given time, or at most on two contiguous units at a time. In this manner, the existing fish collection facilities at Mactaquac would be able to continue to operate while units are being worked on, as fish attraction flows through Unit 1 or Unit 2 would continue to be provided during this time. In the event that maintenance/repair/refurbishment work were to be carried out on Units 1 and 2 at the same time would there be a need for additional fish attraction and collection facilities to be considered, as attraction flows could not be provided during this time. In this event, it would be necessary for NB Power to carefully plan and consider options for achieving temporary fish passage while work is being carried out on Units 1 and 2.

In summary, the various fish species that use the Saint John River, fish passage goals, and the associated methods for allowing their passage, are being studied as part of the MAES. NB Power remains committed to improving long-term fish passage at Mactaquac to achieve targeted fish passage goals, and will select the most appropriate strategy for achieving those goals as part of detailed design of the Preferred Option. Once more scientific study has been conducted and regulatory discussions have been held, the fish species that are of priority for fish passage can be determined. Then the appropriate fish passage facilities can be selected and designed to supplement, or replace, the fish collection and passage facilities currently in place at Mactaquac, on a temporary or permanent basis.

2.3 PHASES AND ACTIVITIES

2.3.1 Construction

2.3.1.1 Site Preparation and Construction of Temporary Ancillary Facilities

As with the end-of-life options, site preparation for construction would be the first construction activity carried out in preparation for the maintenance/repair/refurbishment work as well as for other possible related components. Depending on the magnitude of maintenance and repair activities being completed as part of the Life Achievement Option, site preparation activities could range from being very minimal to more extensive. Site preparation will include surveying, clearing, grubbing and grading

the site, as necessary. Temporary ancillary areas and temporary roads will be developed as required. As part of site preparation, a defined construction zone will be established and a fence will be installed to control access to the site. Temporary services for the site, such as power, sewer and water, will be installed to support construction. Water required during construction for activities such as concrete production and dust control will be withdrawn from the headpond, or supplied from on-site water wells. These same water sources will also be used for the supply of potable water, and water treatment will be applied as needed. If required, potable water could also be transported to the site from nearby sources (*e.g.*, the City of Fredericton).

2.3.1.2 Maintenance/Repair/Refurbishment of Existing Structures and Power Generating Infrastructure

The specific activities and sequence associated with the maintenance/repair/refurbishment of existing structures and power generating infrastructure at the Station (*e.g.*, intake channel, powerhouse, main spillway, diversion sluiceway) depends on the specific activities planned for each component or unit, which may vary. Depending on the results of ongoing studies and detailed planning, different components may be subjected to different approaches or activities. For example, it is possible that very little work would be required for some components (such as the intake structure), whereas with others, considerable repair, refurbishment or replacement may be necessary. Each component or unit is being evaluated to determine the best approach for that component or unit, with the goal of achieving the Station's original intended service life (*i.e.*, to 2068), or as close as possible to it.

Conceptual approaches to achieving maintenance/repair/refurbishment of these structures were presented in Section 2.1.1 above. Those approaches could range from minimal maintenance or repair of a particular component/unit to allow operation until it reaches its end of functional life; to carefully demolishing portions of units, pouring new concrete, and installing new mechanical components. The specific activities and sequence associated with such approaches will therefore vary. The use of cofferdams and related isolation techniques would be considered so as to be able to carry out the maintenance/repair/refurbishment work in the dry. Because they are not currently completely known, such approaches and sequence are not detailed here, but would be incorporated into final project concept. Maintenance/repair/refurbishment activities would be carried out on individual units at a given time, or possibly on two contiguous units at a given time.

2.3.1.3 Channel Excavation

Following site preparation, and if it is determined to be required, excavation for the new approach/discharge channel for the new auxiliary spillway would begin. This excavation would require the removal and transport of a substantial amount of material, mostly rock, from the right bank. To maintain slope stability, the excavation of overburden material would maintain side slopes of 1 m vertical: 2.5 m horizontal, whereas the excavation of rock would maintain side slopes of 6 m vertical:1 m horizontal. Standard earth-moving equipment would be used during excavation, in addition to blasting when bedrock is encountered.

Material excavated from the approach/discharge channel would be designated for future use. The material would be stockpiled in the designated area or transported off-site to the permanent excavated material disposal area.

As with the end-of-life options, the approach/discharge channel would be constructed in the dry by initiating the excavation on land and maintaining a rock plug between the excavation and Saint John River.

2.3.1.4 Construction of New Auxiliary Spillway

If a new auxiliary spillway is required, once excavation of the approach/discharge channel is complete, construction of the new auxiliary spillway would commence, within the dry excavated channel as rock plugs on each end of the channel will remain in place. Construction of the new auxiliary spillway would be carried out in the dry. It would be constructed of concrete and steel. Spillway gates, hoists and associated equipment would be installed after the concrete structures have been constructed.

The rock plugs at each end of the channel would be removed once the new structures are complete.

2.3.1.5 Construction of Improved Fish Passage Facilities

The existing fish collection and passage facilities at the Station will require further work to provide for multi-species upstream and downstream fish passage at Mactaquac. The additional fish passage facilities will be constructed, in accordance with the recommendations arising from the MAES work, consultation with regulatory agencies, and stakeholder and Aboriginal engagement.

2.3.2 Operation

Operation of the Station following completion of the Life Achievement Option would be expected to continue largely as it is carried out today. Power would be generated by allowing water from the headpond to enter the intake channel for the units that are designated for operation on a particular day, and electricity would be generated from passing water through the turbine of each unit.

Continued operation of the fish passage facility would occur, and may be upgraded through other activities carried out in conjunction with the Life Achievement Option. Though hourly and daily fluctuations in water levels may change as compared to current operations, overall the water levels will be managed on a daily basis in a similar manner to currently, and the maximum water level (40.5 m above mean sea level [amsl]) and minimum drawdown level (39 m amsl) will be maintained. Water levels will be manipulated within the operational range and environmental flow restrictions to maximize power generation.

Maintenance will be carried out as needed throughout the life of the facilities to achieve their expected service life, and beyond if possible.

The new auxiliary spillway, if it is determined to be required, would not be expected to operate unless there is a particular need to spill large volumes of water through the facilities beyond current spilling capabilities (*e.g.*, in an extreme weather event).

2.4 MITIGATION

Mitigation for the Life Achievement Option and Possible Related Components would be consistent with mitigation outlined in Section 2.6 of the CER Report (Stantec 2016).

2.4.1 Maintain Transportation Link Between Route 102 and Route 105 (Existing or New)

As outlined in Section 2.6.3 of the CER Report, the earthen dam at the Station provides an important thoroughfare over the Saint John River and an integral link between two collector highways between Nackawic and Fredericton (Routes 102 and 105). Mactaquac Road traverses the earthen dam, the diversion sluiceway, and a short bridge over the powerhouse intake channel, to connect Routes 102 and 105. It is used by approximately 4,500 vehicles per day.

As with the end-of-life options, it is possible that the existing transportation link between Routes 102 and 105 at Mactaquac might be affected by activities associated with the Life Achievement Option and Possible Related Components, either on a temporary or permanent basis. Therefore, each option will require mitigation to maintain a transportation link in the area of the Project. A transportation study conducted for NB Power (exp Services Inc. 2015) identified eight potential alternatives for maintaining a transportation link in the Station area. These alternatives are shown in Figure 2.11 of the final CER Report.

The transportation link at Mactaquac is the responsibility of the New Brunswick Department of Transportation and Infrastructure (NBDTI), as the provincial agency responsible for the road transportation network and infrastructure in New Brunswick. As such, detailed evaluation of the transportation link between Routes 102 and 105 is not provided in this document. As with the end-of-life options, NB Power will continue to consult with NBDTI regarding transportation infrastructure at or near the Station.

2.5 SCHEDULE

NB Power is planning to recommend a Preferred Option in 2016 to prepare for conducting the applicable environmental regulatory approval processes. Completion of these processes by mid-2018 will allow construction of the Life Achievement Option to begin in 2022.

Overall, current estimates indicate that the Life Achievement Option could require up to 13 years to complete. For planning purposes, it is assumed that physical work associated with the Life Achievement Option would begin in 2022 and be completed in 2035. The anticipated schedule for implementing this option, if it is selected, is provided in Table 2.3.

Table 2.3 Anticipated Schedule for the Life Achievement Option

Phase	Anticipated Schedule
Planning Phase	2016-2021
Construction Phase (13 years)	2022-2035
Operation Phase	Present-2068

Timelines are subject to change based on the progression and refinement of engineering design and the results of studies being completed in support of the Project.

2.6 EMPLOYMENT AND EXPENDITURE

Work is ongoing to determine the estimated cost of the Life Achievement Option and Possible Related Components; however, is expected to have a lower capital cost than rebuilding the structures as per Option 1, but with a shorter operational life. Given the construction sequence and the associated logistical complexities of operating part of the Station while construction is taking place on other units, that expenditure would be spread over a longer period than the other end-of-life options (*i.e.*, up to 13 years, compared to 11 years for Option 1 or 10 years for Option 2).

In terms of workforce, the Life Achievement Option would require employment and labour of similar types of trades as other end-of-life options, but perhaps to a lesser scale. The peak labour force is estimated to be 150-275 workers for a period of approximately three months. If the auxiliary spillway or new fish passage facilities are required, the needed workforce would be expected to increase and be similar to or greater than that required for Option 2, but less than that needed for Option 1.

3.0 BACKGROUND AND METHODS

3.1 BACKGROUND

The final CER Report (Stantec 2016) consists of thirteen valued components (VCs). Within each chapter describing individual VCs, there is a description of:

- the scope of the VC, including definitions, identification of key concerns, and selection of an "area of review" that establishes spatial boundaries for conducting the evaluation;
- existing environmental conditions for the VC, based on literature sources and available information, to establish a "baseline" against which potential interactions between the end-of-life options and the VC are discussed;
- a discussion of key issues of concern and potential interactions between the end-of-life options (*i.e.,* Options 1, 2, and 3) and the environment, on a VC-by-VC basis; and
- mitigation for further reducing or enhancing the interactions with the VC (as applicable), as well as information needs for an EIA that might be required, should that option be selected.

The VCs included in the CER Report and also in this CER Addendum are as follows. The chapter in which each VC is discussed in the CER Report is provided in brackets:

- Atmospheric environment (Chapter 4);
- Acoustic environment (Chapter 5);
- Surface water (Chapter 6);
- Groundwater (Chapter 7);
- Aquatic environment (Chapter 8);
- Vegetation and wetlands (Chapter 9);
- Wildlife and wildlife habitat (Chapter 10);
- Economy and employment (Chapter 11);
- Human occupancy and resource use (Chapter 12);
- Infrastructure and services (Chapter 13);
- Transportation (Chapter 14);
- Heritage resources (Chapter 15); and
- Current use of land and resources for traditional purposes by Aboriginal persons (Chapter 16).

The reader is referred to the text of the final CER Report (Stantec 2016) for a detailed description of the scope of each VC, key issues of concern, an overview of existing conditions, and a discussion of potential interactions between the VCs and the end-of-life options, including recommended mitigation.

3.1.1 Overview of the End-of-Life Options and their Interactions with the Environment

For context, a general overview of the potential interactions between the end-of-life options and the environment, as detailed in the CER Report, is provided below. As was discussed in the CER Report, in general, interactions between the end-of-life options and the environment can be grouped into two categories:

- interactions that are attributed to construction, demolition or decommissioning activities associated with each of the options, which are mostly limited to the areas of disturbance or the immediate areas near the Station; and

- interactions that are attributed to changes in the headpond or upstream or downstream flow regimes, which may extend more regionally upstream and downstream of the Station.

Generally speaking, it is not expected that Option 1 (Repowering) or Option 2 (Retain the Headpond, No Power Generation) will result in a substantive change to flow regimes and water levels in the headpond. The more prominent interactions with the environment for these two end-of-life options will be associated with the construction of new facilities (*e.g.*, new powerhouse for Option 1; new main spillway, auxiliary spillway, and fish passage facilities for Options 1 or 2) as well as the demolition of existing concrete facilities following commissioning of the new facilities. These potential interactions include air contaminant and greenhouse gas (GHG) emissions from the combustion of fossil fuels, dust emissions from construction activity, noise emissions, potential for the release of sediment into the aquatic environment, and the loss of vegetation and wildlife habitat in the construction footprint, to name a few. Construction activities for Options 1 and 2 are anticipated to bring in a relatively large influx of workers to the area, and therefore there would likely be increased demands on local services and housing/accommodations arising from these options. Options 1 and 2 are expected to provide improved fish passage at the Station through the design and implementation of improved upstream and downstream fish passage as part of new Project facilities.

The most pronounced change that is expected from Option 3 (River Restoration) will result from dewatering of the headpond and returning the water to a more free-flowing state as a result of removal of the Station and the dam. This would cause considerable changes to the flow regime (discussed below), and will change the nature of the ecosystem from lacustrine (lake-like) to fluvial (river-like) conditions. As with Options 1 and 2, Option 3 would also result in changes near the Station associated with decommissioning activities; however, these are anticipated to be lower in magnitude and shorter in duration as compared to Options 1 and 2. For example, there could be some clearing of vegetation and wildlife habitat for laydown areas needed for Option 3, but its footprint would be much smaller than is required for Options 1 and 2. There would be some air contaminant and GHG emissions from the combustion of fossil fuels associated with decommissioning activities, but the amount of equipment required for Option 3 and duration of activities would be less than with Options 1 and 2. Similarly, there would be an influx of workers to the area, but fewer workers would be required for decommissioning, and therefore there would be lower demands on public services and housing and accommodations as compared to Options 1 and 2.

Option 3 is the only end-of-life option that will result in a substantive change in flow regime, and has the potential to cause changes that extend upstream and downstream of the Station. This option would return the headpond to a river-like environment, causing many changes for those that use the headpond. Option 3 will restore flow conditions to a near-natural flow regime in the Saint John River, and in so doing, fish will be able to pass freely at Mactaquac following the removal of the Station. Some other examples of interactions that could be associated with Option 3 include (but are not limited to) the potential for a loss or enhancement of recreational opportunities (*e.g.*, fishing for smallmouth bass, boating with larger vessels, development of a sport fishery for other species favouring river-like conditions in the former headpond), interactions with surface water users (*e.g.*, stranded water intakes and sewage outfalls), and the potential for changes in groundwater quality and/or quantity in water supply wells adjacent to the headpond, to name a few.

The CER Report discusses the above interactions and various other interactions between the options and VCs in more detail, and where warranted recommends mitigation that could be considered to make the end-of-life options more environmentally acceptable. The reader is referred to the CER Report for a more complete discussion on the potential environmental issues and associated mitigation for Options 1, 2, and 3.

3.2 METHODOLOGY FOR THE CER ADDENDUM

This CER Addendum is organized in the same manner as the CER Report, and covers the same VCs as the CER Report in the same sequential manner. Chapter numbers for the CER Addendum have been developed to match those of the CER Report for the corresponding VC, for ease in understanding and to facilitate cross-referencing between both documents.

Within each VC, the CER Addendum provides a very brief summary of the key issues and interactions that were provided in the CER Report for the end-of-life options, and provides a discussion of the key interactions between the VC and the Life Achievement Option and Possible Related Components. However, the CER Addendum is intended to supplement (and not to duplicate) the information that was presented in considerable detail in the CER Report—as such, the CER Addendum only provides a brief summary and reference to the scoping, existing conditions, and related text for each VC as was presented in the CER Report (with cross-referencing to where more detailed information can be found). The discussion of potential interactions within each VC of the CER Addendum will be based to the extent possible on the information presented in the CER Report—the CER Addendum will identify similarities or differences in interactions between the end-of-life options and the Life Achievement Option, and summarize the nature and extent of those interactions and recommended mitigation.

Where interactions with the Life Achievement Option and Possible Related Components differ from those presented for the end-of-life options in the CER Report, or where new information is available, those issues will be discussed in more detail.

3.3 OVERVIEW OF POTENTIAL INTERACTIONS BETWEEN THE LIFE ACHIEVEMENT OPTION AND THE ENVIRONMENT

A summary of VCs, key issues of concern and the anticipated interactions between the Life Achievement Option and the environment are provided below in Table 3.1. For completeness, we also include in this table a high-level summary of potential interactions between the end-of-life options and the environment as were discussed in more detail in the CER Report.

Table 3.1 Valued Components, Key Issues of Concern, and Anticipated Interactions between the Options and the Environment

Valued Component	Key Issues of Concern	Summary of Interactions with the End-of-Life Options (*i.e.*, Options 1, 2, and 3)	Summary of Interactions with the Life Achievement Option and Possible Related Components
Atmospheric Environment (Chapter 4)	• Potential change in air quality (including dust and odour). • Potential change in greenhouse gas (GHG) emissions. • Potential change in microclimate.	• All of the end-of-life options will contribute GHG, dust and air contaminant emissions during construction. Option 1 will be the most intensive and Option 3 will be the least. • Option 3 will also have the potential to contribute GHGs, odour and dust emissions resulting from the dewatered headpond. • Option 3 could result in a change in microclimate from the loss of the headpond.	• Changes in air quality are anticipated during construction (*e.g.*, equipment emissions, dust) and are expected to be similar to or less than with Option 2. • Changes in GHG emissions are anticipated to result from construction activities and are expected to be similar to or less than with Option 2. • No changes in microclimate are anticipated, as no changes in water levels or operating regime are expected.
Acoustic Environment (Chapter 5)	• Potential change in sound quality (including ground vibration).	• All of the end-of-life options will result in a change in sound quality during construction. Option 1 will be the most intensive, and result in the largest anticipated change at nearby receptors.	• Changes in sound quality are anticipated from construction activities and are expected to be similar to or less than with Option 2.
Surface Water (Chapter 6)	• Potential change in surface water flow regime. • Potential change in surface water and/or sediment quality.	• Only Option 3 will result in a change in surface water flow regime, where water levels will be reduced, especially in lower portions of the headpond. • Option 3 could also result in a change in surface water and sediment quality. • Options 1 and 2 are expected to result in very little change in surface water, apart from some potential temporary interactions during construction (*e.g.* sedimentation).	• Any small changes in surface water flow regime, water quality, and sediment quality are anticipated to be similar to Option 1 or 2. • No changes to surface water from current conditions are anticipated during the operation of the Life Achievement Option.

Table 3.1 Valued Components, Key Issues of Concern, and Anticipated Interactions between the Options and the Environment

Valued Component	Key Issues of Concern	Summary of Interactions with the End-of-Life Options (*i.e.*, Options 1, 2, and 3)	Summary of Interactions with the Life Achievement Option and Possible Related Components
Groundwater (Chapter 7)	• Potential change in groundwater quality. • Potential change in groundwater quantity.	• Only Option 3 would be expected to result in a potential change in groundwater quantity, where water levels will be reduced, in wells adjacent to the headpond. • Option 3 could also result in a change in groundwater quality. • Options 1 and 2 have limited potential to cause a change in groundwater quantity or quality as water levels in the headpond will remain similar to current conditions.	• Changes to groundwater quality and quantity are only anticipated in the immediate area of construction, should a new auxiliary spillway and channel be required in conjunction with the Life Achievement Option. If a new auxiliary spillway is not required, changes in groundwater are not anticipated. • Water levels in the headpond are expected to remain similar to current conditions, and therefore no changes to groundwater quality or quantity are anticipated upstream of the Station.
Aquatic Environment (Chapter 8)	• Potential change in fish habitat. • Potential change in fish mortality. • Potential change in species at risk or species of conservation concern.	• Options 1 and 2 are expected to result in very little change to the aquatic environment apart from some potential temporary interactions during construction (*e.g.*, sedimentation), and improved fish passage. • Option 3 will likely result in the largest changes to the aquatic environment in terms of habitat quantity, habitat quality, and fish populations, but Option 3 will remove the barrier to fish passage at the Station.	• Changes in aquatic environment are anticipated to be similar to Option 1 or 2. • No changes in aquatic environment from current conditions are anticipated during the operation of the Life Achievement Option, except for the potential for improved fish passage if a new fish passage facility is constructed.
Vegetation and Wetlands (Chapter 9)	• Potential change in vegetation communities. • Potential change in species at risk or species of conservation concern. • Potential change in wetland area and/or function.	• Options 1 and 2 are expected to result in very little change to vegetation and wetlands, except for some potential temporary changes associated with the disturbance of undeveloped lands on the south bank of the Saint John River during construction. • Option 3 will result in a change in vegetation communities and wetland area and function as a result of a decrease in water levels upstream of the Station, increasing various types of wetland habitats important for	• Changes to vegetation communities are anticipated in the immediate area of construction of laydown areas and temporary facilities. Should a new auxiliary spillway be required in conjunction with the Life Achievement Option, changes to vegetation communities would be similar to Option 2. • Water levels in the headpond and downstream of the Station are expected to remain similar to current conditions, and therefore no changes to vegetation communities or wetlands are anticipated

Table 3.1 Valued Components, Key Issues of Concern, and Anticipated Interactions between the Options and the Environment

Valued Component	Key Issues of Concern	Summary of Interactions with the End-of-Life Options (*i.e.*, Options 1, 2, and 3)	Summary of Interactions with the Life Achievement Option and Possible Related Components
		many plant species at risk and/or species of conservation concern.	upstream or downstream of the Station.
Wildlife and Wildlife Habitat (Chapter 10)	• Potential change in wildlife habitat. • Direct mortality. • Potential change in species at risk or species of conservation concern.	• Options 1 and 2 will result in very little change to wildlife and wildlife habitat, except for some potential temporary changes associated with the disturbance of undeveloped lands on the south bank of the Saint John River during construction. • Option 3 will result in the largest change to wildlife habitat causing short-term stress for local wildlife habitat and communities; however, long-term improvements in habitat in current headpond area are anticipated. • Option 3 has the lowest potential to cause direct mortality to species at risk/species of conservation concern because it has the smallest area of disturbance.	• Changes to wildlife and wildlife habitat are only anticipated in the immediate area of construction, should a new auxiliary spillway and channel be required in conjunction with the Life Achievement Option. If a new auxiliary spillway is not required, changes to wildlife and wildlife habitat are not anticipated. • Water levels in the headpond and downstream of the Station are expected to remain similar to current conditions, and therefore no changes to wildlife or wildlife habitat are anticipated upstream or downstream of the Station.
Economy and Employment (Chapter 11)	• Potential change in economy. • Potential change in employment.	• All of the end-of-life options will result in a change in economy and employment during construction, with some interactions expected to be positive and others expected to be negative. Option 1 will result in the largest change in economy and employment as it will require the largest peak and average labour force and the longest construction period. • Option 3 could result in the loss of some employment for people currently employed at the Station as well as for some businesses that depend on the headpond for their revenues (*e.g.*, recreational operators, tourism-related employment, commercial fisheries).	• Changes to economy and employment are anticipated to be similar to or less than in Option 2, but will be spread out over a longer period of time (up to 13 years compared to 10 years for Option 2).

Table 3.1 Valued Components, Key Issues of Concern, and Anticipated Interactions between the Options and the Environment

Valued Component	Key Issues of Concern	Summary of Interactions with the End-of-Life Options (*i.e.*, Options 1, 2, and 3)	Summary of Interactions with the Life Achievement Option and Possible Related Components
Human Occupancy and Resource Use (Chapter 12)	• Potential change in land and resource use. • Potential change in navigation. • Potential change in community.	• Options 1 and 2 will change the land use at the location of the new structures. • Option 3 will result in the largest change to land and resource use, navigation and the community structure as a result of the loss of the headpond.	• Similar to Option 2, changes in land and resource use are anticipated in the immediate vicinity of the Station, should a new auxiliary spillway be required in conjunction with the Life Achievement Option. If a new auxiliary spillway is not required, changes to land and resource use are anticipated to be much less than with Option 2. • No changes in navigation or community structure are anticipated.
Infrastructure and Services (Chapter 13)	• Potential change in infrastructure and access. • Potential change in public services. • Potential change in housing and accommodations.	• All of the end-of-life options will result in a change in infrastructure and services during construction. • Option 1 will result in the largest change in public services and housing and accommodations as it will require the largest labour force and the longest construction period. • Option 3 could result in a change to infrastructure and access as a result of receding water levels.	• Change in infrastructure and access are anticipated to be similar to Option 2. • Change in public services, housing and accommodations are anticipated to be similar to or less than with Option 2, but spread out over a longer period of time (up to 13 years compared to 10 years for Option 2).
Transportation (Chapter 14)	• Potential change in transportation (including road infrastructure and traffic volume).	• All of the end-of-life options will require a transportation link to be maintained between Route 102 and 105, possibly a new transportation link. Each of the end-of-life options will result in a temporary or permanent disruption to traffic and an increase in traffic volumes during construction.	• It is anticipated that NBDTI will maintain a transportation link between Route 102 and 105, whether existing or new, regardless of option selected. • The Life Achievement Option is anticipated to require similar or less construction traffic than with Option 2.
Heritage Resources (Chapter 15)	• Potential change in heritage resources (including archaeological, historic, or palaeontological resources).	• All of the end-of-life options will result in a change in heritage resources during construction. Options 1 or 2 may uncover heritage resources in the areas where new structures would be built, or expose or damage any archaeological sites located along shorelines or on land features under the headpond that may be eroding.	• Potential changes in heritage resources are anticipated to be similar to those with Options 1 and 2.

Table 3.1 Valued Components, Key Issues of Concern, and Anticipated Interactions between the Options and the Environment

Valued Component	Key Issues of Concern	Summary of Interactions with the End-of-Life Options (*i.e.*, Options 1, 2, and 3)	Summary of Interactions with the Life Achievement Option and Possible Related Components
		• Option 3 will likely result in the largest change in heritage resources, as heritage resources that may be present under the headpond are exposed after water levels are lowered, subjecting some sites to continued or accelerated erosion.	
Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons (Chapter 16)	• Potential change in traditional use.	• Interactions between the Options and the practice of traditional activities by Aboriginal persons will be defined through a Traditional Knowledge/Traditional Land Use study being conducted by the Maliseet First Nations.	• Interactions between the Options and the practice of traditional activities by Aboriginal persons will be defined through a Traditional Knowledge/Traditional Land Use study being conducted by the Maliseet First Nations.

The following sections of this CER Addendum (Chapters 4 to 16) provide a more detailed discussion on the potential interactions between the various VCs and the Life Achievement Option and Possible Related Components, comparing them where possible to where they are similar to, or different from, the interactions that might occur between Options 1, 2 and 3 and the VC. To maintain the discussion as concise as possible, where interactions are similar to those for the end-of-life options in the CER Report, we provide only a high-level discussion of how that interaction is similar to other options assessed, with reference to further substantive details in the CER Report. Where the Life Achievement Option and Possible Related Components results in an interaction that did not occur with other end-of-life options, or where a different type of interaction occurs, the issue is discussed in further detail in the VCs below.

Further details on the scope of the VCs, boundaries, key issues of concern, existing conditions, and potential interactions of the VC with the end-of-life options, are provided in the CER Report.

4.0 ATMOSPHERIC ENVIRONMENT

The atmospheric environment is the layer of air near the earth's surface; it is a valued component (VC) because a healthy atmosphere helps sustain life and maintain the health and well-being of the biophysical environment and its inhabitants.

4.1 SCOPE OF THE REVIEW

This section of the CER Addendum considers the potential environmental interactions of the Life Achievement Option and Possible Related Components with the atmospheric environment, and mitigation measures recommended to minimize those interactions. The potential environmental interactions of the end-of-life options (*i.e.*, Options 1, 2, and 3) with the atmospheric environment are discussed in Chapter 4 of the CER Report (Stantec 2016). The rationale for selecting the atmospheric environment as a VC is provided in Section 4.1.1 of the CER Report.

The potential environmental interactions with the atmospheric environment are associated with releases of air contaminants and GHGs to the atmosphere. The CER Report had identified two key issues, potential change in air quality and potential change in GHG emissions, to characterize the atmospheric environment in relation to the end-of-life options. A third key issue of concern, potential change in microclimate, was also identified in the CER Report as of concern for Option 3 only, due to physical changes associated with dewatering of the headpond and associated changes to weather patterns on a localized scale arising from those physical changes; however, the Life Achievement Option and Possible Related Components are not anticipated to result in any substantive changes to the headpond water levels compared to current operating regimes during any phase, and therefore a change in microclimate associated with the physical changes to the headpond is not expected. A discussion of microclimate is provided in Chapter 4 of the CER Report—however, since no interactions are anticipated, it is not discussed further in this CER Addendum.

This CER Addendum has been developed to provide further information to NB Power on the key environmental interactions associated with the Life Achievement Option and Possible Related Components, and how that option could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report. The area of review for the atmospheric environment VC and associated existing conditions are the same as in the CER Report (Sections 4.1.3 and 4.2, respectively). Regulations and policies relevant to the atmospheric environment VC are also the same as described in the CER Report (Section 4.1.2).

4.2 POTENTIAL INTERACTIONS WITH THE ATMOSPHERIC ENVIRONMENT

4.2.1 Potential Change in Air Quality

The air contaminants considered, based on the review team's knowledge and experience with large-scale construction projects of the expected types of emissions during the Life Achievement Option and Possible Related Components (if required), are:

- dust [in the form of particulate matter (PM), particulate matter less than 10 microns (PM_{10}), and particulate matter less than 2.5 microns ($PM_{2.5}$)];

- criteria air contaminants (CACs), including sulphur dioxide (SO_2), nitrogen oxides (NO_x), and carbon monoxide (CO); and

- volatile organic compounds (VOCs).

Given the rural nature of the area of review, ambient air quality is expected to be good most of the time and similar to, or better than, that reported for Fredericton. More information regarding the existing conditions with respect to air quality and existing air contaminant emissions can be found in Section 4.2.2.1 of the CER Report.

The Life Achievement Option and Possible Related Components are anticipated to result in emissions mostly from combustion of fossil fuels and fugitive emissions (mainly dust from travel on unpaved areas) from construction activities. It is expected that the annualized emissions from combustion of fossil fuels during construction phases would be similar in composition to, and equal or lesser in magnitude than, those arising from Option 1 or 2, as the activities are of a similar or lesser scope than those associated with the end-of-life options. Though emissions would be expected to occur over a longer duration as compared to the end-of-life options (*i.e.*, up to 13 years, instead of up to 11 years), the anticipated emissions would be relatively small compared to the annual emissions from other sources in the province, as is also expected to be the case for the end-of-life options. Based on the discussion of air contaminant emissions in Section 4.4.1.1.1 of the CER Report, emissions from the combustion of fossil fuels are expected to be small in the local and provincial context, and not expected to cause a substantive or measurable change in air quality.

The greatest change to air quality due to the construction activities involved in the Life Achievement Option and Possible Related Components is anticipated to be the result of particulate matter (dust) generated from the construction activities. Again, based on early planning, it is anticipated that the main sources of dust emissions would be similar to, or less than, those associated with Options 1 and 2. Section 4.4.1.2 of the CER Report provided a detailed discussion of the potential sources of dust. As mitigation, controlling dust emissions from construction sites is a fairly well understood practice and mitigation measures aimed at reducing dust levels are, for the most part, generally effective at achieving those objectives. With implementation of the mitigation methods listed in Section 4.3 of the CER Report, a substantive change in air quality due to particulate matter (dust) emissions, including PM, PM_{10}, and $PM_{2.5}$, is not expected.

Since dewatering of the headpond is not anticipated to be required for the Life Achievement Option or Possible Related Components, it is not expected that there would be any substantive sources of odour emissions and therefore a change in air quality arising from odour emissions is not expected.

4.2.2 Potential Change in GHG Emissions

There is potential for releases of GHGs arising from the Life Achievement Option and Possible Related Components to contribute to the global concentration of GHGs in the atmosphere due to GHG emissions from the burning of fossil fuels in equipment and vehicles during construction. Since there is no appreciable change to water levels expected, GHG emissions from biological activities would be expected to be equivalent to those associated with the existing operation of the Station. Therefore, this latter aspect is not discussed further in this Addendum.

The main GHG emissions would be from the combustion of fossil fuels in the heavy equipment used in transportation, site preparation, and construction of infrastructure. The GHG emissions associated with the combustion of fossil fuels to accomplish the construction activities for the Life Achievement Option and Possible Related Components would be similar to, or less than, those anticipated to result from Option 1 or 2, but the expected duration of these activities may be longer overall (*i.e.*, up to 13 years as compared to 11 years for Option 1 and 10 years for Option 2). Therefore, it is expected that the total GHG emissions will be similar in magnitude to those arising from Option 1 or 2. A more detailed discussion of the potential GHG emission from the construction activities can be found in Section 4.4.2 of the CER Report. Releases of GHGs related to the combustion of fossil fuels can be partially mitigated through efficient equipment use and proactive maintenance. As such, a substantive change in GHG emissions is not anticipated.

4.3 SUMMARY AND DISCUSSION

In summary, the potential interactions between the Life Achievement Option and Possible Related Components and the atmospheric environment VC are summarized in Table 4.1 below. For convenience, the potential interactions of the end-of-life options with the atmospheric environment, as outlined in the CER Report, are also provided.

Table 4.1 Summary of Interactions for the Atmospheric Environment[1]

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does it last?	How often does it occur?	Is additional mitigation beyond standard measures required for this Option?	Is additional mitigation required beyond what is recommended in the CER Report?
Potential Change in Air Quality							
Option 1 (Construction and Demolition only)	Negative	Medium	Area	Medium	Multiple	No	
Option 2 (Construction and Demolition only)	Negative	Medium	Area	Medium	Multiple	No	
Option 3 (Decommissioning)	Negative	Medium	Area	Medium	Multiple	Yes	
Life Achievement Option and Possible Related Components	Negative	Medium	Area	Medium	Multiple	No	No
Potential Change in GHG Emissions							
Option 1 (Construction and Demolition only)	Negative	Medium	Global	Medium	Multiple	No	
Option 2 (Construction and Demolition only)	Negative	Medium	Global	Medium	Multiple	No	
Option 3 (Decommissioning)	Negative	Medium	Global	Long	Continuous	Yes	

Table 4.1 Summary of Interactions for the Atmospheric Environment[1]

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does it last?	How often does it occur?	Is additional mitigation beyond standard measures required for this Option?	Is additional mitigation required beyond what is recommended in the CER Report?
Life Achievement Option and Possible Related Components	Negative	Medium	Global	Medium	Multiple	No	No
Potential Change in Microclimate							
Option 3 (Decommissioning)	Positive/ Negative	Low	Area	Permanent[1]	Single	No	

KEY

Is the interaction negative or positive?
- Positive.
- Negative.

What is the amount of change?
- Low – a change that remains near existing conditions, or occurs within the natural variability for the atmospheric environment.
- Medium – a change that occurs outside the natural variability for atmospheric environment but does not change the overall status of the atmospheric environment.
- High – a change that occurs outside the natural range of change for the atmospheric environment that will change the status of the atmospheric environment locally or regionally.

What is the geographic extent?
- Site – the interaction is limited to the immediate area where Project-related activities occur.
- Area – the interaction is limited to the general area surrounding the Station.
- Region – the interaction occurs throughout the area of review and may extend to other regions.
- Province – the interaction affects the entire province.

How long does it last?
- Short – the interaction occurs for less than 3 months.
- Medium – the interaction occurs for 3 months – 1 year.
- Long – greater than a year.
- Permanent – there is no foreseeable end-date for the interaction.

How often does it occur?
- Single – the interaction occurs once.
- Multiple – the interaction occurs several times, either sporadically or at regular intervals.
- Continuous – the interaction occurs continuously.

Has additional mitigation been recommended?
- Yes.
- No.

Note:

[1] Some of the ratings for the environmental interactions in the table above have been updated from those provided in the Draft CER Report dated September 2015 (Stantec 2015), to more accurately reflect the nature and extent of the anticipated interactions with the Options and to reflect feedback received during the public comment period.

In summary, the CER Report had identified that based on a review of the New Brunswick Air Quality Monitoring Results reports for the Fredericton area and given the relatively rural nature of the area, existing ambient air quality conditions in the Mactaquac and surrounding areas is good, most of the time. The expected releases of combustion gas emissions for the Life Achievement Option and Possible Related Components are not expected to cause a substantive (or even measurable) change in air quality and would be temporary in nature. Dust generation during construction has a potential to interact with ambient air quality, and as with other end-of-life options, mitigation of dust will be important in maintaining good air quality during construction. Once construction is completed, there will be little interaction with air quality, similar to the existing operation of the Station. Odour emissions are not expected as the headpond water levels would not be expected to be lowered. With careful mitigation for dust emissions, a substantive change in air quality is not expected.

GHG emissions from the combustion of fossil fuels during construction of the Life Achievement Option and Possible Related Components are not expected to contribute in a substantive way to existing provincial GHG emissions totals and would be temporary. A substantive change in GHG emissions is therefore not expected.

No change in microclimate is expected, since no dewatering of the headpond is expected to occur and the operating regime of the Station would be expected to remain similar to existing conditions.

Overall, the potential interactions between the Life Achievement Option and Possible Related Components and the atmospheric environment VC are not expected to differ markedly from those that were identified in the CER Report Options 1 and 2. The review did not identify the need for additional mitigation, other than the standard mitigation described in Section 4.5.2 of the CER Report.

5.0 ACOUSTIC ENVIRONMENT

Sound quality can be defined as a listener's perceived reaction to sound and how acceptable a sound is (*i.e.*, the nature and level of sound). For example, sound quality in an urban area is typically characterized by traffic, other human activities, and natural sources such as wind. Intrusive noises such as chainsaws, construction equipment or loud music could be perceived as reducing sound quality. Noise, as perceived by humans as a result of changes to sound quality, is defined as unwanted sound.

Ground vibration is caused mainly by shock waves moving through the earth as a result of some natural or man-made activity. Vibration can cause annoyance to people, if perceptible, and can also cause structural vibration and damage if the vibration is strong enough.

5.1 SCOPE OF THE REVIEW

This section of the CER Addendum considers the potential environmental interactions of the Life Achievement Option and Possible Related Components with the acoustic environment, and mitigation measures likely to be required to minimize those interactions. The potential environmental interactions of the end-of-life options (*i.e.*, Options 1, 2, and 3) with the acoustic environment are discussed in Chapter 5 of the CER Report (Stantec 2016). Those interactions are associated with a change in sound quality (including ground vibration). The rationale for selecting acoustic environment as a VC is provided in Section 5.1.1 of the CER Report.

This CER Addendum has been developed to provide further information to NB Power on the key environmental interactions associated with the Life Achievement Option and Possible Related Components, and how that option could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report. The area of review for the acoustic environment VC and associated existing conditions are the same as in the CER Report (Section 5.1.3 and 5.2 respectively). Regulations and policies relevant to the acoustic environment VC are also the same as described in the CER Report (Section 5.1.2).

5.2 POTENTIAL INTERACTIONS WITH THE ACOUSTIC ENVIRONMENT

The key issue of concern for the acoustic environment is a potential change in sound quality (including ground vibration), possibly from the following sources:

- increased traffic noise;
- increased noise from blasting, if a new auxiliary spillway is required;
- increased noise from mobile construction equipment (such as excavators);
- increased noise from other site activities, such as rock crushing and concrete production;
- perceivable ground vibration; and/or
- ground vibration causing structural damage.

If not properly managed, noise and ground vibration could cause annoyance to nearby residents, loss of enjoyment of property, sleep disturbance, or property damage.

The Station is located in a relatively rural area. As was discussed in the CER Report, the existing acoustic environment near the Station is affected by natural sounds, traffic, noise from recreational activities, and other human-related activities. Further study into estimated and measured baseline sound data and the methods used can be found in Section 5.2.2 of the CER Report. Baseline sound pressure levels near the Station have been measured to range from 45 to 58 dBA during the day, and from 35 to 48 dBA during the night. Residences that are closer to Routes 102 and 105 are expected to experience levels at the higher end of these ranges. There are no substantive existing sources of ground vibration near the Station, and thus the existing level of ground vibration in the area of review is assumed to be negligible.

The construction activities required for the Life Achievement Option and Possible Related Components (if required) are largely similar to those required for Options 1 or 2 (*e.g.*, site preparation, excavation, construction, demolition). A detailed discussion of these interactions with the end-of-life options is provided in Section 5.4.1.1 of the CER Report. As with the end-of-life options, changes in sound pressure levels would be expected to occur intermittently over the approximate 13 year construction period. However, a 13-year overall construction period would be considered by regulatory agencies including Health Canada to be a long-term source of noise, and potentially also for ground vibration (although this is expected mostly from blasting – see below for further discussion). It is important to note that construction activities will not be continuous during the entire 13 year period of construction—there will be greater levels of activity during some periods generating noise and ground vibration, and lesser activity during other periods. Emissions causing noise and ground vibration would be expected to be minimal at night. Screening-level noise modelling presented in Section 5.4.1.1 of the CER Report had identified that noise levels from the end-of-life options would be expected to be at or near background levels at approximately 1,000 m from the location of noise producing activities, with decreasing intensity as one moves away from the source of noise. Similar natural attenuation would be expected with the Life Achievement Option and Possible Related Components.

Ground vibration is expected to occur primarily as a result of blasting of the approach and discharge channel for the new auxiliary spillway, should that be required in conjunction with the Life Achievement Option. Blasting will be necessary to accomplish the excavation of the approach and discharge channel and would be expected to occur for only a portion of the 13-year construction period (5 years or less). Ground vibration from blasting activity associated with the end-of-life options is discussed in Section 5.4.1.1 of the CER Report. As with the end-of-life options, blasting would be limited to a few times a day for the duration of excavation activities for the approach and discharge channel, and for relatively short durations during each blast (*i.e.*, a few seconds). The anticipated magnitude of noise and vibration associated would be expected to be similar to, or less than, that associated with Option 2. The blasting frequency, duration, and geographic extent of the resulting noise and vibration would also be expected to be similar to or less than that associated with Option 2. However, as the overall construction period for the Life Achievement Option and Possible Related Components is greater than that of other end-of-life options (up to 13 years compared to up to 11 years), noise and vibration emissions and their associated potential to be perceived at sensitive receptors would be expected to persist longer than with the end-of-life options. Nearby residents will be apprised of the blasting schedule and will be notified prior to blasting activities.

Standard mitigation is discussed in Sections 2.6 and 5.3 of the CER Report, and additional mitigation that may be required to further mitigate the potential interactions of the end-of-life options with the acoustic environment is discussed in Section 5.5.1 of that report. Similar mitigation would be applied to the Life Achievement Option and Possible Related Components. The additional mitigation will be investigated as needed to control the noise levels to be below Heath Canada guidelines. With planned mitigation, the potential interactions with the acoustic environment VC are not expected to be substantive.

5.3 SUMMARY AND DISCUSSION

In summary, the potential interactions between the Life Achievement Option and Possible Related Components and the acoustic environment VC are summarized in Table 5.1 below. For convenience, the potential interactions of other end-of-life options (*i.e.*, Options 1, 2 and 3) with the acoustic environment, as outlined in the CER Report, are also provided.

Table 5.1 Summary of Interactions for the Acoustic Environment

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does it last?	How often does it occur?	Is additional mitigation beyond standard mitigation required for this Option?	Is additional mitigation required beyond that recommended in the CER Report?
Potential Change in Sound Quality (including ground vibration)							
Option 1 (Construction and Demolition only)	Negative	Medium	Area	Long	Multiple	Yes	
Option 2 (Construction and Demolition only)	Negative	Medium	Area	Long	Multiple	Yes	
Option 3 (Decommissioning)	Negative	Medium	Area	Long	Multiple	Yes	
Life Achievement Option and Possible Related Components	Negative	Medium	Area	Long	Multiple	Yes	No

KEY

Is the interaction negative or positive?
- Positive.
- Negative.

What is the amount of change?
- Low – a change that remains near existing conditions, or occurs within the natural variability for the atmospheric environment.
- Medium – a change that occurs outside the natural variability for atmospheric environment but does not change the overall status of the atmospheric environment.
- High – a change that occurs outside the natural range of change for the atmospheric environment that will change the status of the atmospheric environment locally or regionally.

How long does it last?
- Short – the interaction occurs for less than 3 months.
- Medium – the interaction occurs for 3 months – 1 year
- Long – greater than a year.
- Permanent – there is no foreseeable end-date for the interaction.

Table 5.1 Summary of Interactions for the Acoustic Environment

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does it last?	How often does it occur?	Is additional mitigation beyond standard mitigation required for this Option?	Is additional mitigation required beyond that recommended in the CER Report?
What is the geographic extent? • Site – the interaction is limited to the immediate area where Project-related activities occur. • Area – the interaction is limited to the general area surrounding the Station. • Region – the interaction occurs throughout the area of review and may extend to other regions. • Province – the interaction affects the entire province.				**How often does it occur?** • Single – the interaction occurs once. • Multiple – the interaction occurs several times, either sporadically or at regular intervals. • Continuous – the interaction occurs continuously. **Has additional mitigation been recommended?** • Yes. • No.			

Because of the relatively long duration of construction (beyond one year is considered long-term construction by Heath Canada in relation to noise), noise management and the implementation of standard mitigation is an important consideration to limit disturbance and interactions with nearby residents and land users. Detailed noise mitigation may be required for any of the options during construction activities to achieve noise levels below the Heath Canada guidelines.

If a new auxiliary spillway and channel are required, noise and ground vibration from blasting may be noticeable for a considerable distance (several kilometres) from the blast site and may influence sound quality; however, blasting would be limited to a few times a day for the duration of excavation activities for the approach and discharge channel, and for relatively short durations during each blast (*i.e.*, a few seconds). Nearby residents will be apprised of the blasting schedule and will be notified prior to blasting activities.

Noise management, including planned mitigation, communication, and complaint resolution processes will be required for any of the options. This review has not identified the need for additional mitigation beyond that discussed in the CER Report.

6.0 SURFACE WATER

Surface water, as it pertains to both water and sediment quantity and quality, is an important component of an ecosystem and is integrally linked to all valued components (VCs). River flow affects the speed, depth, channel shape, sediment transport and ice flow regime (and subsequent flooding), water quality, temperature and oxygen levels. Surface water also generates and transports sediments and other sources of contaminants.

6.1 SCOPE OF THE REVIEW

This section of the CER Addendum considers the potential environmental interactions of the Life Achievement Option and Possible Related Components with surface water, and mitigation measures likely to be recommended to minimize those interactions. The potential environmental interactions of the end-of-life options (*i.e.*, Options 1, 2, and 3) with surface water are discussed in Chapter 6 of the CER Report (Stantec 2016). The rationale for selecting surface water as a VC is provided in Section 6.1.1 of the CER Report.

The potential environmental interactions with surface water are associated with changes in the local surface water flow regime (*i.e.*, water levels and velocities) and releases of sediment to the river downstream of the Station.

Many of the interactions of the Project with surface water described in the CER Report were associated with the potential of returning the headpond to a natural river environment, as envisioned with Option 3 (river restoration). As described in the CER Report, this would result in changes to navigation opportunities in the river, flow retention and management, ice flow regime, sediment transport, shoreline stability, slumping of sediments and, the assimilative capacity/mixing characteristics for existing effluent discharges. However, as the Life Achievement Option is not anticipated to result in lower water levels in the headpond, interactions associated with lowering water levels in the headpond to near natural river levels do not apply and will not be discussed in this CER Addendum.

This CER Addendum has been developed to provide further information to NB Power on the key environmental interactions associated with the Life Achievement Option and Possible Related Components, and how that option could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report. The area of review for each key issue in the surface water VC and associated existing conditions are the same as in the CER Report (Sections 6.1.3 and 6.2, respectively). Regulations and policies relevant to the surface water VC are also the same as described in the CER Report (Section 6.1.2).

6.2 POTENTIAL INTERACTIONS WITH SURFACE WATER

6.2.1 Potential Change in Surface Water Flow Regime

The Life Achievement Option will result in limited changes to the surface water flow regime including changes to water flow patterns, water levels, depths, and velocities that are anticipated to occur downstream of the Station. However, since lowering of the headpond levels below current operating levels is not anticipated, the surface water flow regime upstream of the Station is expected to be similar to existing conditions.

The Saint John River watershed occupies an area of approximately 55,100 square kilometres (km^2), and more than 200 tributaries transport collected runoff from the drainage area and discharge directly to the headpond. The Station is located at a natural change in slope along the river, with portions of the river upstream of the Station generally steeper than those downstream. As described in the CER Report, the mean annual river flow downstream of the Station at the NB Power hydrometric station is 813 m^3/s, and the historical suspended sediment concentrations in the river vary between 0.9 and 140.2 mg/L. More information on the existing conditions with respect to the surface water flow regime is presented in Section 6.2 of the CER Report.

Construction activities associated with the refurbishment of the existing facilities as part of the Life Achievement Option may result in small changes to the local flow patterns and velocities and potentially some associated erosion and deposition patterns immediately downstream of the Station. These localized changes will be permanent in nature and initiated following the completion of the construction activities. These changes would be expected to be similar to, or smaller than, those arising from Options 1 or 2.

Should NB Power decide to proceed with a new auxiliary spillway, the construction of this component will result in ground breaking and earth moving activities and associated physical disturbance that could require the removal of overburden and primarily underlying bedrock within the approach and discharge channel. The excavated material could be an additional source of sediment that would be at risk of release to the river if not properly managed. This risk can be reduced through implementation of standard mitigation described in Chapter 6 of the CER Report. These changes would be expected to be similar to, or smaller than, changes anticipated for Options1 or 2 described in the CER Report.

A new auxiliary spillway (if constructed) would augment spilling capacity only during unlikely and extreme rainfall events. This feature would result in short-term changes to the local flow patterns and velocities and subsequent local changes in erosion and deposition patterns immediately downstream of the Station when the new auxiliary spillway is in use (if ever). As the spillway would only operate during extreme rainfall events, any changes that may occur to the surface water regime would be expected to be similar to, and of shorter duration than, those expected for the proposed auxiliary sluiceway feature required for Options 1 or 2.

If deemed necessary for ongoing operation of the facilities, new fish passage facilities may be constructed in conjunction with the Life Achievement Option to allow upstream and downstream fish migration. Several concepts for this fish passage facility were considered as part of the preliminary design of Options 1 and 2, and similar fish passage facilities would likely be considered. Should NB Power decide to proceed with new fish passage facilities, depending on their design, a portion of the surface water flow would likely need to be diverted to the fish passage facilities, as required by design to provide attraction flows for fish and/or to allow them to pass upstream. Changes to the surface flow regime arising from this component would result in long-term changes to the local flow patterns and velocities and a subsequent adjustment to local erosion and depositional patterns of the immediate area downstream of the Station. These changes to the surface water flow regime would be re-established over a short period of time following the completion of construction activities.

6.2.2 Potential Change in Surface Water or Sediment Quality

The Saint John River drainage area upstream of the headpond has a long history of farming, which contributes nutrients, sediments and chemicals to nearby watercourses through soil erosion and discharges of effluent, eventually depositing into the headpond or perhaps further downstream. The headpond also receives discharged treated water from bordering municipalities, including Woodstock, Woodstock First Nation, and Nackawic.

There are no features of the Life Achievement Option that would be expected to result in a long-term change to water quality in the Saint John River, upstream or downstream of the Station, compared to current conditions.

Construction activities will include the use of motorized equipment such as heavy vehicles and pumps which have potential to release petroleum products and hydraulic fluids into the river in the case of a spill or leak. Heavy equipment activity may also temporarily cause erosion, resulting in increased suspended sediment levels in the river during construction. Construction activities associated with any new laydown areas, construction roads, and the new auxiliary spillway approach and discharge channel (if required) may introduce sediment from placed substrate material and initial stabilization of the channel. There may be a corresponding increase in suspended sediments transported in the river. Mitigation of these interactions for the end-of-life options is outlined in Section 6.3 of the CER Report, and would be expected to be similar for the Life Achievement Option and Possible Related Components. Construction and operation would not be expected to result in a long-term change to sediment quality in the Saint John River, upstream or downstream of the Station, compared to current conditions.

The potential change in surface water or sediment quality is expected to be similar to that described in the CER Report for Options 1 and 2. No other changes to surface water or sediment quality are anticipated to occur.

6.3 SUMMARY AND DISCUSSION

In summary, the potential interactions between the Life Achievement Option and Possible Related Components and the surface water VC are summarized in Table 6.1 below. For convenience, the potential interactions of other end-of-life options with surface water, as outlined in the CER Report, are also provided.

Table 6.1 Summary of Interactions for Surface Water

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does it last?	How often does it occur?	Has additional mitigation been recommended?	Is additional mitigation required beyond that recommended in the CER Report?
Potential Change in Surface Water Flow Regime							
Option 1 (Construction and Demolition only)	Negative	Low	Site	Long	Single	Yes	
Option 2 (Construction and Demolition only)	Negative	Low	Site	Long	Single	Yes	
Option 3 (Decommissioning)	Positive and Negative	High	Region	Permanent	Continuous	Yes	
Life Achievement Option and Possible Related Components	Negative	Low	Site	Long	Single	Yes	No
Potential Change in Surface Water or Sediment Quality							
Option 1 (Construction and Demolition only)	Negative	Low	Site	Long	Single	Yes	
Option 2 (Construction and Demolition only)	Negative	Low	Site	Long	Single	Yes	
Option 3 (Decommissioning)	Negative	High	Region	Permanent	Multiple	Yes	
Life Achievement Option and Possible Related Components	Negative	Low	Site	Long	Single	Yes	No

KEY

Is the interaction negative or positive?
- Positive.
- Negative.

What is the amount of change?
- Low – a change that remains near existing conditions, or occurs within the natural variability for surface water.
- Medium – a change that occurs outside the natural variability for surface water but does not change the overall status of surface water.
- High – a change that occurs outside the natural range of change for surface water that will change the status of the atmospheric environment locally or regionally.

What is the geographic extent?
- Site – the interaction is limited to the immediate area where Project-related activities occur.
- Area – the interaction is limited to the general area surrounding the Station.
- Region – the interaction occurs throughout the area of review and may extend to other regions.
- Province – the interaction affects the entire province.

How long does it last?
- Short – the interaction occurs for less than 3 months.
- Medium – the interaction occurs for 3 months – 1 year
- Long – greater than a year.
- Permanent – there is no foreseeable end-date for the interaction.

How often does it occur?
- Single – the interaction occurs once.
- Multiple – the interaction occurs several times, either sporadically or at regular intervals.
- Continuous – the interaction occurs continuously.

Has additional mitigation been recommended?
- Yes.
- No.

Construction/demolition/refurbishment may result in a temporary change in water quality conditions; however this will be managed by implementing standard mitigation measures. Construction of new facilities, such as the new auxiliary spillway, approach and discharge channels, and fish passage facility, may result in a localized change to erosion and deposition, and will be mitigated in design.

The Life Achievement Option and Possible Related Components would not result in a substantive change to the existing flow regime or to surface water or sediment quality. Potential interactions with surface water would be similar to Options 1 and 2, as presented in the CER Report. No additional mitigation or information requirements have been identified beyond those discussed for the end-of-life options in the CER Report.

7.0 GROUNDWATER

The water that lies beneath the ground surface is referred to as groundwater. The groundwater supply that can be accessed by water wells or springs at the earth's surface is referred to as groundwater resources. Groundwater is important as a water resource in New Brunswick, with more than 75% of the population relying on groundwater as a source of drinking water (Statistics Canada 2010). Groundwater from drilled or screened wells is used for domestic, agricultural, municipal, commercial, institutional, and industrial purposes. Groundwater is most often preferred over surface water as a source of drinking water as it generally can be used with little to no treatment.

7.1 SCOPE OF THE REVIEW

This section of the CER Addendum considers the potential environmental interactions of the Life Achievement Option and Possible Related Components with groundwater, and mitigation measures likely to be recommended to minimize those interactions. The potential environmental interactions of the end-of-life options (*i.e.*, Options 1, 2, and 3) with groundwater are discussed in Chapter 7 of the CER Report (Stantec 2016). The rationale for selecting groundwater as a VC is provided in Section 7.1.1 of the CER Report.

The potential environmental interactions with groundwater are largely associated with the construction of a new auxiliary spillway (*i.e.*, blasting and dewatering activities), should NB Power decide to proceed with this component in conjunction with the Life Achievement Option. Those activities have the potential to result in interactions with water levels, well yields and groundwater quality. Changes in water levels and well yields that could result from a decrease in water levels in the headpond were key issues of concern in the CER Report, particularly for large consumers of groundwater such as municipalities. However, since headpond water levels will be maintained within the current operating regime, neither the repair/maintenance/refurbishment of existing facilities nor the construction or operation of new fish passage facilities (if required) are anticipated to result in any substantive changes to the headpond, and therefore changes to the availability of groundwater associated with the headpond water levels are not expected. A full discussion of the changes to groundwater quantity and quality is provided in Section 7.0 of the CER Report.

The CER Addendum has been developed to provide further information to NB Power on the key environmental interactions associated with the Life Achievement Option and Possible Related Components, and how that option could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report. The area of review for each key issue in the groundwater VC and associated existing conditions is the same as in the CER Report (Sections 7.1.3 and 7.2, respectively). Regulations and policies relevant to the groundwater VC are also the same as described in the CER Report (Section 7.1.2).

7.2 POTENTIAL INTERACTIONS WITH GROUNDWATER

7.2.1 Potential Change in Groundwater Quantity

Construction activities have the potential to change groundwater levels and water well yields in the area near specific construction zones, potentially causing water wells to no longer be available for use for their intended purposes.

Groundwater in the vicinity of the headpond is used by both rural and urban users. Rural users typically extract groundwater from wells completed in bedrock, with an average well depth of 62.6 m below ground surface (bgs) (NBDELG 2015). Based on data provided by the New Brunswick Department of Environment and Local Government (NBDELG), about 10% of these wells are shallow (*i.e.*, less than 30 m deep), and have an average safe yield of 290 m^3/d. The average static groundwater level (*i.e.*, the water level when there is no pumping of the well) within the area of review is 9.4 m bgs.

Six major users of groundwater were identified in the CER Report, including the town of Nackawic, Jolly Farmer Products Inc., Gray's Aqua Farms Ltd., Woodstock First Nation, the town of Woodstock, and Kingsclear First Nation. Of these, three have wells completed in sand and gravel aquifers in connection with the headpond, and three others are completed in bedrock aquifers.

As indicated above, in general, the Life Achievement Option and Possible Related Components are not anticipated result in any changes to the headpond, the level of which is not expected to change as compared to the current operating regime of the Station. Similarly, the repair/maintenance/refurbishment of the existing structures are not anticipated to interact with groundwater quantity, given the limited physical change expected to those facilities. The construction and operation of new fish passage facilities (if required) would similarly not be expected to result in a substantive change to groundwater quantity.

Should NB Power proceed with a new auxiliary spillway to augment the existing spilling capacity, blasting of hard bedrock to excavate the approach and discharge channel, and the removal of groundwater from within these excavations, may be required. Blasting may cause changes (either increases or decreases) in the yield of groundwater wells located within approximately 500 m of these activities. Well yield could increase if new fractures that can carry more groundwater to the well are created by shifting of the bedrock during blasting. Well yield could also decrease if existing open fractures in the bedrock are closed or partially infilled with sediment during blasting activities. Shallow, very low yield wells located in the immediate vicinity of the construction activates would typically be more susceptible to changes in well yield from blasting.

Construction activities that require the removal of groundwater from excavated areas could also cause changes in well yield by temporarily lowering the water level in nearby wells. The removal of groundwater in these excavations will only be required while construction is active; therefore, the duration is anticipated to be short-term. Groundwater levels could be lowered to levels slightly below the depth of construction or to the base of the excavation. Well yields of groundwater wells located within 300 m of the dewatering activities could decrease as the groundwater levels in the surrounding aquifers are lowered as a result of the water removal activities. Should a new auxiliary spillway be required, the potential for changes to groundwater quantity will be similar in magnitude to those described for Options 1 and 2 in the CER Report.

7.2.2 Potential Change in Groundwater Quality

Construction activities have the potential to change groundwater quality in the area near the construction zones, potentially causing water wells to no longer be suitable for their intended purposes.

In general, the groundwater quality within the area of review is good and is described as a hard, slightly alkaline, calcium-chloride water type with low dissolved solids. Some wells have reported concentrations of some metals that naturally exceed the respective health-based Guidelines for Canadian Drinking Water Quality (GCDWQ; Health Canada 2014). Water from these wells requires treatment for use as a drinking water supply. Most wells have concentrations of iron and manganese that exceed respective GCDWQ aesthetic objectives, which is common in New Brunswick because of the local geology (NBENV 2008). *E.coli* and total coliform bacteria counts were noted in some wells. The presence of bacteria could be due to poor well construction, particularly casing integrity; or, depending on the timing of the sample collection, they could be remnants of the drilling and well constructing process.

Construction activities associated with the repair/maintenance/refurbishment of the existing structures are not anticipated to interact with groundwater quality, as there will be no blasting of hard bedrock that could increase the turbidity in a water supply well.

Blasting of hard bedrock associated with the potential excavation of a new approach and discharge channel (if required) could cause minor changes to the groundwater quality, particularly the turbidity of the groundwater. Vibrations in the bedrock caused by the blasting may dislodge or move sediments present in the fractures or accumulated on the borehole walls or riser pipe. This may temporarily decrease the clarity of the groundwater (*i.e.,* increase the colour and/or turbidity) in a well supply. Any interactions between the blasting activities and groundwater quality that might arise are expected to be temporary as the turbidity would return to pre-blast conditions shortly after a blasting event as dislodged sediment settles. As such, the potential interactions between the construction of a new auxiliary spillway and groundwater would be expected to be similar in magnitude to those described for Options 1 and 2 of the CER Report.

The construction and operation of new fish passage facilities (if required) would not be expected to cause a substantive change in groundwater quality.

7.3 SUMMARY AND DISCUSSION

In summary, the potential interactions between the Life Achievement Option and Possible Related Components and the groundwater VC are summarized in Table 7.1 below. For convenience, the potential interactions of the end-of-life options with groundwater, as outlined in the CER Report, are also provided.

Table 7.1 Summary of Interactions for Groundwater[1]

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does it last?	How often does it occur?	Is additional mitigation beyond standard mitigation required for this Option?	Is additional mitigation required beyond that recommended in the CER Report?
Potential Change in Groundwater Quantity and/or Quality							
Option 1 (Construction and Demolition only)	Negative	Low	Site	Short	Single or Continuous	Yes	
Option 2 (Construction and Demolition only)	Negative	Low	Site	Short	Single or Continuous	Yes	
Option 3 (Decommissioning)	Negative	Low or High	Area	Permanent[1]	Continuous	Yes	
Life Achievement Option and Possible Related Components	Negative	Low	Site	Short	Single or Continuous	Yes	No

KEY

Is the interaction negative or positive?
- Positive.
- Negative.

What is the amount of change?
- Low – a change that remains near existing conditions, or occurs within the natural variability for the atmospheric environment.
- Medium – a change that occurs outside the natural variability for atmospheric environment but does not change the overall status of the atmospheric environment.
- High – a change that occurs outside the natural range of change for the atmospheric environment that will change the status of the atmospheric environment locally or regionally.

What is the geographic extent?
- Site – the interaction is limited to the immediate area where Project-related activities occur.
- Area – the interaction is limited to the general area surrounding the Station.
- Region – the interaction occurs throughout the area of review and may extend to other regions.
- Province – the interaction affects the entire province.

How long does it last?
- Short – the interaction occurs for less than 3 months.
- Medium – the interaction occurs for 3 months – 1 year.
- Long – greater than a year.
- Permanent – there is no foreseeable end-date for the interaction.

How often does it occur?
- Single – the interaction occurs once.
- Multiple – the interaction occurs several times, either sporadically or at regular intervals.
- Continuous – the interaction occurs continuously.

Has additional mitigation been recommended?
- Yes.
- No.

Note:

[1] Some of the ratings for the environmental interactions in the table above have been updated from those provided in the Draft CER Report dated September 2015 (Stantec 2015), to more accurately reflect the nature and extent of the anticipated interactions with the Options and to reflect feedback received during the public comment period.

The construction activities associated with the refurbishment of the existing facilities for the Life Achievement Option are not anticipated to cause a substantive change in groundwater quantity or quality. Temporary, short-term, local interactions are anticipated with the construction of a new auxiliary spillway, should it be required. Additional mitigation was recommended for groundwater quantity and quality, as described in Section 7.5.1 of the CER Report. The review has not identified the need for additional mitigation beyond that discussed in the CER Report.

8.0 AQUATIC ENVIRONMENT

The aquatic environment is defined in this review as all freshwater aquatic habitat excluding wetlands, and the species that inhabit such habitats. Of the organisms that inhabit aquatic environments, this review considers fishes, algae, plants and invertebrates. The Saint John River drainage basin, among the largest in North America, supports a diverse aquatic community that includes various species of fishes, algae, plants and invertebrates (CRI 2011).

8.1 SCOPE OF THE REVIEW

This section of the CER Addendum considers the potential environmental interactions of the Life Achievement Option and Possible Related Components with the aquatic environment, and mitigation measures likely to be required to minimize those interactions. The aquatic environment is defined here as all freshwater aquatic habitat excluding wetlands, and related organisms. Of the organisms that inhabit aquatic environments, fishes, algae, plants, and invertebrates are all considered. The potential environmental interactions of the end-of-life options (*i.e.*, Options 1, 2, and 3) with the aquatic environment are discussed in Chapter 8 of the CER Report (Stantec 2016). The rationale for selecting the aquatic environment as a VC is provided in Section 8.1.1 of the CER Report.

Potential environmental interactions with the aquatic environment are associated with changes to fish habitat, fish populations, and/or species at risk (SAR)/species of conservation concern (SOCC) (Table 3.1 of this CER Addendum). As with the end-of-life options described in the CER Report, these three key issues are all anticipated to change under the Life Achievement Option and Possible Related Components.

This CER Addendum has been developed to provide further information to NB Power on the key environmental interactions associated with the Life Achievement Option and Possible Related Components, and how that option could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report. The area of review for the aquatic environment VC and associated existing conditions are the same as in the CER Report (Sections 8.1.3 and 8.2, respectively). Regulations and policies relevant to the aquatic environment VC are also the same as described in the CER Report (Section 8.1.2).

8.2 POTENTIAL INTERACTIONS WITH THE AQUATIC ENVIRONMENT

8.2.1 Potential Change in Fish Habitat

Change in fish habitat includes changes in the physical, chemical and biological characteristics of the Saint John River watershed. Therefore, this may include water flow characteristics, water quality, sediment quality, habitat quantity, and habitat connectivity.

As detailed in Section 8.2.2 of the CER Report, the presence of the Station creates unique aquatic habitat features between the upstream and downstream components of the area of review. The headpond is the main habitat feature upstream of the Station. The creation of the headpond from a flowing river when the Station was initially constructed resulted in a wider main channel for the Saint John River, greater depth, and numerous flooded valleys that previously contained tributary streams. While the headpond resembles a lake (*i.e.*, a lentic environment), many of its characteristics

are river-like (lotic) in nature, which is common in large dam headponds. In essence, the headpond is still a river, though now slower moving and deeper. The lake-like features of the headpond, such as variable depths and shoreline bathymetry, allow for more variable water quality characteristics like light penetration, temperature and dissolved oxygen. Additionally, portions of the headpond (*e.g.*, near Nackawic) have accumulated fine organic and sandy sediments that would otherwise have been transported downstream of the Station, creating unique benthic environments. All of these diverse physical characteristics have, in turn, created diverse environments in the headpond, with implications for the relative abundance and composition of algae, aquatic plants, plankton, macroinvertebrates and fish species. Aquatic habitats downstream of the Station are typical of a large river environment with higher velocities (particularly in the area upstream of Fredericton) and lower water depths than those in much of the headpond. The shallower depths enable greater mixing, reduced thermal stratification, and more consistent dissolved oxygen concentrations and water temperatures. It is likely that the Station has reduced sediment (particularly bedload) and nutrient transport relative to pre-dam conditions. Further information on the existing fish habitat conditions in the area of review is described in Section 8.2.2.1 of the CER Report.

In terms of fish passage, currently, the Station obstructs the passage of migrating fish species both upstream and downstream of the dam. Fish collection facilities are present on the downstream side of the powerhouse, adjacent to the turbine water outflow. Fisheries and Oceans Canada (DFO) uses this facility to trap Atlantic salmon (*Salmo salar*) and gaspereau (*Alosa pseudoharengus; Alosa aestivalis*) in support of management objectives. The Station does not have infrastructure designed specifically for fish passage that aids the downstream movement of fishes from the headpond past the dam. Fishes must move through the turbines, through the main spillway or over the diversion sluiceway; however, the main spillway and diversion sluiceway can be accessed only during periods of high water flow, such as during the spring. A more detailed description of the existing fish populations in the area of review and the existing fish passage infrastructure at the Station is described in Sections 2.3.5 and 8.2.2.2 of the CER Report.

The principal construction activities associated with the Life Achievement Option include the maintenance, repair, or refurbishment of existing structures and power generating infrastructure at the Station. Similar to Options 1 and 2, these construction-related activities are expected to result in short-to-medium term interactions with, or changes to, fish habitat, particularly downstream of the Station. Activities on the power generating units within the powerhouse could modify water flow patterns downstream of the Station, although the overall water velocity and volume is expected to be consistent with current conditions. The interactions and mitigation measures associated with these activities are similar to those described for Options 1 and 2 of the CER Report.

The powerhouse maintenance, repair, or refurbishment activities include the need to close power generating units when work is being completed. Units 1 and 2 (nearest to the left or north bank of the River) are currently used to generate attraction flow for fishes to enter the fish collection facilities at the Station, which is instrumental to the collection and transport of Atlantic salmon and gaspereau at the fish collection facilities. Should both of these units need to be shut down at the same time, habitat connectivity for these managed species would be interrupted—specifically due to the potential interruption of fish attraction flow to the fish collection and passage facilities at the Station. The habitat connectivity of freshwater mussel species, which may attach to these fishes during the larval stage, may also be affected. As mitigation, it is recommended that only one of the power generating units that

provide fish attraction flows be shut down at any given time during the construction of the Life Achievement Option. If this is not possible, NB Power intends to work with the appropriate regulatory agencies to achieve temporary fish passage, as necessary, while work is being carried out on Units 1 and 2, in the event that new fish passage facilities are not operational by that time. Temporary upstream fish passage solutions may include the installation of an alternate fish attraction flow in combination with a trapping system that allows Atlantic salmon and gaspereau to be collected downstream of the Station. Based on this mitigation, habitat connectivity during construction is not expected to change in a manner that will influence Atlantic salmon and gaspereau at the population level. Habitat connectivity will remain similar to existing conditions for all other species.

Should NB Power decide to proceed with a new auxiliary sluiceway to augment its spilling capability, the potential interactions with fish habitat and associated mitigation during construction are consistent with the short-term interactions described for the other maintenance, repair, or refurbishment activities described above.

Overall, long-term changes to fish habitat resulting from construction are not anticipated. With the planned mitigation, the magnitude of construction-related interactions is expected to be low and not affect aquatic organisms at the population level.

Operation of the Life Achievement Option and Possible Related Components are expected to be similar to existing conditions. As indicated in Section 2.1.3 of this Addendum, changes in habitat connectivity will likely be the most influential interaction, should new upstream and downstream fish passage facilities be constructed. New fish passage facilities would have the potential to increase the ability of fishes to move across the structure and, therefore, improve habitat connectivity. Please see Section 8.4.1 of the CER Report for a discussion on potential considerations for improved fish passage facilities.

8.2.2 Potential Change in Fish Populations

Change in fish populations includes changes that may cause direct and indirect mortality of fish. Emphasis is placed on potential sources of mortality that could result in population-level interactions with fish abundance and community structure.

While the Saint John River is known to contain fifty-three fish species, forty-two have been recorded in the area of review (CRI 2011). Most are permanent residents in the area and have breeding populations upstream and downstream of the Station. Five non-native species have been recorded in the area, including most notably two popular recreational fishing species: smallmouth bass (*Micropterus dolomieu*) and muskellunge (*Esox masquinongy*). Eleven fish species are diadromous; using both freshwater and marine environments.

Changes to fish populations are most likely to occur from changes in fish passage. The maintenance, repair, or refurbishment of existing structures will require the closure of power generating units while work is being carried out on them. These units are used to generate attraction flow for fishes which is instrumental to the collection and transport of Atlantic salmon and gaspereau at the fish collection facilities. Should both of these units need to be shut down at the same time, habitat connectivity for these managed species would be interrupted and this could interact with their ability to complete their life cycles, which may have interactions at the population level. As mitigation, it is recommended that

only one of the power generating units that provide fish attraction flows be shut down at any given time during the construction of the Life Achievement Option. If this is not possible, NB Power intends to work with regulatory agencies to achieve temporary upstream fish passage while work is being carried out on Units 1 and 2, in the event that new fish passage facilities are not operational by that time. Therefore, relative to existing conditions, changes to upstream fish passage during construction are not expected to influence the viability of Atlantic salmon and gaspereau populations substantially.

The maintenance, repair, or refurbishment of existing structures and power generating infrastructure at the Station may cause fish mortality or injury in a similar manner to Options 1 and 2; although the magnitude is expected to be lower than for those options (see Section 8.4.2 of the CER Report). Specifically, potential sources of mortality include water flow changes, stranding in drained areas, direct mortality from machinery, and increased sedimentation downstream (Coker *et al.* 2010). Changes in water flow patterns downstream of the Station due to powerhouse construction is not expected to cause substantive fish mortality. Mitigation efforts will be similar to that described in the CER Report. In consideration of the planned mitigation, fish mortality from these interactions is expected to be low and, therefore, is not expected to affect aquatic organisms at the population level.

Should NB Power decide to proceed with a new auxiliary sluiceway, the potential interactions on fish populations and associated mitigation during construction are consistent with the other maintenance, repair, or refurbishment activities described above. Additionally, there will be some blasting required during construction that is similar in scale and magnitude to that described for Option 2. Blasting will contribute to increased sedimentation and there is potential for blasting-related mortality. However, the risk of blasting-related mortality will be minimized as detailed in the CER Report under Options 1 and 2.

Overall, long-term changes to fish populations resulting from construction are not anticipated. With the planned mitigation, the magnitude of construction-related interactions is expected to be low and not affect aquatic organisms at the population level.

Operation of the Life Achievement Option and Possible Related Components are expected to be similar to existing conditions and Option 1. As indicated in Section 2.1.3, changes to fish passage will likely be the most influential interaction during operation. Fish passage has a direct relationship to the ability of aquatic organisms to survive and reproduce; particularly migratory species. If constructed, the operation of new fish passage facilities has the potential to increase the ability of fishes to move across the structure and, therefore, improve survival and reproduction. Therefore, operation of the Life Achievement Option in conjunction with fish passage would be expected to have a positive interaction on fish populations. Please see Section 8.4.2 of the CER Report for a discussion on potential considerations for improved fish passage facilities.

8.2.3 Potential Change in Species at Risk and/or Species of Conservation Concern

Species at risk (SAR) and species of conservation concern (SOCC) are species that are either legally protected, or species that are considered rare in New Brunswick and the long-term sustainability of their populations has been evaluated as tenuous. For an expanded definition of SAR/SOCC, please see Section 8.2.2.3 of the CER Report.

Potential changes in SAR/SOCC were captured by assessing species-specific sensitivities associated with changes to fish habitat and fish populations including consideration of the identified Project interactions. Ten aquatic SAR/SOCC may exist in the area of review, or may have been recent residents, including six fish species, two mussel species and two aquatic insects (dragonflies). A more detailed description of the SAR/SOCC in the area of review is described in Section 8.2.2.3 of the CER Report.

Potential changes in SAR/SOCC during the maintenance, repair, or refurbishment of existing structures and power generating infrastructure at the Station are similar to the potential interactions described above for fish habitat and fish populations. As Atlantic salmon are an SAR/SOCC, the interactions associated with the potential need for temporary upstream fish passage solutions is the most substantial potential interaction with a SAR/SOCC population. Therefore, with effective temporary fish passage implemented, construction is generally not expected to influence any SAR/SOCC at the population level.

The Life Achievement Option will generally be similar to existing conditions during operation. As indicated in Section 2.1.3, changes to fish passage (if any) would likely be the most influential interaction during operation. Of the aquatic SAR/SOCC included in this review, five are diadromous fish species, and two are freshwater mussel species which rely on host fishes to support and disperse their parasitic larvae. The existing Station acts as a barrier to fish movements upstream and downstream, which can lead to reduced survival and reproduction. Any modifications to the existing fish passage infrastructure, including the construction of new fish passage facilities (if completed) could increase habitat connectivity and reduce passage-related mortality or injury for these SAR/SOCC. This is especially true for the unmanaged diadromous fishes, including American eel, Atlantic sturgeon, shortnose sturgeon, and striped bass. Please see Section 8.4.3 of the CER Report for an expanded discussion on the interactions on SAR/SOCC associated with improved fish passage facilities and the ongoing operation of the Station.

8.3 SUMMARY AND DISCUSSION

In summary, the potential interactions between the Life Achievement Option and Possible Related Components and the aquatic environment VC are summarized in Table 8.1, below. For convenience, the potential interactions of other end-of-life options with the aquatic environment, as outlined in the CER Report, are also provided.

Table 8.1 Summary of Interactions for the Aquatic Environment

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does the interaction last?	How often does the interaction occur?	Is additional mitigation beyond standard measures required for this Option?	Is additional mitigation required beyond what is recommended in the CER Report?
Potential Change in Fish Habitat							
Option 1: Construction, demolition and operation	Negative	Low	Region	Permanent	Continuous	Yes	
	Positive	Low	Region	Permanent	Continuous	Yes	
Option 2: Construction, demolition and operation	Negative	Low	Region	Permanent	Continuous	Yes	
	Positive	Medium	Region	Permanent	Continuous	Yes	
Option 3: Decommissioning	Positive	High	Region	Permanent	Continuous	Yes	
	Negative	High	Region	Permanent	Continuous	Yes	
Life Achievement Option and Possible Related Components	Negative	Low	Region	Permanent	Continuous	Yes	Possible
	Positive	Low	Region	Permanent	Continuous	Yes	No
Potential Change in Fish Populations							
Option 1: Construction, demolition and operation	Negative	Low	Region	Permanent	Continuous	Yes	
	Positive	Low	Region	Permanent	Continuous	Yes	
Option 2: Construction, demolition and operation	Negative	Low	Region	Permanent	Continuous	Yes	
	Positive	Medium	Region	Permanent	Continuous	Yes	
Option 3: Decommissioning	Positive	High	Region	Permanent	Continuous	Yes	
	Negative	High	Region	Permanent	Continuous	Yes	
Life Achievement Option and Possible Related Components	Negative	Low	Region	Permanent	Continuous	Yes	Possible
	Positive	Low	Region	Permanent	Continuous	Yes	No
Potential Change in Species at Risk and/or Species of Conservation Concern							
Option 1: Construction, demolition and operation	Negative	Low	Region	Permanent	Continuous	Yes	
	Positive	Low	Region	Permanent	Continuous	Yes	
Option 2: Construction, demolition and operation	Negative	Low	Region	Permanent	Continuous	Yes	
	Positive	Medium	Region	Permanent	Continuous	Yes	
Option 3: Decommissioning	Positive	High	Region	Permanent	Continuous	Yes	
	Negative	High	Region	Permanent	Continuous	Yes	
Life Achievement Option and Possible Related Components	Negative	Low	Region	Permanent	Continuous	Yes	Possible
	Positive	Low	Region	Permanent	Continuous	Yes	No

KEY

Is the interaction negative or positive?

- Positive.
- Negative.

What is the amount of change?

- Low – a change that remains near existing conditions, or occurs within the natural variability for the aquatic environment.
- Medium – a change that occurs outside the natural variability for the aquatic environment but does not change the overall status of the aquatic environment.

How long does it last?

- Short – the interaction occurs for less than 3 months.
- Medium – the interaction occurs for 3 months – 1 year.
- Long – greater than a year.
- Permanent – there is no foreseeable end-date for the interaction.

Table 8.1 Summary of Interactions for the Aquatic Environment

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does the interaction last?	How often does the interaction occur?	Is additional mitigation beyond standard measures required for this Option?	Is additional mitigation required beyond what is recommended in the CER Report?
• High – a change that occurs outside the natural range of change for the aquatic environment that will change the status of the aquatic environment locally or regionally. **What is the geographic extent?** • Site – the interaction is limited to the immediate area where Project-related activities occur. • Area – the interaction is limited to the general area surrounding the Station. • Region – the interaction occurs throughout the area of review and may extend to other regions. • Province – the interaction affects the entire province.				**How often does it occur?** • Single – the interaction occurs once. • Multiple – the interaction occurs several times, either sporadically or at regular intervals. • Continuous – the interaction occurs continuously. **Has additional mitigation been recommended?** • Yes. • No.			

The Project will interact with the aquatic environment and the socio-economic activities that rely upon it (*e.g.* tourism, recreation, fishing). The Life Achievement Option and Possible Related Components will have both positive and negative interactions with the aquatic environment.

The Life Achievement Option and Possible Related Components are expected to produce interactions similar to Options 1 and 2; however, the magnitude of the construction phase interactions is different. Specifically, potential negative interactions associated with in-stream work (*e.g.* increased sedimentation, blasting-related mortality) may be reduced relative to Options 1 and 2. Further, temporary upstream fish passage solutions will be required and this may positively influence the passage of Atlantic salmon and gaspereau. NB Power is committed to the development of temporary upstream fish passage solutions as required for the construction phase to mitigate these potential interactions.

Changes in upstream and downstream fish passage facilities (if any) would be the most influential interaction during operation. These positive interactions and the considerations associated with effective fish passage design are similar to those described for Option 1 in the CER Report.

The review identified the need for additional mitigation, beyond that described for the end-of-life options in the CER Report, only if maintenance/repair/refurbishment activities are being carried out on Units 1 and 2 at the same time, since they provide attraction flows for fish to reach the fish collection facilities. However, should those activities be carried out at separate times for Units 1 and 2, no additional mitigation is required beyond that described in the CER Report.

9.0 VEGETATION AND WETLANDS

Vegetation and wetlands includes vegetation, specifically vascular plants, and focuses on terrestrial plant communities and rare species; and wetlands, which includes wetland type and area, but also focuses on wetland function.

9.1 SCOPE OF THE REVIEW

This section of the CER Addendum considers the potential environmental interactions of the Life Achievement Option and Possible Related Components with vegetation and wetlands, and mitigation measures likely to be recommended to minimize those interactions. The potential environmental interactions of the end-of-life options (*i.e.*, Options 1, 2, and 3) with vegetation and wetlands are discussed in Chapter 9 of the CER Report (Stantec 2016). The rationale for selecting vegetation and wetlands as a VC is provided in Section 9.1.1 of the CER Report.

The potential environmental interactions with vegetation and wetlands are associated with changes in vegetation communities and vegetation species at risk (SAR) or species of conservation concern (SOCC). Although a change in wetland area and/or function was also evaluated in the CER Report with respect to the end-of-life options, there are no mapped wetlands near the Station or where the expected footprint of the Life Achievement Option and Possible Related Components may occur, and aerial imagery does not suggest additional unmapped wetlands are likely to occur in this area. Further, it is not anticipated that the water level in the headpond will need to be lowered during any of the construction activities, so indirect effects to wetlands upstream of the Station are not anticipated. Potential erosion and sediment runoff will be reduced by sediment control measures, limiting major interactions with downstream wetlands; the closest mapped wetlands are more than 4.5 km from the Station. Operation of the Station under the Life Achievement Option, including water levels upstream and downstream of the Station, is not expected to differ from current operation. Therefore, a change in wetland area and/or function as a result of either the construction or operation is not expected with this option, and this interaction is not discussed further. The discussion below is therefore focused on change in vegetation communities and a change in species at risk (SAR) and/or species of conservation concern (SOCC) that might arise from the Life Achievement Option and Possible Related Components.

This CER Addendum has been developed to provide further information to NB Power on the key environmental interactions associated with the Life Achievement Option and Possible Related Components, and how that option could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report. The area of review for each key issue associated with the vegetation and wetlands VC and associated existing conditions are the same as in the CER Report (Sections 9.1.3 and 9.2, respectively). Regulations and policies relevant to the vegetation and wetlands VC are also the same as described in the CER Report (Section 9.1.2).

9.2 POTENTIAL INTERACTIONS BETWEEN THE LIFE ACHIEVEMENT OPTION AND VEGETATION AND WETLANDS

9.2.1 Potential Change in Vegetation Communities

Vegetation community types are plant assemblages that share the same dominant plant species or taxonomic groups. Eight vegetation communities were found in the area of review: hardwood forest, mixedwood forest, softwood forest, plantation, shrub, agriculture, riparian mineral shore, and wetlands. The compositions of these communities and any Environmentally Significant Areas (ESAs) that occur within them are described in Section 9.2.2.4 of the CER Report. The majority of the area of review is composed of a mix of forest types and agriculture, with more agriculture present downstream of the Station and more forested land present upstream of the Station.

A change in vegetation communities resulting from the end-of-life options (*i.e.*, Options 1, 2, and 3) was discussed in Section 9.4.1 of the CER Report. Similar to Options 1 and 2, the construction phase of the Life Achievement Option and Possible Related Components are only expected to interact with vegetation communities in the near vicinity of the Station. This interaction will occur from the construction and use of temporary ancillary facilities for the Life Achievement Option as well as from the excavation for the new auxiliary spillway, if NB Power decides to proceed with this component. Site preparation (clearing, grading, and/or grubbing) for temporary ancillary facilities, and the creation of areas for permanent disposal of concrete removed during repair and refurbishment activities and material excavated from the approach/discharge channel may result in changes in vegetation communities.

The repair/maintenance/refurbishment of existing structures at the Station is expected to result in minimal change in vegetation communities, as most construction activity would be carried out largely within existing footprints at the Station—the only exception would be for temporary ancillary facilities (*e.g.*, laydown areas) created to facilitate construction activities at the Station. As described in the CER Report, the habitats in the vicinity of the Station are not considered to be of particularly high ecological value. Besides being of relatively low ecological value, these habitats are also common within the area of review. Should NB Power decide to construct a new auxiliary spillway, the construction of that component would require the excavation of an approach and discharge channel on the right bank of the Saint John River, which would require the removal of some forest and shrub-dominated areas in that construction footprint; however, given the limited spatial extent of such disturbance and the abundance of vegetation in the general area, this would not be expected to result in a substantive loss of vegetation communities. Direct loss of vegetation communities associated with the Life Achievement Option and Possible Related Components is not expected to be substantive to the extent that effects could be realized at the regional level. Also, since it is not expected that the water level in the headpond will need to be lowered during any of the construction activities, indirect effects to vegetation communities upstream of the Station are not anticipated.

Excavation and construction of the new auxiliary spillway (if required) will be conducted in the dry, and these activities are not expected to have substantive inputs of sediment or changes in water velocities. If constructed, the new auxiliary spillway will only be used during rare extreme weather events. The operation of the new auxiliary spillway (if operated at all) is therefore is not expected to result in changes to currents or result in any new erosive forces that could cause a change in downstream vegetation communities.

Sediment control measures associated with the construction and use of temporary ancillary facilities near the banks of the Saint John River will reduce potential sediment and runoff from entering the water, thus limiting potential interactions with downstream vegetation communities.

As recommended with the end-of-life options, if the Life Achievement Option is selected, field surveys should be conducted prior to any construction activities to confirm forest mapping from the New Brunswick Department of Natural Resources (NBDNR), and determine if any vegetation communities are improperly mapped. Further site-specific mitigation may be necessary if it is determined through field work that there are ecologically important habitats within the construction footprint. However, the Life Achievement Option and Possible Related Components are not expected to cause a substantive change in vegetation communities at, near, upstream, or downstream of the Station.

9.2.2 Potential Change in Species at Risk and/or Species of Conservation Concern

SAR have been defined in the CER Report as species listed as Extirpated, Endangered, Threatened, or Special Concern under the New Brunswick *Species at Risk Act* (NB *SARA*) or the federal *Species at Risk Act* (*SARA*), or by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). SOCC are defined in the CER Report as species that do not meet the above definition of SAR but have been ranked in the province by the Atlantic Canada Conservation Data Centre (AC CDC) as S1 or S2, or S3 with a Canadian Endangered Species Conservation Council (CESCC) general status rank of at risk, may be at risk, or sensitive.

A review of Atlantic Canada Conservation Data Centre (AC CDC) records indicates no SAR but several SOCC have been historically observed to occur near the Station, and thus may occur within the footprint of the Life Achievement Option and Possible Related Components (AC CDC 2014; 2015). A change in SAR and/or SOCC resulting from end-of-life options was discussed in Section 9.4.2 of the CER Report. Similar to Options 1 and 2, the construction phase has the potential to interact with SAR and/or SOCC in the vicinity of the Station.

The AC CDC records examined for the CER (AC CDC 2014; 2015) provide a listing of known observations of plants in the area of review, and these records as well as a description of their estimated locations and preferred habitats are provided in Section 9.4.2.1 of the CER Report. The area near and around the Station has been surveyed for rare plant species several times (AC CDC 2014; 2015). In many cases, the SOCC observations were made prior to construction of the Station. It is probable that those species no longer occur at the observed location due to either the construction of the Station or the resulting rise in water level in the headpond area occurring after the area was flooded for the operation of the Station. Only two species may still occur in the vicinity of the Station, and possibly within the footprint of the Life Achievement Option and Possible Related Components: Drummond's rockcress (*Arabis drummondii*, S2/sensitive) and Canada wild rye (*Elymus canadensis*, S2/may be at risk). Both species are also recorded at additional locations within the area of review, and the loss of individuals near the Station, should they be found in the construction footprint, is not expected to result in a measurable change to the overall populations of these species.

As discussed in Section 9.2.1 of this CER Addendum, the habitats near the Station are not considered to have particularly high ecological value. Considering this, it is unlikely that SAR or additional SOCC are currently growing near the Station and be affected by construction activity within the footprint. However, as was recommended for the end-of-life options, field surveys are recommended within

planned construction footprints, to verify the presence of and locations of Drummond's rockcress and Canada wild rye, and to determine if other plant SAR or SOCC are present. If SAR or SOCC are found during field surveys, additional mitigation may be necessary.

9.3 SUMMARY AND DISCUSSION

In summary, the potential interactions between the Life Achievement Option and Possible Related Components and the vegetation and wetlands VC are summarized in Table 9.1 below. For convenience, the potential interactions of other end-of-life options with vegetation and wetlands, as outlined in the CER Report, are also provided.

Table 9.1 Summary of Interactions for Vegetation and Wetlands

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does it last?	How often does it occur?	Is additional mitigation beyond standard measures required for this Option?	Is additional mitigation required beyond what is recommended in the CER Report?
Potential Change in Vegetation Communities							
Option 1 (Construction and Demolition only)	Negative	Low	Site	Permanent	Single	No	
Option 2 (Construction and Demolition only)	Negative	Low	Site	Permanent	Single	No	
Option 3 (Decommissioning)	Positive and Negative	High	Region	Long-Permanent	Continuous	Yes	
Life Achievement Option and Possible Related Components	Negative	Low	Site	Permanent	Single	No	No
Potential Change in Species at Risk and/or Species of Conservation Concern							
Option 1 (Construction and Demolition only)	Negative	Low	Site	Permanent	Single	No	
Option 2 (Construction and Demolition only)	Negative	Low	Site	Permanent	Single	No	
Option 3 (Decommissioning)	Positive and Negative	Medium	Region	Long-Permanent	Continuous	Yes	
Life Achievement Option and Possible Related Components	Negative	Low	Site	Permanent	Single	No	No
Potential Change in Wetland Area and/or Function							
Option 3 (Decommissioning)	Positive and Negative	High	Region	Long-Permanent	Continuous	Yes	

Table 9.1 Summary of Interactions for Vegetation and Wetlands

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does it last?	How often does it occur?	Is additional mitigation beyond standard measures required for this Option?	Is additional mitigation required beyond what is recommended in the CER Report?
KEY **Is the interaction negative or positive?** • Positive. • Negative. **What is the amount of change?** • Low – a change that remains near existing conditions, or occurs within the natural variability for the atmospheric environment. • Medium – a change that occurs outside the natural variability for atmospheric environment but does not change the overall status of the atmospheric environment. • High – a change that occurs outside the natural range of change for the atmospheric environment that will change the status of the atmospheric environment locally or regionally. **What is the geographic extent?** • Site – the interaction is limited to the immediate area where Project-related activities occur. • Area – the interaction is limited to the general area surrounding the Station. • Region – the interaction occurs throughout the area of review and may extend to other regions. • Province – the interaction affects the entire province.				**How long does it last?** • Short – the interaction occurs for less than 3 months. • Medium – the interaction occurs for 3 months – 1 year • Long – greater than a year. • Permanent – there is no foreseeable end-date for the interaction. **How often does it occur?** • Single – the interaction occurs once. • Multiple – the interaction occurs several times, either sporadically or at regular intervals. • Continuous – the interaction occurs continuously. **Has additional mitigation been recommended?** • Yes. • No.			

Under the Life Achievement Option and Possible Related Components, the interactions with vegetation and wetlands are expected to be similar to or less than with Options 1 and 2, due to what is anticipated to be a slightly smaller footprint in the vicinity of the Station. This area has not been identified to have high ecological value, and there are no known SAR and relatively few noted SOCC recorded near the Station. If pre-construction vegetation surveys of the area do not identify new information on the presence of plant SAR or SOCC, given the relatively small construction footprint in relation to the ecoregion, the potential loss of this area is not considered to represent a considerable loss of vegetation communities or SAR/SOCC within the area of review. No interactions with wetlands are anticipated.

No additional mitigation or information requirements are identified beyond those discussed for the end-of-life options in the CER Report.

10.0 WILDLIFE AND WILDLIFE HABITAT

Wildlife and wildlife habitat includes wildlife (fauna) and the habitats that support wildlife species. This valued component (VC) is focussed on birds, mammals, amphibians, reptiles and certain arthropods with terrestrial components of their life-cycle, as well as the habitats that support them.

10.1 SCOPE OF THE REVIEW

This section of the CER Addendum considers the potential environmental interactions of the Life Achievement Option and Possible Related Components with wildlife and wildlife habitat, and mitigation measures likely to be recommended to minimize those interactions. The potential environmental interactions of the end-of-life options (*i.e.*, Options 1, 2 and 3) with wildlife and wildlife habitat are discussed in Chapter 10 of the CER Report (Stantec 2016). The rationale for selecting wildlife and wildlife habitat as a VC is provided in Section 10.1.1 of the CER Report. As in the CER Report, wildlife habitat encompasses the terrestrial, riparian and river ecosystems that support non-aquatic species. The aquatic environment and the aquatic species that depend on it are discussed in Chapter 8.

The potential environmental interactions with wildlife and wildlife habitat are associated with changes affecting wildlife habitat, wildlife populations, species at risk (SAR) and species of conservation concern (SOCC). Specific vegetation or wetland communities are only discussed in this VC if they provide important wildlife habitats or are managed for wildlife, and may be affected by changes related to the Life Achievement Option and Possible Related Components—otherwise, vegetation and wetlands were discussed in Chapter 9. There is one area designated as having special importance for wildlife, near the discharge channel of the existing Station, that may be affected. While wetlands are also important wildlife habitats, there are no mapped wetlands present in the expected footprint of the Life Achievement Option and Possible Related Components.

This CER Addendum has been developed to provide further information to NB Power on the key environmental interactions associated with the Life Achievement Option and Possible Related Components, and how that option could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report. The area of review for the wildlife and wildlife habitat VC and associated existing conditions are the same as in the CER Report (Sections 10.1.3 and 10.2, respectively). Regulations and policies relevant to the wildlife and wildlife habitat VC are also the same as described in the CER Report (Section 10.1.2).

10.2 POTENTIAL INTERACTIONS WITH WILDLIFE AND WILDLIFE HABITAT

10.2.1 Potential Change in Wildlife Habitat

Consideration of interactions with wildlife habitat is focussed on changes in features and areas that are either designated as significant for or are managed specifically for wildlife, or have been otherwise identified as important for supporting wildlife populations or SAR/SOCC. There is one Environmentally Significant Area (ESA) identified as an important foraging site for bald eagles (*Haliaeetus leucocephalus*), near the discharge channel from the existing Station. There may also be habitats that support SAR/SOCC including birds and monarch butterflies within the footprint of the temporary ancillary facilities for the Life Achievement Option as well as in the area of the new auxiliary spillway, if it

is decided to proceed with this component. The potential interactions with these features are similar to those expected for Options 1 and 2, which were discussed in Section 10.4.1 of the CER Report.

Most activities associated with the repair/maintenance/refurbishment of the existing structures at the Station will be carried out largely within existing footprints at the Station, thereby limiting additional disturbance of habitats. The repair/maintenance/refurbishment of existing structures at the Station are expected to interact with habitat in the vicinity of the Station primarily as a result of site preparation activities (*e.g.*, clearing, grading, and/or grubbing) for temporary ancillary facilities and disposal of concrete removed during repair and refurbishment activities. In addition, should NB Power decide to proceed with the development of a new auxiliary spillway to augment its spilling capacity, direct habitat loss would occur in the area of the new approach/discharge channel as well as from the storage or disposal of material excavated from the channel. However, since the water level in the headpond is not expected to be lowered during any of the construction activities or during operation of the Life Achievement Option as compared to current levels, direct interactions with wildlife and wildlife habitat upstream of the Station are not anticipated.

The extent of the new auxiliary spillway (if it is required) and temporary ancillary facilities are not currently fully defined. The terrestrial habitat within the area of review likely to experience disturbance is considered to be of low ecological value and generally consists of a mix of former agricultural land (fallow pasture), developed land (industrial and rural settlements), and young to immature-aged forests. These habitats may support a variety of species of conservation concern that are associated with open grasslands such as bobolinks (*Dolichonyx oryzivorus*), common nighthawks (*Chordeiles minor*), and monarch butterflies. Habitats in these areas are expected to be completely lost, but while they likely consist of suitable habitat for some SAR/SOCC, they do not likely have critical value for wildlife, and their availability is not a limiting factor on wildlife populations that use the area of review given the abundance of similar habitats in the ecoregion.

Should the Life Achievement Option result in the replacement of the turbines at the Station, presumably these would consist of more modern turbine systems that may reduce fish mortality through the turbines and thus reduce the number of injured or dead fish that surface in that area. Improved fish passage (should NB Power advance this component) may also reduce the number of live fish remaining at the base on the Station, due to improved upstream passage. This area is an important foraging site for many fish-eating species, such as osprey (*Pandion haliaetus)*, bald eagle, gulls (*Larus spp.*) and cormorants (*Phalacrocorax sp.*). To highlight the importance of this site to bald eagles and osprey, the Mactaquac Dam ESA has been identified at the current discharge channel area of the Station because it provides a local abundance of food. This localized change would be expected to be beneficial from the perspective of fish populations and reduced mortality, but conversely it would likely result in a long-term reduction in the quality of local habitat for bald eagles and some other birds. However, given the abundance of habitat in the area, this is not expected to lead to reduced survival of birds that forage in the region generally, or in the area specifically. Also, with the Life Achievement Option, fish injury or mortality would presumably still occur despite any improvements in fish passage (although likely to a lesser extent than currently occurs), so a food source for fish-eating species would not be expected to completely disappear.

Indirect interactions with wildlife habitat quality, including in the Mactaquac Dam ESA (1.5 km downstream of the Station), will result from increased noise and dust produced by construction activities. Species that may nest and forage nearby, such as bank swallow (*Riparia riparia*), bobolink and bald eagle, might avoid using the area during refurbishment activities. Wherever birds nest within areas of anticipated disturbance, it is recommended that clearing and noise generating activities be carried out outside the normal breeding bird season (generally April 1 to August 31) to avoid unnecessary disturbance or harassment of migratory birds (an infraction of the *Migratory Birds Convention Act*). Wherever this is not possible, open-area nest surveys are recommended before ground disturbance is conducted during the normal breeding bird season to reduce potential interactions with breeding birds.

Sediment control measures associated with the construction of temporary ancillary facilities occurring near the banks of the Saint John River will reduce the potential of sediment and runoff entering the water, thus limiting potential interactions with downstream wildlife habitat.

As recommended with the end-of-life options, field surveys should be conducted prior to any construction activities to determine use of important wildlife habitat features such as the Mactaquac Dam ESA and the fields and shorelines on each end of the Station. Further site-specific mitigation may be necessary if it is determined that there are ecologically-important habitats within the construction footprint.

10.2.2 Potential Change in Wildlife Populations, and Potential Change in Species at Risk and/or Species of Conservation Concern

SAR have been defined in the CER Report as species listed as Extirpated, Endangered, Threatened, or Special Concern under the New Brunswick *Species at Risk Act* (NB *SARA*) or the federal *Species at Risk Act* (*SARA*), or by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). SOCC are defined in the CER Report as species that do not meet the above definition of SAR but have been ranked in the province by the Atlantic Canada Conservation Data Centre (AC CDC) as S1 or S2, or S3 with a Canadian Endangered Species Conservation Council (CESCC) general status rank of at risk, may be at risk, or sensitive.

All end-of-life options have the potential to have some interaction with various wildlife species. However, no populations of wildlife including SAR or SOCC are expected to be compromised by any of the options, including the Life Achievement Option. However, in the case of SAR, federal and provincial legislation make it illegal to kill, harm, or harass individuals. SAR also tend to be most vulnerable and additional consideration for potential interactions with these species is warranted.

The AC CDC records examined for the CER (AC CDC 2014) provide a listing of known observations of wildlife in the area of review, and these records indicate that SAR and SOCC have been documented to occur historically near the Station, and thus these species, if present, may use habitat within some of the footprints associated with the Life Achievement Option and Possible Related Components (AC CDC 2014). A change in SAR and/or SOCC resulting from end-of-life options was discussed in Section 10.4.2 of the CER Report. In a manner similar to Options 1 and 2, the construction activities have potential to interact with SAR and/or SOCC in the vicinity of the Station. The wildlife SAR and SOCC that may be affected are similar to those expected for Options 1 and 2, as described in Section 10.4.2.1 of the CER Report. The only wildlife SAR/SOCC for which AC CDC records exist in the vicinity of the Station

are the monarch butterfly (listed as Special Concern under *SARA*) and northern rough-winged swallow (*Stelgidopteryx serripennis*). Bald eagle and bank swallow are anecdotally known to use the area as well. None of these species is likely to be directly affected by the Life Achievement Option and Possible Related Components, although the areas around the construction site would be surveyed prior to any disturbance and mitigation identified to protect any local populations if found to exist near the construction site. If these species breed in the area, they might be adversely affected by noise generated by construction activities. Bald eagles and bank swallows have been seen using the area as recently as June 2015, though no bald eagle nests are known to be present nearby. Because of the potential for bank swallow nesting activity near the Station, there is some potential for interaction with this species.

As discussed in Section 10.2.1 above, lowered fish mortality as a result of the potential replacement of turbines and potentially improved fish passage may reduce available food for foraging species including bald eagle; however, this is not expected to lead to reduced survival of birds that forage in this area. Thus, like Options 1 and 2, the operation phase of the Life Achievement Option is expected to cause minimal changes to wildlife SAR/SOCC.

As was recommended for the end-of-life options, field surveys are recommended within planned construction footprints to assess use of the area by the above-noted and other SAR and SOCC species. If SAR or SOCC are found during field surveys, additional mitigation may be necessary. That stated, direct interactions with migratory birds including wildlife SAR/SOCC will be avoided through mitigation including seasonal timing of construction activities and other measures (*e.g.*, open-nest surveys during breeding periods) described in Section 10.2.1 above.

With mitigation, the Life Achievement Option and Possible Related Components are not expected to result in a measurable change to the overall populations of wildlife species, including known SAR/SOCC.

10.3 SUMMARY AND DISCUSSION

In summary, the potential interactions between the Life Achievement Option and Possible Related Components and the wildlife and wildlife habitat VC are summarized in Table 10.1, below. For convenience, the potential interactions of other end-of-life options with wildlife and wildlife habitat, as outlined in the CER Report, are also provided.

Table 10.1 Summary of Interactions for Wildlife and Wildlife Habitat

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does it last?	How often does it occur?	Is additional mitigation beyond standard mitigation required for this Option?	Is additional mitigation required beyond that recommended in the CER Report?
Potential Change in Wildlife Habitat							
Option 1 (Construction and Demolition only)	Negative	Low	Site	Permanent	Single	Yes	
Option 2 (Construction and Demolition only)	Negative	Low	Site	Permanent	Single	Yes	
Option 3 (Decommissioning)	Positive and Negative	High	Region	Permanent	Continuous	Yes	
Life Achievement Option and Possible Related Components	Negative	Low	Site	Permanent	Single	Yes	No
Potential Change in Wildlife Populations							
Option 1: Construction, demolition and operation	Negative	Low	Site	Short	Single	Yes	
Option 2: Construction, demolition and operation	Negative	Low	Site	Short	Single	No	
Option 3: Decommissioning	Negative	Low	Site	Short	Single	No	
Life Achievement Option and Possible Related Components	Negative	Low	Site	Short	Single	Yes	No
Potential Change in Species at Risk and/or Species of Conservation Concern							
Option 1 (Construction and Demolition only)	Negative	Low	Site	Permanent	Continuous	Yes	
Option 2 (Construction and Demolition only)	Negative	Low	Site	Permanent	Continuous	Yes	
Option 3 (Decommissioning)	Positive and Negative	Low	Region	Permanent	Continuous	Yes	
Life Achievement Option and Possible Related Components	Negative	Low	Site	Permanent	Continuous	Yes	No

Table 10.1 Summary of Interactions for Wildlife and Wildlife Habitat

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does it last?	How often does it occur?	Is additional mitigation beyond standard mitigation required for this Option?	Is additional mitigation required beyond that recommended in the CER Report?
KEY **Is the interaction negative or positive?** • Positive. • Negative. **What is the amount of change?** • Low – a change that remains near existing conditions, or occurs within the natural variability for the atmospheric environment. • Medium – a change that occurs outside the natural variability for atmospheric environment but does not change the overall status of the atmospheric environment. • High – a change that occurs outside the natural range of change for the atmospheric environment that will change the status of the atmospheric environment locally or regionally. **What is the geographic extent?** • Site – the interaction is limited to the immediate area where Project-related activities occur. • Area – the interaction is limited to the general area surrounding the Station. • Region – the interaction occurs throughout the area of review and may extend to other regions. • Province – the interaction affects the entire province.				**How long does it last?** • Short – the interaction occurs for less than 3 months. • Medium – the interaction occurs for 3 months – 1 year • Long – greater than a year. • Permanent – there is no foreseeable end-date for the interaction. **How often does it occur?** • Single – the interaction occurs once. • Multiple – the interaction occurs several times, either sporadically or at regular intervals. • Continuous – the interaction occurs continuously. **Has additional mitigation been recommended?** • Yes. • No.			

Under the Life Achievement Option and Possible Related Components, the interactions with wildlife and wildlife habitat are expected to be very similar to those associated with Options 1 and 2, although a slightly smaller disturbance footprint in the vicinity of the Station is likely required compared to those other options. This area has not been identified to have high value as wildlife habitat, and there are few known SAR and SOCC using the area. However, field studies are required to characterize the use of the area around the Station by wildlife, breeding birds, SAR and SOCC in order to determine the need for additional targeted mitigation.

Until use of the area is better understood, no additional mitigation or information requirements are identified beyond what is discussed in the CER Report.

11.0 ECONOMY AND EMPLOYMENT

Economy and employment refers to the labour market and availability, employment, employment income, business income, and their aggregate influence on the local, regional and provincial economies and the provincial gross domestic product (GDP).

11.1 SCOPE OF THE REVIEW

This section of the CER Addendum considers the potential environmental interactions of the Life Achievement Option and Possible Related Components with economy and employment, and mitigation measures likely to be required to minimize or enhance those interactions. The potential environmental interactions of the end-of-life options (*i.e.*, Options 1, 2 and 3) with economy and employment are discussed in Chapter 11 of the CER Report (Stantec 2016). The rationale for selecting economy and employment as a VC is provided in Section 11.1.1 of the CER Report.

The potential environmental interactions with the economy and employment VC are associated with changes to the local and provincial economies as well as changes in local employment. Business opportunities are also discussed.

This CER Addendum has been developed to provide further information to NB Power on the key environmental interactions associated with the Life Achievement Option and Possible Related Components, and how that option could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report. The area of review for the economy and employment VC and associated existing conditions are the same as in the CER Report (Sections 11.1.4 and 11.2, respectively). Regulations and policies relevant to the economy and employment VC are also the same as described in the CER Report (Section 11.1.2).

11.2 POTENTIAL INTERACTIONS WITH ECONOMY AND EMPLOYMENT

As outlined in Section 11.1.4 of the CER Report, the key issues of concern for economy and employment are: change in economy, and change in employment. These are discussed below, in relation to the Life Achievement Option and Possible Related Components.

11.2.1 Potential Change in Economy

As discussed in Section 2.5 of this CER Addendum, while engineering and costing work associated with the Life Achievement Option and Possible Related Components is ongoing, it is expected that the capital cost for this work will be lower than rebuilding the structures as per Option 1, and also likely lower than Option 2. That expenditure would be spread over a period up to 13 years, compared to 11 years for Option 1 or 10 years for Option 2.

Given the anticipated employment and expenditure associated with construction activity, as with other end-of-life options, the Life Achievement Option and Possible Related Components are anticipated to have a positive interaction with the local and provincial economies. Local expenditures, incomes for employees and contractors, revenues from ongoing electricity generation, contracts with local, regional and provincial businesses, and increased demand for goods and services, are expected during construction. As a major construction project providing up to 13 years of employment and

expenditure in the Mactaquac area, this work would contribute positively to the local and provincial economies.

However, as with the end-of-life options, there may be some disruption to local businesses due to potential nuisance interactions associated with long-term construction (*e.g.*, dust, noise, traffic disruptions). In particular, traffic disruptions resulting in decreased accessibility to attractions and resources could negatively affect the recreation and tourism industries in the area. As with other options, the mitigation outlined in the CER Report will be implemented to avoid, or reduce, the extent of negative economic interactions. Ongoing engagement by NB Power with representatives of local industries, municipalities, Aboriginal communities and business and labour organizations will assist in identifying concerns and possible solutions to those concerns.

11.2.2 Potential Change in Employment

As discussed in Section 2.5 of this CER Addendum, the Life Achievement Option and Possible Related Components are expected to employ a peak labour force of approximately 150-275 people and be constructed over 13 years. While the labour force is anticipated to be substantially less than that assessed in Option 1 or Option 2 of the CER, the duration of this employment will be longer than with the end-of-life options. In addition to direct employment, indirect and induced employment would also be expected through the supply of goods and services during construction as well as from economic spin-off benefits associated with local spending by the labour force.

It is also expected that due to the sustained workforce over an extended period of time, workers may move to the area, bringing their families and purchasing houses in the communities near the Station, further contributing to the local economy and tax base. This investment in property and real estate and the associated increased demands for goods and services in these communities is expected to have a positive interaction with the local and regional economies.

As with the end-of-life options, however, the Life Achievement Option and Possible Related Components may also result in some disruption to local businesses due to potential nuisance interactions associated with long-term construction (*e.g.*, dust, noise, traffic disruptions). In particular, traffic disruptions during construction could negatively interact with the local tourism and recreation industries, including possible negative interactions with employment in these industries in the area. Mitigation as outlined in the CER Report for other options will be implemented to minimize the extent of those negative interactions. Ongoing engagement by NB Power with various stakeholders, organizations, government agencies, and Aboriginal communities and businesses will assist in identifying concerns and possible solutions to those concerns.

11.3 SUMMARY AND DISCUSSION

In summary, the potential interactions between the Life Achievement Option and Possible Related Components and the economy and employment VC are summarized in Table 11.1 below. For convenience, the potential interactions of other end-of-life options with infrastructure and services, as outlined in the CER Report, are also provided.

Table 11.1 Summary of Interactions for Economy and Employment[1]

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does the interaction last?	How often does it occur?	Is additional mitigation beyond standard mitigation required for this Option?	Is additional mitigation required beyond that recommended in the CER Report?
Potential Change in Economy							
Option 1: Construction, demolition and operation	Positive	High	Province	Long	Continuous	Yes	
	Negative	Low	Site	Long	Multiple	Yes	
Option 2: Construction, demolition and operation	Positive	High	Province	Long	Continuous	Yes	
	Negative	Low	Site	Long	Multiple	Yes	
Option 3: Decommissioning	Positive	Medium	Region	Long	Continuous	Yes	
	Negative	Medium	Area	Long/Permanent[1]	Continuous	Yes	
Life Achievement Option and Possible Related Components	Positive	High	Region	Long	Continuous	Yes	No
	Negative	Low	Site	Long	Multiple	Yes	No
Potential Change in Employment							
Option 1: Construction, demolition and operation	Positive	High	Region	Long	Continuous	Yes	
	Negative	Low	Site	Short	Continuous	Yes	
Option 2: Construction, demolition and operation	Positive	High	Region	Long	Continuous	Yes	
	Negative	Low	Site	Long	Multiple	Yes	
Option 3: Decommissioning	Positive	Medium	Region	Long	Continuous	Yes	
	Negative	Medium	Region	Long/Permanent[1]	Continuous	Yes	
Life Achievement Option and Possible Related Components	Positive	High	Region	Long	Continuous	Yes	No
	Negative	Low	Site	Long	Multiple	Yes	No

KEY

Is the interaction negative or positive?

- Positive.
- Negative.

What is the amount of change?

- Low – a change that remains near existing conditions, or occurs within the natural variability for economy and employment.
- Medium – a change that occurs outside the natural variability for economy and employment but does not change the overall status of economy and employment.
- High – a change that occurs outside the natural range of change for economy and employment that will change the status of economy and employment locally or regionally.

What is the geographic extent?

- Site – the interaction is limited to the immediate area where Project-related activities occur
- Area – the interaction is limited to the general area surrounding the Station
- Region – the interaction occurs throughout the area of review and may extend to other regions
- Province – the interaction affects the entire province

How long does it last?

- Short – the interaction occurs for less than 3 months.
- Medium – the interaction occurs for 3 months – 1 year
- Long – greater than a year.
- Permanent – there is no foreseeable end-date for the interaction.

How often does it occur?

- Single – the interaction occurs once.
- Multiple – the interaction occurs several times, either sporadically or at regular intervals.
- Continuous – the interaction occurs continuously.

Has additional mitigation been recommended?

- Yes.
- No.

Note:

[1] Some of the ratings for the environmental interactions in the table above have been updated from those provided in the Draft CER Report dated September 2015 (Stantec 2015), to more accurately reflect the nature and extent of the anticipated interactions with the Options and to reflect feedback received during the public comment period.

The Life Achievement Option and Possible Related Components would have a generally similar environmental interaction with economy and employment as would be expected with Options 1 and 2, as a result of increased employment and increased business incomes and activities on a local and regional scale and their associated effect on the provincial gross domestic product (GDP). Construction activities could also negatively interact with the recreation and tourism industries. As outlined in the CER Report, positive interactions with economy and employment could be enhanced by engaging local and Aboriginal-owned businesses when developing education, training, hiring and supplier development measures.

This review has not identified the need for additional mitigation beyond that recommended in the CER Report for the end-of-life options.

12.0 HUMAN OCCUPANCY AND RESOURCE USE

Human occupancy and resource use refers to current and future proposed occupancy, and public and private use of land and resources by humans as part of their everyday lives. It includes uses such as residency, commercial ventures, recreation and public and private enjoyment of land and resources, and the interactions between the Project and those uses.

12.1 SCOPE OF THE REVIEW

This section of the CER Addendum considers the potential environmental interactions of the Life Achievement Option and Possible Related Components with human occupancy and resource use, and mitigation measures likely to be required to minimize those interactions. The potential environmental interactions of the end-of-life options (*i.e.*, Options 1, 2 and 3) with human occupancy and resource use are discussed in Chapter 12 of the CER Report (Stantec 2016). The rationale for selecting human occupancy and resource use as a VC is provided in Section 12.1.1 of the CER Report.

The potential environmental interactions associated with changes in human occupancy and resource use are: change in land and resource use, and change in navigation. These are discussed below, in relation to the Life Achievement Option. Change in community was also listed as a key issue of concern for human occupancy and resource use in the CER Report; however, as with Options 1 and 2, the Life Achievement Option and Possible Related Components will leave the headpond and transportation links largely unchanged, aside from minor and sporadic disruptions to traffic during construction (mitigation for transportation is discussed further in Chapter 14 of this CER Addendum). As a result, changes to community dynamics in the area of review are not anticipated to occur, and are thus not discussed further in this section. A full discussion of human occupancy and resource use is provided in Chapter 12 of the CER Report.

This CER Addendum has been developed to provide further information to NB Power on the key environmental interactions associated with the Life Achievement Option and Possible Related Components, and how that option could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report. The area of review for each key issue in the human occupancy and resource use VC and associated existing conditions are the same as in the CER Report (Sections 12.1.4 and 12.2, respectively). Regulations and policies relevant to the human occupancy and resource use VC are also the same as described in the CER Report (Section 12.1.2).

12.2 POTENTIAL INTERACTIONS WITH HUMAN OCCUPANCY AND RESOURCE USE

12.2.1 Potential Change in Land and Resource Use

The headpond area is used by residents and tourists as a recreational area. As discussed in Sections 2.2.1.1 and 2.4 of this CER Addendum, the Life Achievement Option will result in construction activities at the current location of the Station, and potentially extending to other areas (*e.g.*, the south bank of the Saint John River for a possible auxiliary spillway) over a period up to 13 years. As with Options 1 and 2, areas to be used for construction activity will be designated as a construction zone, and a safety fence will be erected to control access to the area, resulting in the loss of some land that may be currently used for recreational purposes. While most construction activity associated with the

repair/maintenance/refurbishment of the existing structures at the Station would occur in areas already inaccessible to the public and users, any new land required (*e.g.*, on the south bank of the river, laydown areas) to accomplish construction activity would no longer be accessible for public access, thereby changing land and resource use in these areas.

During the construction period for the Life Achievement Option, nuisance interactions are anticipated as a result of the noise, vibration and dust related to construction activities, especially if NB Power should decide to proceed with other Possible Related Components, which would expand the construction footprint. Similar to Options 1 and 2, construction activities could result in negative changes to the enjoyment of land at private residences and public recreation areas in the vicinity of the Station; however, it is expected that these interactions will be short term and sporadic. It is possible that these nuisance interactions could also negatively affect property values in the area, though likely on a modest scale and on a temporary basis— since dewatering of the headpond is not required, potential changes to property values due to changing landscape are not expected. Mitigation measures related to acoustic nuisances are discussed further in Section 5.3 of the CER Report.

Should NB Power decide to proceed with the construction of a new auxiliary spillway, as with Options 1 and 2, commercially-zoned land on the right bank of the Saint John River will no longer be accessible and will be rezoned as industrial land. This has the potential to displace recreational users and other uses in this immediate area, including the use of this area as a common lookout point to the headpond and Station. Also, construction activity associated with the new auxiliary spillway would further add to the duration and magnitude of possible nuisance interactions within the area of review. In addition, as with Options 2 and 3, the Riverside Resort and Conference Centre and its associated recreational facilities could be negatively affected on a temporary basis during construction, though not permanently as would result with Option 1. Snowmobile trail crossings near this area may be adversely affected, as with Options 1 and 2. The implications for tourism-related accommodations are discussed in Chapters 11 and 13 of the CER Report.

12.2.2 Potential Change in Navigation

As was discussed in the CER Report, construction of the Station increased the water level upstream of the Station to create the Mactaquac headpond. While the Station presents a barrier to navigation at the location of the dam itself and an exclusion zone near the dam for safety purposes, it created navigational and recreational opportunities within the headpond itself. With the Life Achievement Option, the headpond would remain in place for the remainder of the service life of the Station, thereby continuing to provide such navigational and recreational opportunities. As with Options 1 and 2, water levels in the headpond would be expected to remain largely as current, within the operating regime of the Station. Long-term navigation both upstream and downstream of the Station is expected to remain largely as it currently is.

Similar to Options 1 and 2, some limited interruptions to navigation caused by the implementation of safety exclusion zones surrounding construction areas would be expected. These exclusion zones are anticipated to be largely similar to the exclusion zones that are currently in place, and therefore a low amount of change is anticipated.

12.3 SUMMARY AND DISCUSSION

In summary, the potential interactions between the Life Achievement Option and Possible Related Components and the human occupancy and resource use VC are summarized in Table 12.1 below. For convenience, the potential interactions of other end-of-life options with human occupancy and resource use, as outlined in the CER Report, are also provided.

Table 12.1 Summary of Interactions for Human Occupancy and Resource Use[1]

Key Issues	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does the interaction last?	How often does the interaction occur?	Is additional mitigation beyond standard mitigation required for this Option?	Is additional mitigation required beyond that recommended in the CER Report?
Potential Change in Land and Resource Use							
Option 1: Construction, demolition and operation	Negative	Low	Area	Medium	Multiple	Yes	
Option 2: Construction, demolition and operation	Negative	Low	Area	Medium	Multiple	Yes	
Option 3: Decommissioning	Negative/Positive	High	Region	Permanent	Continuous	Yes	
Life Achievement Option and Possible Related Components	Negative	Low	Area	Long	Multiple	Yes	No
Potential Change in Navigation							
Option 1: Construction, demolition and operation	Negative	Low	Site	Short	Multiple	No	
Option 2: Construction, demolition and operation	Negative	Low	Site	Short	Multiple	No	
Option 3: Decommissioning	Negative/Positive	High	Region	Permanent[1]	Continuous	Yes	
Life Achievement Option and Possible Related Components	Negative	Low	Site	Short	Multiple	No	No
Potential Change in Community							
Option 3: Decommissioning	Negative	High	Region	Long	Continuous	Yes	

KEY

Is the interaction negative or positive?
- Positive.
- Negative.

What is the amount of change?
- Low – a change that remains near existing conditions, or occurs within the natural variability for human occupancy and resource use.
- Medium – a change that occurs outside the natural variability for human occupancy and resource use but does not change the overall status of human occupancy and resource use.
- High – a change that occurs outside the natural range of change for human occupancy and resource use that will change the status of human occupancy and resource use locally or regionally.

What is the geographic extent?
- Site – the interaction is limited to the immediate area where

How long does it last?
- Short – the interaction occurs for less than 3 months.
- Medium – the interaction occurs for 3 months – 1 year.
- Long – greater than a year.
  Permanent – there is no foreseeable end-date for the interaction.

How often does it occur?
- Single – the interaction occurs once.
- Multiple – the interaction occurs several times, either sporadically or at regular intervals.
- Continuous – the interaction occurs continuously.

Has additional mitigation been recommended?
- Yes.
- No.

Table 12.1 Summary of Interactions for Human Occupancy and Resource Use[1]

Key Issues	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does the interaction last?	How often does the interaction occur?	Is additional mitigation beyond standard mitigation required for this Option?	Is additional mitigation required beyond that recommended in the CER Report?
Project-related activities occur. • Area – the interaction is limited to the general area surrounding the Station. • Region – the interaction occurs throughout the area of review and may extend to other regions. • Province – the interaction affects the entire province.							

Note:

[1] Some of the ratings for the environmental interactions in the table above have been updated from those provided in the Draft CER Report dated September 2015 (Stantec 2015), to more accurately reflect the nature and extent of the anticipated interactions with the Options and to reflect feedback received during the public comment period.

In summary, in a manner largely similar to Options 1 and 2, the Life Achievement Option and Possible Related Components may interact with a variety of uses in the immediate area of construction activities; however, relatively few changes will occur beyond the area to be disturbed to make way for the new facilities. This option would have a similar environmental interaction with human occupancy and resource use as Option 2 as a result of the similar construction zone barricades, nuisance interactions and safety exclusion zones on the headpond as well as the lack of change to community dynamics. Few land and resource use changes are expected, except in new areas slated for construction activity (*e.g.*, location of the auxiliary spillway if constructed, laydown areas), and except for safety exclusion zones to be implemented near new facilities, navigational opportunities will remain largely as currently. The public will continue to have access to and use of the headpond as a major recreational feature, and few changes to those activities are expected except in the immediate vicinity of the structures (*e.g.*, exclusion zones). Though these and other nuisance-type interactions are expected, they will occur on a temporary basis and within a relatively limited area. Mitigation as detailed in Chapter 12 of the CER Report will be implemented to lessen the negative interactions of the Life Achievement Option with human occupancy and resource use.

As outlined in Section 12.5.1 of the CER Report, additional information from the Social Impact Comparative Review (Dillon 2015) and the property value market analysis recommended in the CER Report (if undertaken) could be used to further assess how changes in land and resource use, navigation and community interact with the Life Achievement Option.

This review has not identified additional mitigation beyond that discussed in the CER Report.

13.0 INFRASTRUCTURE AND SERVICES

Infrastructure and services refers to public infrastructure and services provided to local populations through public and government funding, and infrastructure and in place to meet social needs. Infrastructure and services examined include: emergency response (*e.g.,* fire, medical, and police and emergency services), ongoing support (*e.g.,* health and social services), public infrastructure (*e.g.,* water distribution systems, schools and training institutions), and housing and accommodations.

13.1 SCOPE OF THE REVIEW

This section of the CER Addendum considers the potential environmental interactions of the Life Achievement Option and Possible Related Components with infrastructure and services, and mitigation measures likely to be required to minimize those interactions. The potential environmental interactions of the end-of-life options (*i.e.*, Options 1, 2 and 3) with infrastructure and services are discussed in Chapter 13 of the CER Report (Stantec 2016). The rationale for selecting infrastructure and services as a VC is provided in Section 13.1.1 of the CER Report.

The potential environmental interactions with infrastructure and services are associated with a change in infrastructure and/or access, change in public services, and change in housing and/or accommodations (see Table 3.1, Chapter 3 of this CER Addendum). In addition to those key interactions, changes in infrastructure and/or access arising from water level changes during construction, or dewatering and flood and ice jam events, were key issues of concern in the CER Report; however, the Life Achievement Option and Possible Related Components are not anticipated to result in any substantive changes to water levels in the headpond below the normal operating regimes associated with the current operation of the Station. Therefore, changes to infrastructure and/or access related to dewatering of the headpond are not expected.

This CER Addendum has been developed to provide further information to NB Power on the key environmental interactions associated with the Life Achievement Option and Possible Related Components, and how that option could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report. The area of review for each key issue in the infrastructure and services VC and associated existing conditions are the same as in the CER Report (Sections 13.1.3 and 13.2, respectively). Regulations and policies relevant to the infrastructure and services VC are also the same as described in the CER Report (Section 13.1.2).

13.2 POTENTIAL INTERACTIONS WITH INFRASTRUCTURE AND SERVICES

13.2.1 Potential Change in Infrastructure and/or Access

A change in infrastructure and/or access arising from the end-of-life options was discussed in Section 13.4.1 of the CER Report. As with Options 1 and 2, construction activity arising from the Life Achievement Option and Possible Related Components is anticipated to result in the temporary or permanent disruption to the transportation link between Routes 102 and 105 at Mactaquac, which could result in considerable changes in infrastructure and/or access, disruptions to traffic flow, delays, and increased wait times. Mitigation for changes in transportation is discussed in Section 14.4.1 of the CER Report. Regardless of the Option selected, however, the results of transportation studies carried out

suggest that a suitable transportation link between Routes 102 and 105 at or near the Station should be maintained, with other mitigation aimed at reducing traffic concerns arising from construction activity. With that mitigation, the Life Achievement Option is not expected to unduly affect local infrastructure or access to an extent that would cause a substantive disruption in traffic flows, delays, or wait times.

Similar to Options 1 and 2, the Life Achievement Option and Possible Related Components are not expected to interact substantially with other permanent infrastructure in the area, including upstream and downstream bridges, structures, intakes, outfalls, or other infrastructure. Activities associated with the maintenance/repair/refurbishment of existing structures and power generating infrastructure are not anticipated to affect existing water users as lowering of the headpond water levels below normal operating regimes is not planned during construction. Similarly, should NB Power decide to build a new auxiliary spillway or new fish passage facilities, construction of these new facilities would not be expected to affect existing infrastructure in the area. During operation, water levels will be maintained similar to the current operating levels to those of the existing Station (*i.e.*, between 40.5 m and 39 m amsl).

Similar to Options 1 and 2, there is no anticipated change to ice jam-related flooding from existing conditions as described in Section 13.4.1.2.2 of the CER Report. Since headpond water levels will not be lowered during construction and since the Station's facilities will remain in place, there is no anticipated movement of ice sheets that form in the headpond during winter to move downstream. The Station will continue to have a moderating effect on the movement of large amounts of ice downstream, which reduces the probability of downstream ice jams and associated floods from occurring.

Temporary ancillary facilities needed for the Life Achievement Option and Possible Related Components are expected to be relatively similar to those required for Options 1 and 2. As discussed in the CER Report, Options 1 and 2 may result in the movement of one or more transmission line towers on the south bank. However, the temporary ancillary facilities footprint will be split between the north and south bank, closer to where construction activities are being carried out, and thus resulting in a smaller footprint on the south bank compared with Options 1 and 2 and will not likely need to include the area occupied by the transmission line towers. Therefore, local infrastructure and/or access will not be affected by temporary ancillary facilities under the Life Achievement Option.

13.2.2 Potential Change in Public Services

The greatest potential change to public services due to construction activities associated with the Life Achievement Option is due to the influx of workers required to accomplish the project, which could place demands on existing public services locally (*i.e.*, healthcare, emergency services and education).

During peak construction activity associated with the maintenance/repair/refurbishment of existing structures, the peak labour force is estimated to be 150-275 workers for a period of three months. Construction will be completed over a period of up to 13 years, with the labour force varying over time depending on the activities being conducted. It is conservatively assumed that approximately half of those workers will be non-local and will move into the area of review. This could place additional demands on public services; however, workforce labour requirements would be less than that required for Options 1 and 2. Similar mitigation to that developed for Options 1 and 2 (see Sections 13.4.2.1 and 13.4.2.2 of the CER Report) will be applied to the Life Achievement Option.

If new fish passage facilities or a new auxiliary spillway are not required, the anticipated demands on public services as part of the Life Achievement Option would be expected to be less than with Option 2, but the workforce required would be expected to be needed for a longer duration (*i.e.*, up to 13 years for the Life Achievement Option, compared to 11 years for Option 1 and 10 years for Option 2). If the auxiliary spillway or new fish passage facilities are required, the needed workforce would be expected to increase and be similar to or greater than that required for Option 2, but less than that needed for Option 1. Therefore, in comparison to the end-of-life options, the demands on public services are expected to be within the same order of magnitude as other options, and as with the end-of-life options, are expected to be met largely by existing public service levels. Should levels of public services in the area become inadequate as a result of the Project or other reasons, it is expected that governments and affected service agencies would respond accordingly to meet those added demands.

13.2.3 Potential Change in Housing and/or Accommodations

The greatest anticipated change to housing and/or accommodations due to construction activities associated with the Life Achievement Option is due to the influx of workers required that could reduce availability of accommodations for other purposes (*e.g.,* for tourism). Under the Life Achievement Option, the peak work force for the maintenance/repair/refurbishment of existing structures is estimated to be 150-275 workers for a period of three months. It is conservatively estimated that 50% of the required 150-275 workers will be from nearby communities. However, due to the anticipated limited availability of specialized local skills, many of the workers will likely come from communities outside of the area. Workers given long-term employment may look for permanent housing.

This influx of workers for the maintenance/repair/refurbishment of existing structures would be smaller compared with Options 1 and 2 which will be managed as part of the mitigation described in the CER Report (see Sections 13.4.3.1 and 13.4.3.2 of the CER Report). The reduced number of non-local workers compared with Options 1 and 2 will result in less anticipated demand on temporary or permanent accommodations compared to those end-of-life options. As stated in Section 13.4.3.1 of the CER Report, occupancy rates in the Fredericton area alone appear to be largely sufficient to accommodate the construction workforce for Option 1, which is substantially larger than the workforce for the Life Achievement Option. Although the length of construction is estimated to be longer than with Options 1 and 2, the housing market is likely to respond to this increase in demand from the construction labour force (as discussed in Section 13.4.3 of the CER Report).

If new fish passage facilities or a new auxiliary spillway are not required, the anticipated demands on housing and/or accommodations as part of the Life Achievement Option would be less than those anticipated with Option 2 (*i.e.*, a peak of 150-275 workers as compared to a peak of 1,000 with Option 2), but the workforce would be expected to be needed for a longer duration (*i.e.*, up to 13 years, compared to 11 years for Option 1 and 10 years for Option 2). If the new auxiliary spillway or new fish passage facilities are required, the workforce would be expected to increase and be similar to or greater than that required for Option 2, but less than that needed for Option 1. Again, as with the other end-of-life options, it is anticipated that current housing and accommodation levels would be sufficient to house the workforce required for the Project; should these levels prove to be insufficient, it is anticipated that the market would respond to fill those demands.

13.3 SUMMARY AND DISCUSSION

In summary, the potential interactions with Life Achievement Option and Possible Related Components and infrastructure and services are summarized in Table 13.1 below. For convenience, the potential interactions of other end-of-life options with infrastructure and services, as outlined in the CER Report, are also provided.

Table 13.1 Summary of Interactions for Infrastructure and Services

Key Issues	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does the interaction last?	How often does the interaction occur?	Is additional mitigation beyond standard mitigation required for this Option?	Is additional mitigation required beyond that recommended in the CER Report?
Potential Change in Infrastructure and/or Access							
Option 1: Construction and, demolition only	Negative	Medium[1]	Area	Medium	Multiple	Yes	
Option 2: Construction and demolition only	Negative	Medium[1]	Area	Medium	Multiple	Yes	
Option 3: Decommissioning	Negative	Medium[1]	Region	Long	Continuous	Yes	
Life Achievement Option and Possible Related Components	Negative	Medium[1]	Area	Medium	Multiple	Yes	No
Potential Change in Public Services							
Option 1: Construction and demolition only	Negative	High	Region	Medium	Multiple	Yes	
Option 2: Construction and demolition only	Negative	Medium	Region	Medium	Multiple	Yes	
Option 3: Decommissioning	Negative	Low	Area	Medium	Multiple	Yes	
Life Achievement Option and Possible Related Components	Negative	Medium	Region	Medium	Multiple	Yes	No
Potential Change in Housing and/or Accommodations							
Option 1: Construction and demolition only	Negative	Medium	Area	Medium	Multiple	Yes	
Option 2: Construction and demolition only	Negative	Medium	Area	Medium	Multiple	Yes	
Option 3: Decommissioning	Negative/ Positive	Low	Area	Medium	Multiple	Yes	
Life Achievement Option and Possible Related Components	Negative	Medium	Area	Medium	Multiple	Yes	No

Table 13.1 Summary of Interactions for Infrastructure and Services

Key Issues	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does the interaction last?	How often does the interaction occur?	Is additional mitigation beyond standard mitigation required for this Option?	Is additional mitigation required beyond that recommended in the CER Report?
KEY **Is the interaction negative or positive?** • Positive. • Negative. **What is the amount of change?** • Low – a change that remains near existing conditions, or occurs within the natural variability for infrastructure and services. • Medium – a change that occurs outside the natural variability for infrastructure and services but does not change the overall status of infrastructure and services. • High – a change that occurs outside the natural range of change for infrastructure and services that will change the status of infrastructure and services locally or regionally. **What is the geographic extent?** • Site – the interaction is limited to the immediate area where Project-related activities occur. • Area – The interaction is limited to the general area surrounding the Station. • Region – the interaction occurs throughout the area of review and may extend to other regions. • Province – the interaction affects the entire province.				**How long does it last?** • Short – the interaction occurs for less than 3 months. • Medium – the interaction occurs for 3 months – 1 year. • Long – greater than a year. • Permanent – there is no foreseeable end-date for the interaction. **How often does it occur?** • Single – the interaction occurs once. • Multiple – the interaction occurs several times, either sporadically or at regular intervals. • Continuous – the interaction occurs continuously. **Has additional mitigation been recommended?** • Yes. • No.			

Under the Life Achievement Option and Possible Related Components, the interactions with infrastructure and/or access are anticipated to be approximately the same as with Options 1 and 2 due to the temporary or permanent disruption of the transportation link between Routes 102 and 105. With mitigation, however, this interaction is not expected to cause widespread limitations on access to infrastructure.

A change in public services is anticipated to be approximately the same as with Option 2, as the amount of labour workforce is not anticipated to place extra demands on public services above what was anticipated for Option 2, including during the peak construction period. The increased length in total construction time is not anticipated to place greater demands that would burden public health, emergency services or education facilities. The interactions for change in housing and/or accommodations are also anticipated to be approximately the same as with Option 2, as there will be substantially fewer workers required for the Life Achievement Option and Possible Related Components compared to those required for Option 1. For the same reasons, a change in housing and/or accommodations is not anticipated to be greater than that anticipated for other end-of-life options. In both cases, should service levels or availability become stressed to a level that is insufficient to meet the needs of the area, it is anticipated that governments and/or private developers would respond to meet the increased demands.

This review has not identified additional mitigation outside of what is discussed in the CER Report.

14.0 TRANSPORTATION

Transportation refers to the quality of road transportation networks and infrastructure and their capacity to provide safe and efficient service for movement of vehicles on provincial highways. This review considers the arterial, collector and local highways, and bridges and interchanges between Nackawic and Fredericton.

14.1 SCOPE OF THE REVIEW

This section of the CER Addendum considers the potential environmental interactions of the Life Achievement Option and Possible Related Components with transportation, and mitigation measures likely to be required to minimize those interactions. The potential environmental interactions of the end-of-life options (*i.e.*, Options 1, 2 and 3) with transportation are discussed in Chapter 14 of the CER Report (Stantec 2016). The rationale for selecting transportation as a VC is provided in Section 14.1.1 of the CER Report.

Similar to all of the end-of-life options, the potential environmental interactions with transportation are associated with potential physical changes to the transportation network at the Station, and associated changes in traffic volumes and traffic patterns within local communities arising from additional traffic on local roadways as a result of the Project (see Table 3.1 in Chapter 3 of this CER Addendum). These changes will occur during construction activities, but also during operation, as there could be permanent changes to the road network at the Station.

This CER Addendum has been developed to provide further information to NB Power on the key environmental interactions associated with the Life Achievement Option and Possible Related Components, and how that option could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report. The area of review for the transportation VC and associated existing conditions is the same as in the CER Report (Sections 14.1.3 and 14.2, respectively). Regulations and policies relevant to the transportation VC are also the same as described in the CER Report (Section 14.1.2).

14.2 POTENTIAL INTERACTIONS WITH TRANSPORTATION

Mactaquac Road, which passes over the earthen dam at the Station, provides an important transportation link between Routes 102 and 105 over the Saint John River. Route 102 provides access from the south side of the Station, and is one of the main secondary roads used by travellers between the south side of Fredericton and Mactaquac. Route 105 provides access from the north side of the Station, and is one of the main secondary roads used by travellers between the north side of Fredericton and Mactaquac. There are four river crossings between Fredericton and Nackawic. Of these crossings, Mactaquac Road had the third highest annual average daily traffic (AADT) volumes (exp Services Inc. 2015).

The potential interactions of the Life Achievement Option and Possible Related Components with transportation will be very similar to those arising with the other end-of-life options, and mitigation will be required to maintain a transportation link in the area of the Project. As with the end-of-life options, construction will result in a temporary or permanent disruption to traffic on Mactaquac Road as the

existing structures at the Station are maintained/refurbished/repaired. This includes the potential for periodic traffic interruptions on Mactaquac Road as maintenance and repair work is carried out, as well as increased traffic volumes for delivery of goods and services to the Station.

All activities associated with the Life Achievement Option are expected to generate construction related traffic at the Station. Construction related traffic will be from increased heavy truck movement, and increased passenger vehicle movement generated by the influx of workers to the area. The Life Achievement Option and Possible Related Components are expected to generate traffic volumes that are similar to Option 2, but will occur over a longer duration as the Life Achievement Option will be completed over 13 years compared to 7 years for Option 2. Further information on the expected traffic volumes for the end-of-life options, including mitigation to reduce adverse interactions from increased traffic volumes, is provided in Section 14.4.1 of the CER Report.

Should NB Power decide to construct a new auxiliary spillway as part of the Life Achievement Option, as with Options 1 and 2, a section of Mactaquac Road between Route 102 and the earthen dam would need to be closed to allow for the construction of a new approach channel. This would require a temporary access road to access Mactaquac Road while excavation is taking place, and a new transportation link constructed either over the new excavation or at a location downstream of the Station. Several routes and locations for the new transportation link are being considered and are described in Section 2.6.3 of the CER Report. With a new transportation link as mitigation to maintain a river crossing between Routes 102 and 105, and considering other measures being considered to maintain traffic flow, the environmental interactions of the Life Achievement Option with transportation arising from the temporary or permanent disruption to traffic on Mactaquac Road will be minimal.

As with the end-of-life options, changes in transportation patterns will depend on the selected elements of the Life Achievement Option (*i.e.*, whether or not a new auxiliary spillway is required), the origin and destination of Project-related vehicles, and which, if any, new transportation link is selected, with all other factors being equal. As discussed in the CER Report, further traffic studies and assessment will be required for the Preferred Option and planned changes to the transportation network to predict specifically how transportation will be affected by the Project. However, regardless of the option ultimately selected, with the maintenance and implementation of a transportation link between Routes 102 and 105 and other traffic mitigation described in Section 14.4.1 of the CER Report, no unacceptable interactions are expected with respect to traffic flows or road infrastructure.

15.0 HERITAGE RESOURCES

Heritage resources are those resources, both human and natural, created by past human activities that remain to inform present and future societies of that past. Heritage resources include archaeological, architectural (built heritage), and palaeontological resources, as further elaborated in the CER Report (Stantec 2016).

15.1 SCOPE OF THE REVIEW

This section of the CER Addendum considers the potential environmental interactions of the Life Achievement Option and Possible Related Components with the heritage resources, and mitigation measures likely to be required to minimize those interactions. The potential environmental interactions of the end-of-life options (*i.e.*, Options 1, 2, and 3) with heritage resources are discussed in Chapter 15 of the CER Report. The rationale for selecting heritage resources as a VC is provided in Section 15.1.1 of the CER Report.

The potential environmental interactions with heritage resources are associated with the documented presence of heritage resources, and the potential for undocumented heritage resources, within lands submerged under the current headpond, as well as potential for undocumented heritage resources within areas subject to ground-breaking activities related to construction. A full discussion of the history of the area and known heritage resources is provided in Chapter 15 of the CER Report.

This CER Addendum has been developed to provide further information to NB Power on the key environmental interactions associated with the Life Achievement Option and Possible Related Components, and how that option could be made acceptable, following a similar approach to that followed for the three end-of-life options in the CER Report. The area of review for the heritage resources VC and associated existing conditions are the same as in the CER Report (Sections 15.1.4 and 15.2, respectively). Regulations and policies relevant to the heritage resources VC are also the same as described in Section 15.1.2 of the CER Report.

15.2 POTENTIAL INTERACTIONS FOR HERITAGE RESOURCES

The Life Achievement Option and Possible Related Components includes many of the same activities, of similar nature and duration, as outlined for Options 1 and 2 in Section 15.4.1 of the CER Report. As such, the potential interaction with heritage resources are expected to be similar to the interactions identified for Options 1 and 2.

The key issue of concern is a change in heritage resources. As with Options 1 and 2, maintaining water levels will result in the continued inaccessibility of, and potential continued erosion of, any currently submerged archaeological and palaeontological resources within the headpond, and/or potential continued erosion of known archaeological resources exposed along the shorelines of the headpond.

The activities associated with the construction of new facilities for the maintenance, repair, or refurbishment of existing structures and power generating infrastructure will include ground-breaking and earth moving; however, this will take place largely within the existing footprint of the Station. These activities could affect any unidentified heritage resources within that construction footprint, should any such resources be present in these areas. However, as with Options 1 and 2, it is not anticipated that

any heritage resources, were they to have existed within the construction area of the current Station, would have survived the construction activities associated with the development of the existing Station.

As with the end-of-life options, the construction activities associated with site preparation and construction of temporary ancillary facilities for the maintenance/repair/refurbishment of existing structures could include clearing, grubbing, and grading the site. These activities are expected to be smaller in extent than with the end-of-life options, but would still involve ground-breaking and earth moving and associated physical disturbance that could affect unidentified heritage resources.

Should NB Power decide to proceed with a new auxiliary spillway, the construction of the approach and discharge channel for this component will result in ground-breaking, blasting, and earth moving activities and associated physical disturbance of a new footprint that could affect currently unidentified heritage resources, again, on a smaller scale than anticipated with either Option 1 or 2. The excavated material is expected to consist primarily of bedrock, which could contain palaeontological resources (*i.e.*, fossils) that would be exposed and/or altered through planned excavation and blasting activities.

The construction of fish passage facilities (if required), however, is not anticipated to result in a change in heritage resources as no new ground disturbance is anticipated as a result of the construction of this facility.

As indicated in the CER Report, to better understand the potential interactions between the options and heritage resources and to plan for mitigation of any archaeological or palaeontological sites that might be present in the construction areas, it is recommended that a Heritage Impact Assessment, including a review of the palaeo-shoreline layer, be completed prior to construction for all areas subject to ground-breaking activities or other physical disturbance.

As with Options 1 and 2, the water levels within the headpond will not be lowered if the Life Achievement Option is selected, and there will be no opportunity to examine submerged shorelines and landforms for heritage resources during the construction or operation phases for this option.

During operation, as with Options 1 and 2, the interactions between the Life Achievement Option are anticipated to be largely similar to existing conditions because operating water levels will be maintained at current levels. Maintaining current water levels during the operation phase may expose and damage, or continue to expose and damage, heritage resources located in eroding land features under the headpond. It is also possible that the accumulation of sediment, resulting from the installation of the Station, may have afforded protection to some of the submerged heritage resources. These same resources may continue to benefit from sediment accumulation during the continued operation of the Station. Further details describing how the processes of erosion and sedimentation may adversely affect and/or protect heritage resources is described in Section 15.2 of the CER Report (Stantec 2016).

There is no reasonable mitigation that can be implemented to survey for and/or excavate unknown submerged archaeological resources; however, it may be possible to control erosion, stabilize soils or implement other mitigation to protect heritage resources located along current shorelines of the headpond. Further pre-construction field work to identify and delineate any heritage resources in the construction footprints will confirm whether these resources are present, and define needs for mitigation or follow-up.

15.3 SUMMARY AND DISCUSSION

In summary, the potential interactions between the Life Achievement Option and Possible Related Components and heritage resources are summarized in Table 15.1, below. For convenience, the potential interactions of other end-of-life options with heritage resources, as outlined in the CER Report, are also provided.

Table 15.1 Summary of Interactions for Heritage Resources

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent	How long does it last?	How often does it occur?	Is additional mitigation beyond standard mitigation required for this Option?	Is additional mitigation required beyond that recommended in the CER Report?
Potential Change in Heritage Resources							
Option 1 (Construction and Operation)	Negative	Low	Site/ Headpond	Short/ Long	Single/ Continuous	Yes/ No	
Option 2 (Construction and Operation)	Negative	Low	Site/ Headpond	Short/ Long	Single/ Continuous	Yes/ No	
Option 3 (Decommissioning)	Negative	High	Headpond	Long	Single	Yes	
Life Achievement Option and Possible Related Components	Negative	Low	Site/ Headpond	Short/ Long	Single/ Continuous	Yes/ No	No

KEY

Is the interaction negative or positive?
- Positive.
- Negative.

What is the amount of change?
- Low – a change that remains near existing conditions, or occurs within the natural variability for the atmospheric environment.
- Medium – a change that occurs outside the natural variability for atmospheric environment but does not change the overall status of the atmospheric environment.
- High – a change that occurs outside the natural range of change for the atmospheric environment that will change the status of the atmospheric environment locally or regionally.

What is the geographic extent?
- Site – the interaction is limited to the immediate area where Project-related activities occur.
- Area – the interaction is limited to the general area surrounding the Station.
- Region – the interaction occurs throughout the area of review and may extend to other regions.
- Province – the interaction affects the entire province.

How long does it last?
- Short – the interaction occurs for less than 3 months.
- Medium – the interaction occurs for 3 months – 1 year.
- Long – greater than a year.
- Permanent – there is no foreseeable end-date for the interaction.

How often does it occur?
- Single – the interaction occurs once.
- Multiple – the interaction occurs several times, either sporadically or at regular intervals.
- Continuous – the interaction occurs continuously.

Has additional mitigation been recommended?
- Yes.
- No.

As with Options 1 and 2, the interactions related to the construction phase for the Life Achievement Option and Possible Related Components are expected to be low, and site-specific to the areas directly affected by ground disturbing, earth moving, and/or blasting activities. Construction activities are unlikely to encounter heritage resources following the completion of the mitigation (*i.e.*, Heritage Impact Assessment, avoidance, and mitigation of known heritage resources if discovered). Although ground disturbance associated with construction will be a relatively short-term activity, the interaction with any heritage resources that might be present will be permanent because no archaeological site or palaeontological site can be returned to the ground in its original state once it has been removed, even through proper archaeological/palaeontological techniques.

During operation, as with Options 1 and 2, the geographic extent of a change in heritage resources will be limited to the site-specific location of such resources; however, the exact spatial extent is not known. The duration would be long-term and is anticipated to last as long as the headpond exists. Any such interactions with heritage resources would be continuous during operation because the continued erosion of sediments over archaeological sites may expose these sites and subject them to continual damage or destruction over time. As stated above, some archaeological sites may be afforded additional protection if sediment is transported over the sites.

It is not anticipated that any new additional mitigation or information requirements will be needed beyond what was recommended in the CER Report for the end-of-life options.

16.0 CURRENT USE OF LAND AND RESOURCES FOR TRADITIONAL PURPOSES BY ABORIGINAL PERSONS

"Current use" refers to the use of land and/or resources by Aboriginal persons in order to practice their traditional activities (*e.g.*, traditional hunting, fishing, trapping, gathering, and use of land for cultural or spiritual purposes) in relatively modern times. This includes the time prior to construction of the Mactaquac Generating Station (the Station). "Use" refers to activities such as hunting, fishing and gathering for traditional purposes, which includes subsistence, social, and ceremonial purposes.

16.1 SCOPE OF THE REVIEW

This section of the CER Addendum considers the potential environmental interactions of the Life Achievement Option and Possible Related Components with current use of land and resources for traditional purposes by Aboriginal persons. The potential environmental interactions of the end-of-life options (*i.e.*, Options 1, 2 and 3) with current use of land and resources for traditional purposes by Aboriginal persons are discussed at a high-level in Chapter 16 of the CER Report (Stantec 2016), based on the general knowledge of the Study Team. The rationale for selecting current use of land and resources for traditional purposes by Aboriginal persons as a VC is provided in Section 16.1 of the CER Report.

The potential environmental interactions with current use of land and resources for traditional purposes by Aboriginal persons relate largely to the current and past use of the land and resources by Aboriginal persons in carrying out their traditional activities as an integral part of their lives and culture. The area of review for the current use of land and resources for traditional purposes by Aboriginal persons VC and associated existing conditions are the same as in the CER Report (Sections 16.1.3 and 16.2, respectively). Subject to confirmation as part of a Traditional Knowledge/Traditional Land Use study that is currently being conducted by the six Maliseet First Nation communities, key issues likely include a temporary or permanent change to traditional activities by Aboriginal persons such as hunting, fishing, trapping, gathering, harvesting, or temporary or permanent change to cultural or spiritual practices or sites.

16.2 POTENTIAL INTERACTIONS WITH CURRENT USE OF LAND AND RESOURCES FOR TRADITIONAL PURPOSES BY ABORIGINAL PERSONS

Availability of habitat for some plant and animal resources that decreased in abundance in the headpond area after the Station was constructed was considered in the CER Report (Section 16.3.2). However, the Life Achievement Option is not anticipated to result in changes to water levels in the headpond below the normal operating regime associated with the current operation of the Station. Therefore, this interaction is not discussed further herein.

It is important to note that at the time of writing the CER Addendum, no Traditional Knowledge/Traditional Land Use studies have been completed specific to the Mactaquac Project. NB Power conducted an extensive Aboriginal engagement process beginning in 2014, which is ongoing, and has since funded a Traditional Knowledge/Traditional Land Use study to be carried out by the Maliseet First Nation, the results of which were not available to the Study Team at the time of finalizing the CER Report in August 2016.

Since the Study Team was provided with no specific information from First Nations communities in relation to current use activities on the Saint John River generally or in or near the headpond specifically, it would be inappropriate to presume how Aboriginal persons are specifically practicing current use activities for traditional purposes in the area of review, or how the Project Options might affect their use (and potentially their Aboriginal and treaty rights). Therefore, a discussion of the interactions between the Life Achievement Option and Current Use has not been provided, and no mitigation recommendations have been made.

Specific information on traditional uses in the area of review, potential interactions of the Options with such traditional activities, and potential mitigation will be informed by the separate Traditional Knowledge/Traditional Land Use study that was underway at the time of finalizing the CER Report in August 2016. This information will be used by NB Power, separately from the CER Report, in making its recommendation regarding its Preferred Option.

17.0 SUMMARY AND CONCLUSION

In this Addendum to the Final Comparative Environmental Review (CER) Report for the Mactaquac Project, Stantec conducted a high-level evaluation of the potential interactions between the Life Achievement Option and Possible Related Components being considered at Mactaquac and various valued components (VC) of the environment. The Life Achievement Option consists of a range of potential approaches to repair, maintain, or partially refurbish the existing structures at the Station so as to achieve the original intended 100-year service life of the Station (*i.e.*, to the year 2068), or as close as possible to it. Other related components (*e.g.*, new auxiliary spillway, fish passage facilities) are also being considered in conjunction with the Life Achievement Option.

This Addendum was intended to supplement the CER Report (Stantec 2016) that was developed to evaluate the potential interactions of the end-of-life options (*i.e.*, Options 1, 2, and 3) and the environment. The Addendum provides further information to NB Power on the possible environmental issues associated with the Life Achievement Option and Possible Related Components, and how these could be made acceptable.

In this Addendum, the Life Achievement Option and Possible Related Components are evaluated to determine if activities would interact with the same thirteen valued components (VCs) that were evaluated for the end-of-life options in the CER Report, and in the same way that was completed in the CER Report.

Overall, this CER Addendum demonstrates that the Life Achievement Option itself (in the absence of other possible components such as an additional auxiliary spillway and fish passage facilities that may be considered by NB Power as part of this option) has very limited interactions with the environment, since most construction activities would take place within existing footprints of the Station. The interactions of the Life Achievement Option with the environment would be largely focused on the immediate area surrounding the Station (e.g., noise, dust, clearing of vegetation/habitat). The new auxiliary spillway and fish passage facilities, should NB Power decide to proceed with them as part of Life Achievement, would have an additional footprint (similar to Option 2) that would interact with the environment in a manner that is largely similar in nature and magnitude but shorter in duration to Option 1 or Option 2, which are discussed in the CER Report. The Life Achievement Option would not be expected to result in any changes to the surface water flow regime upstream or downstream of the Station, and therefore the interactions discussed in the CER Report associated with dewatering the headpond are not anticipated. As with the end-of-life options, the Life Achievement Option may have both some positive and negative attributes from an environmental, social, or socio-economic standpoint. Any option selected by NB Power will require careful planning, management, and execution to achieve acceptable environmental results and enhance positive attributes.

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