Stantec Consulting Ltd.
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Fredericton NB E3B 2T7
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June 25, 2014
File: 121811420

Ms. Paulette Hall, OHM Biologist
Fisheries Protection Program
Fisheries and Oceans Canada
343 University Avenue, P.O. Box 5030
Moncton, NB E1C 9B6

Dear Ms. Hall:

RE: SISSON PROJECT: APPLICATION FOR AUTHORIZATION UNDER SECTION 35(2) OF THE *FISHERIES ACT*

On behalf of Sisson Mines Ltd., as the General Partner of the Sisson Project Limited Partnership, please find attached a completed "Application Form for Paragraph 35(2)(b) *Fisheries Act* Authorization (Normal Circumstances)" and associated fish habitat offsetting plan for the Sisson Project proposed by Sisson Mines Ltd. near Napadogan, New Brunswick. The attached application form and offsetting plan is intended to fulfill the information requirements of the *Fisheries Act* for an application for authorization under Section 35(2) of the *Fisheries Act* in relation to the Sisson Project. They are also intended to provide information needed for listing the Sisson Project tailings storage facility (TSF) on Schedule 2 of the *Metal Mining Effluent Regulations*.

The Sisson Project is a tungsten-molybdenum open pit mine and associated facilities located on provincial Crown land near Napadogan, New Brunswick, approximately 60 km directly northwest of the city of Fredericton. A *Fisheries Act* Authorization is required due to potential "serious harm to fish" in fish-bearing watercourses that will result from the construction and operation of the Project-related facilities, including the open pit and TSF. Serious harm may also arise due to reductions in catchment area of residual stream segments, and reductions in mean annual flow to West Branch Napadogan Brook downstream of the Project.

The Offsetting Plan is intended to support the Application by proposing means for offsetting serious harm under Section 35(2) of the *Fisheries Act*. The proposed offsetting project to offset serious harm caused by the Sisson Project consists of the removal of an existing water-level control dam and road culvert at Nashwaak Lake and its replacement by a new woods-road bridge. The plan will restore fish passage, and open up 1,143,728 m^2 of habitat, within Nashwaak Lake and its three tributaries. Authorization for this offsetting project is also being sought herein.

We trust this meets your present requirements. Please do not hesitate to contact Ms. Louise Steward of the Sisson Project Limited Partnership at (506) 455-0530 if you have any questions or require additional information.

Sincerely,
STANTEC CONSULTING LTD.

Denis L. Marquis, M.Sc.E., P.Eng.
Principal, Environmental Services

cc. Louise Steward, the Sisson Project Limited Partnership

Attachments:
1) Application Form for Paragraph 35(2)(b) *Fisheries Act* Authorization (Normal Circumstances)
2) Letter of Credit
3) Sisson Project: Information Requirements in Support of the Application for *Fisheries Act* Authorization, and Offsetting Plan

Application Form for Paragraph 35(2)(*b*) *Fisheries Act* Authorization (Normal Circumstances)

I, the undersigned, hereby request authorization to carry on a work, undertaking or activity which will result in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery. I understand that the *Fisheries Act* Authorization, if granted, is only from the standpoint of the Minister of Fisheries and Oceans and does not release me from my obligation to obtain permission from other concerned regulatory agencies.

1. Applicant Contact Information

Applicant's Name:	**If applicable:** Authorized Representative's Name:
Louise Steward, P.Eng. Vice President, Government and Regulatory Affairs Northcliff Resources Ltd. On behalf of Sisson Mines Ltd. as the General Partner of the Sisson Project Limited Partnership	
Address:	**Address:**
Local Office: 47 Avonlea Court, Fredericton, NB E3C 1N8 Head Office: 15th Floor – 1040 W. Georgia St., Vancouver, BC V6E 4H8	
Telephone No.:	**Telephone No.:**
1-506-455-0530	
Fax No.:	**Fax No.:**
1-506-455-0533	
E-mail:	**E-mail:**
LouiseSteward@northcliffresources.com	

DFO File Referral No. (if known):

2. Checklist for Prescribed Information

An applicant does not need to re-submit documents that have already been submitted to DFO for review. An applicant may reference documents such as Environmental Impact Statements, technical supplements, etc. in their application but must provide the appropriate reference to any document cited, including the chapter, section, page reference and date of submission.

Type of Information/ Documentation	Have you submitted the following? (Yes/No)	Identify the appropriate reference document: Title, Chapter, Section, Page Number and Date of Submission	DFO Comments (For official use only)
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Type of Information/ Documentation	Have you submitted the following? (Yes/No)	Identify the appropriate reference document: Title, Chapter, Section, Page Number and Date of Submission	DFO Comments (For official use only)
Letter of Credit			
Description of Proposed work, undertaking or activity	Yes	1) Attached document; and 2) Sisson Project: Environmental Impact Assessment (EIA) Report (Chapter 3, Section 3.1.1, pp. 3-1 to 3-2; Section 3.2, pp. 3-8 to 3-27; and Chapter 3, Section 3.4, pp. 3-79 to 3-143), July 2013.	
Project engineering specifications, scale drawings and dimensional drawings (for physical works)	Yes	1) Attached document; and 2) Sisson Project: Environmental Impact Assessment (EIA) Report (Chapter 3, Section 3.2, pp. 3-13 to 3-23), July 2013.	
Timeline information	Yes	1) Attached document; and 2) Sisson Project: Environmental Impact Assessment (EIA) Report (Chapter 1, Section 1.2.3, p. 1-9; and Chapter 3, Section 3.1.4, p. 3-8), July 2013.	
Location information	Yes	1) Attached document; and 2) Sisson Project: Environmental Impact Assessment (EIA) Report (Chapter 1, Section 1.2.1, p. 1-3, p. 1-7; and Chapter 8, Section 8.5.2.1, p. 8-155), July 2013.	
Description of Fish and Fish Habitat (Aquatic Environment)	Yes	1) Attached document; 2) Sisson Project: Environmental Impact Assessment (EIA) Report (Chapter 8, Section 8.5.2.3, pp. 8-161 to 8-189), July 2013; and 3) Sisson Project: Baseline Aquatic Environment Technical Report (Chapter 4, Section 4.2.3 pp. 69-79), June 1, 2012.	
Description of Effects on Fish and Fish Habitat	Yes	1) Attached document; and 2) Sisson Project: Environmental Impact Assessment (EIA) Report (Chapter 8, Section 8.5.4.1, pp. 8-193 to 8-205), July 2013.	

Description of Measures and Standards to Avoid or Mitigate Serious Harm to Fish	Yes	1) Attached document; and 2) Sisson Project: Environmental Impact Assessment (EIA) Report (Chapter 8, Section 8.5.4.2, pp. 8-205 to 8-207; Chapter 3, Section 3.3, pp. 3-45 to 3-60), July 2013.	
Description of the Residual Serious Harm to Fish	Yes	1) Attached document; and 2) Sisson Project: Environmental Impact Assessment (EIA) Report (Chapter 8, Section 8.5.6.1, pp. 8-243 to 8-244), July 2013.	
Offsetting Plan	Yes	Attached document.	

3. Public and Aboriginal Engagement

Have you engaged the public or Aboriginal group(s) who may be affected by your proposed work, undertaking or activity?

(•) Yes ( ) No

If yes, provide details including the groups engaged, type of engagement, dates, outcomes, etc.

Northcliff has organized a series of First Nations EA Working Group (FNEAWG) meetings since April 2012 which involved federal and provincial government representatives, as well as representatives of Woodstock and St. Mary's First Nations and the Assembly of First Nations Chiefs of New Brunswick (AFNCNB, representing all other New Brunswick First Nations). A discussion of potential offset project options was planned for a November 22, 2012 meeting of the FNEAWG, which was cancelled due to a lack of attendance and again at a December 5, 2012 FNEAWG meeting, which First Nations did not attend. The offset plan proposed in the EIA Report was discussed at a FNEAWG meeting on October 1, 2013. A meeting specifically on offset plan options was held on November 19, 2013 that involved Northcliff, DFO, Woodstock First Nation, St. Mary's First Nation, and the AFNCNB. At that meeting, both the removal of the Nashwaak culvert and Lower Lake Dam were discussed, no specific concerns with either option were expressed, and First Nations were invited to suggest other options; none have been received to date.

Northcliff has also organized a series of aquatic stakeholder working group meetings since May 2011 that involved representatives of the Nashwaak Watershed Association (NWAI), the Canadian Rivers Institute, the Atlantic Salmon Federation and other interested stakeholder groups. At a December 6, 2012 meeting, the offset plan proposed in the EIA Report was discussed. Under a contract with Northcliff, NWAI has provided a report on potential habitat enhancement/offset options, which are mostly small-scale (e.g. road culvert removals) projects that are not of sufficient quantity to offset the Project's serious harm. Other small-scale enhancement opportunities will be considered by Northcliff.

A summary of key issues or concerns raised by Aboriginal groups during Project engagement activities, and Northcliff's responses, is included in the EIA Report as Table 4.3.3. As well, a similar but more detailed table was provided by Northcliff in response to an information request from the CEA Agency (IR CEA-03-01).

If providing (attaching) supporting documentation to describe your engagement activities (e.g., meeting log, summary of meetings, etc.), include the title of each document.

Further detail on First Nations engagement activities carried out by Northcliff is provided in "Sisson Project: Environmental Impact Assessment (EIA) Report, July 2013" (Chapter 4, Section 4.3, pp. 4-13 to 4-34).

4. Fisheries Management Objectives

Did you consider local Fisheries Management Objectives in your planning process? ( ) Yes (•) No

If yes, please identify the Fisheries Management Objective(s)/Plan considered and, if applicable, reference the relevant sections.

Not applicable to this project; however, local priorities do include the removal of anthropogenic barriers to fish migration.

Please identify any effects that the proposed work, undertaking or activity may have on achieving these objectives.

Restore fish passage to habitat in Nashwaak Lake and its three tributaries that is currently inaccessible, or partially accessible, to CRA fish species due to the presence of a partial-to-full barrier to fish passage that is created by th Nashwaak Lake culvert.

Applicant Declaration

I solemnly declare the that information provided for this application are true, complete and correct, and I make this declaration conscientiously believing it to be true knowing that it is of the same force and effect as if made under oath. This declaration applies to all material submitted as part of this application for a Paragraph 35(2)(*b*) *Fisheries Act* Authorization.

L Steward

Applicant's signature (and corporate seal):

13/06/2014

Date

Information about the above-noted proposed work, undertaking or activity is collected by DFO under the authority of the *Fisheries Act* for the purpose of administering the Fisheries Protection Provisions of the *Fisheries Act*. Personal information will be protected under the provisions of the *Privacy Act* and will be stored in the Personal Information Bank number DFO PPU 680. Under the provisions of the *Privacy Act*, individuals have a right to, and on request shall be given access to, any personal information about them contained in a personal information bank. Instructions for obtaining personal information are contained in the Government of Canada's Info Source publications available at www.infosource.gc.ca or in Government of Canada offices. Information other than "personal" information may be accessible or protected as required by the provision of the *Access to Information Act*.

If you require additional space to provide relevant information, please attach that information and indicate the title of the form being used and the section to which you are responding.

Place and date of issue *Lieu et date d'émission*

Letter of Credit Reference No. SBGV755517

Beneficiary:
Receiver General of Canada on behalf of Fisheries and Oceans Canada, Place du Portage Phase III, 11A2, 11 rue Laurier, Gatineau, QC K1A 0S5

Applicant:
Sisson Project Limited Partnership by its General Partners, Sisson Mines Ltd., 1500 - 1040 West Georgia St., Vancouver, BC. V6E 4H1

Amount: CAD 185,000.00
One Hundred and Eighty Five Thousand Canadian Dollars

Date of Expiry: 17 June 2015

We hereby authorize you to draw upon the Canadian Imperial Bank of Commerce, 400 Burrard Street, 6th Floor, Vancouver BC V6C 3A6 for the account of our Customer Sisson Project Limited Partnership by its General Partner, Sisson Mines Ltd., up to the sum total of CAD185,000.00 (One Hundred and Eighty Five Thousand Canadian Dollars) available on demand as follows:

Pursuant to the request of our Customer, we Canadian Imperial Bank of Commerce ("CIBC") hereby establish and give to you an irrevocable Standby Letter of Credit (the "Credit") in your favour in the total amount of CAD185,000.00. The Credit may be drawn on, by you, at any time and from time to time upon written demand by you. We will honour any such demand made by you without inquiring whether you have a right as between yourself and our Customer to make such demand and without recognizing any claim, instructions, direction or notification to the contrary from the Customer.

Provided, however, that you are to deliver to us at such time as a written demand for payment is made upon us, a certificate purported to be signed by you, agreeing and/or confirming that monies drawn pursuant to this Standby Letter of Credit will be retained and used by you to meet our Customer's obligations in connection with offsetting and monitoring conditions of Fisheries Act Paragraph 35(2) Authorization Reference number 11-E1A3-099.

This original Standby Letter of Credit must also be presented at the time for endorsement of the claim paid and will be returned to you.

It is understood and agreed that the obligation of the undersigned under this Credit is an obligation to pay money only and that in no circumstances shall the undersigned be obliged to perform or cause to perform any of our Customer's actual obligations to you.

Partial drawings are permitted hereunder.

This Standby Letter of Credit shall be reduced automatically, by the amount of each drawing paid hereunder and/or by amendment, by the amount of reduction that may be authorized by the Beneficiary from time to time by their signed written request given to CIBC.

CIBC hereby agrees that it will honour the Beneficiary's demand for payment, presented in compliance with the terms of this Letter of Credit, without enquiring whether the Beneficiary has a right as between itself and the Customer to make such demand, and without recognizing any claim of the said Customer.

This Standby Letter of Credit will expire on the above-mentioned expiry date, subject to the following condition:

Specification of negotiations made under the instrument
Détail des négociations effectuées en vertu de cet instrument

Date of negotiation *Date de négociation*	Name of negotiating Bank *Nom de la banque négociatrice*	Amount in words *Montant en lettres*	Amount in figures *Montant en chiffres*

Place and date of issue *Lieu et date d'émission*

This Page forms an integral part of our Letter of Credit No. SBGV755517.

It is a condition of this Standby Letter of Credit that it shall be deemed to be automatically extended without amendment for one year periods from the present or any future expiration date hereof, unless at least thirty (30) days prior to any such expiration date, CIBC notifies the Beneficiary in writing by registered mail or courier that CIBC elects not to consider this Standby Letter of Credit renewed for such further period.

This Standby Letter of Credit may be cancelled prior to the expiry date upon CIBC's receipt of the original Standby Letter of Credit and the Beneficiary's dated and signed letter referencing this Standby Letter of Credit number and authorizing cancellation of same. Such cancellation shall be effective on the date CIBC receives the documents noted herein.

The Beneficiary may from time to time advise CIBC of the Beneficiary's address by letter to CIBC at CIBC's address stated above, dated and signed by the Beneficiary and quoting this Letter of Credit number. Any notice by CIBC to the Beneficiary regarding this Standby Letter of Credit shall be adequately given if sent by registered mail or courier to the last address so advised, or if no address has been so advised, then to the address of the Beneficiary stated above.

This Standby Letter of Credit is subject to the Uniform Customs and Practice for Documentary Credits of the International Chamber of Commerce, current at the time of issuance of this Standby Letter of Credit.

For Canadian Imperial Bank of Commerce

Counter Signature

Authorized Signature

M. Leung - L2926

Specification of negotiations made under the instrument
Détail des négociations effectuées en vertu de cet instrument

Date of negotiation *Date de négociation*	Name of negotiating Bank *Nom de la banque négociatrice*	Amount in words *Montant en lettres*	Amount in figures *Montant en chiffres*

Sisson Project: Information Requirements in Support of the Application for *Fisheries Act* Authorization, and Offsetting Plan

Submitted to:
Fisheries Protection Program
Fisheries and Oceans Canada
343 University Avenue, P.O. Box 5030
Moncton, NB E1C 9B6

Prepared for:
Sisson Mines Ltd.
as the General Partner of the
Sisson Project Limited Partnership
47 Avonlea Court
Fredericton, NB E3C 1N8

Prepared by:
Stantec Consulting Ltd.
845 Prospect Street,
Fredericton, NB E3B 2T7

Project No. 121811420
June 13, 2014

ABOUT THIS DOCUMENT

This report has been prepared by Stantec Consulting Ltd. (Stantec) for the sole benefit of Northcliff Resources Ltd. (Northcliff). The report may not be relied upon by any other person or entity, other than for its intended purposes, without the express written consent of Stantec and Northcliff.

This report was undertaken exclusively for the purpose outlined herein and is limited to the scope and purpose specifically expressed in this report. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Stantec makes no representation or warranty with respect to this report, other than the work was undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Any information or facts provided by others and referred to or used in the preparation of this report have been assumed to be correct. This report should not be construed as legal advice.

This report presents the best professional judgment of Stantec personnel available at the time of its preparation. Stantec reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the observations and any conclusions provided herein.

ABOUT THE PROPONENT

After submission of the Sisson Project EIA Report to governments in July 2013, Northcliff Resources Ltd. and Todd Minerals Ltd. entered into a limited partnership agreement to advance the development of the Sisson Project. As a result of this agreement, the Sisson Project is now being developed and advanced by Sisson Mines Ltd., on behalf, and as general partner, of the Sisson Project Limited Partnership. Thus, the Proponent of the Sisson Project is now Sisson Mines Ltd., and all references to Northcliff Resources Ltd. (Northcliff) in this document or in previous documentation relating to the Sisson Project can be read as referring to Sisson Mines Ltd.

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1.0 INTRODUCTION

This report is intended to fulfill the information requirements for authorization of the Sisson Project under the *Fisheries Act* and to provide information required for listing the tailings storage facility (TSF) in Schedule 2 of the *Metal Mining Effluent Regulations* (*MMER*). The information requirements for a Section 35(2) *Fisheries Act* Authorization are described in Schedule 1 of the *Applications for Authorization under Paragraph 35(2)(b) of the Fisheries Act Regulations* under the *Fisheries Act*. The Sisson Project is a proposed tungsten-molybdenum open pit mine and associated facilities located on provincial Crown land near Napadogan, New Brunswick, approximately 60 km directly northwest of the city of Fredericton. The Proponent of the Sisson Project is Sisson Mines Ltd. (hereafter referred to as "the Proponent").

1.1 REGULATORY CONTEXT AND SCOPE OF APPLICATION

Section 35 of the *Fisheries Act* prohibits the carrying out of a work, undertaking or activity that results in *"serious harm to fish that are part of a commercial, recreational or Aboriginal fishery"* (hereinafter referred to as "CRA fisheries") without first obtaining an Authorization from Fisheries and Oceans Canada (DFO). "Serious harm to fish" is defined in the *Fisheries Act* as *"the death of fish or any permanent alteration to, or destruction of, fish habitat"*. Authorization under the Act requires that the proponent must offset any serious harm to fish that were part of, or supported, CRA fisheries such that the productivity of the fisheries is maintained or improved. An Offsetting Plan must accompany the application for authorization, and is evaluated by DFO following the "Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting" (DFO 2013a). Temporary alterations to fish habitat (*e.g.,* construction of road culverts or reductions in mean annual flow less than about 10%) are no longer subject to the provisions of Section 35 and therefore no longer require a *Fisheries Act* authorization.

Additionally, under Section 36 of the *Fisheries Act*, *"no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish"* without authorization. For mines, the requirements of Section 36 of the *Fisheries Act* are further defined and regulated by the *Metal Mining Effluent Regulations* (*MMER*). The depositing of deleterious substances produced by mines (*e.g.*, tailings, waste rock) into waters frequented by fish is authorized through a regulatory amendment to Schedule 2 of *MMER*, with associated compensation/offsetting.

There are fish within the Project area that currently support commercial (*e.g.,* American eel (*Anguilla rostrata*)), recreational (*e.g.*, brook trout (*Salvelinus fontinalis*)), and Aboriginal (*e.g.*, brook trout) fisheries (collectively termed CRA fisheries). All fish species within the general area of the Project could be considered as Aboriginal fisheries. However, as defined by DFO (2013b), slimy sculpin, creek chub, pearl dace, blacknose dace, common shiner, longnose sucker, white sucker and sea lamprey do not support CRA fisheries (DFO 2013b). Historically, Atlantic salmon (*Salmo salar*) in the Saint John River system supported a commercial, recreational and Aboriginal fishery, but those fisheries have been closed (DFO 2012).

In addition to the presence of the CRA species mentioned above, American eel and Outer Bay of Fundy (OBoF) Atlantic salmon may be present in watercourses near the Sisson Project. Both these species have been classified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC); American eel is listed by COSEWIC as "Threatened", and OBoF Atlantic salmon is listed as "Endangered". Neither American eel nor OBoF Atlantic salmon are listed on Schedule 1 of the federal *Species at Risk* Act (*SARA*). Only those species listed in Schedule 1 of *SARA* are subject to the prohibitions of Sections 32-36 and 58 of *SARA*.

The scope of this Application for Authorization under Section 35(2) of the *Fisheries Act* includes:

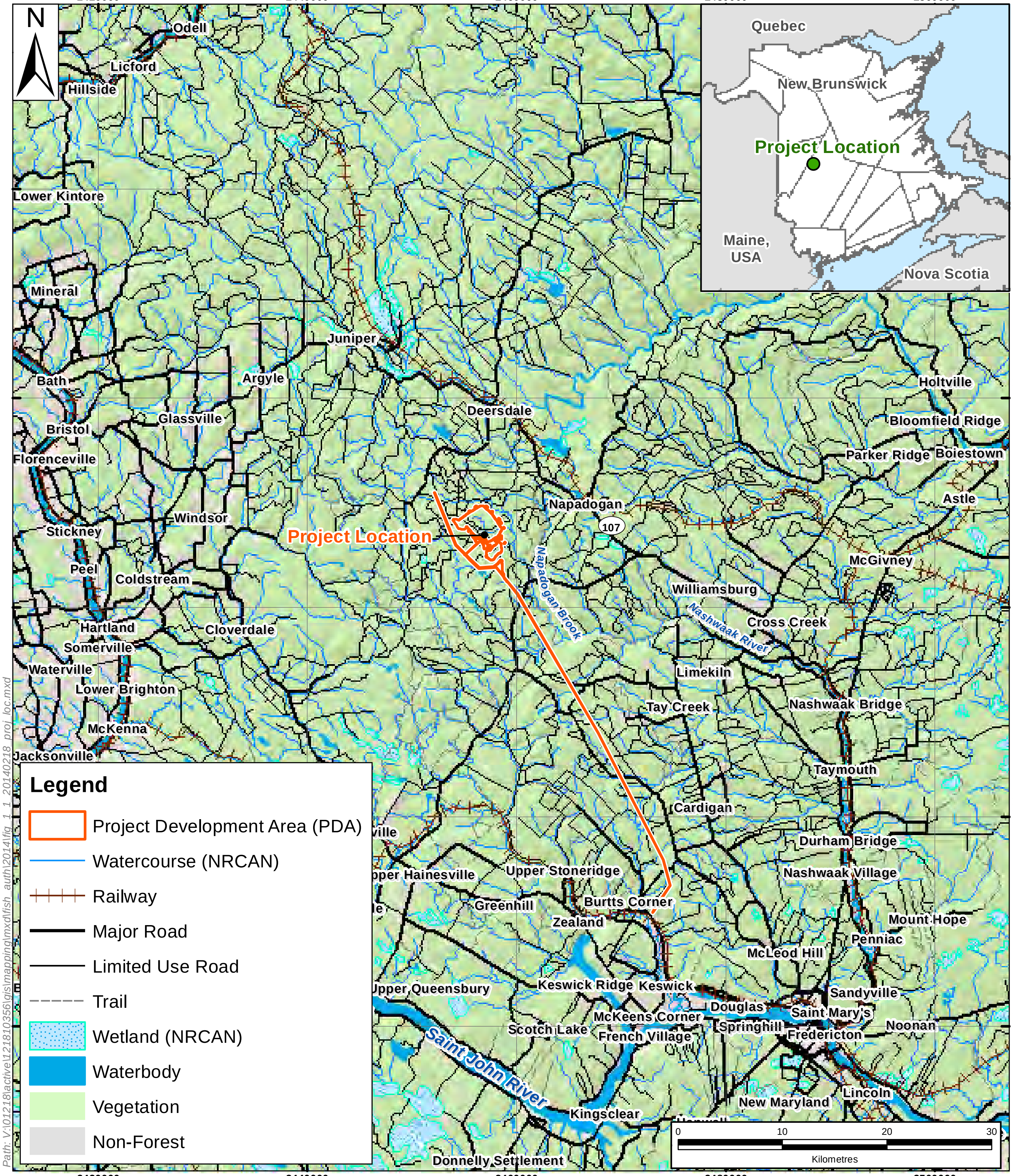
- authorization for "serious harm to fish" arising from direct loss of portions of Bird Brook, Sisson Brook, an unnamed tributary to West Branch Napadogan Brook (identified as "Tributary A"), and a small portion of McBean Brook, and their tributaries, due to the construction and operation of Project facilities (*e.g.*, open pit, TSF);
- authorization for "serious harm to fish" arising from the indirect loss of residual segments of Bird Brook, Sisson Brook, and Tributary A to West Branch Napadogan Brook due to loss of catchment area upstream of these residual segments, and consequent reductions of stream flows in them, arising from the placement of Project facilities;
- authorization for "serious harm to fish" arising from the reduction in downstream flow in Napadogan Brook associated with the withholding of mine contact water within the Project site, resulting in a reduction in the available habitat in Napadogan Brook; and
- authorization to carry out the removal of the existing water level control structure and road culvert at Nashwaak Lake and its associated replacement with a bridge, as an offsetting project to offset the "serious harm to fish" that will arise from the above alterations.

Additionally, this application is also intended to initiate and inform the regulatory amendment process to add the Sisson Project TSF (referred to as a tailings impoundment area, or TIA, in the *MMER*) to Schedule 2 of *MMER*. Other information requirements for this process will be submitted separately to Environment Canada in support of this process.

Finally, this Application also contains the information required for an Offsetting Plan to offset serious harm arising from the Sisson Project, as required under Section 35 of the *Fisheries Act*. The same information is also relevant to habitat compensation/offsetting that is required under the *MMER* Schedule 2 regulatory amendment process.

1.2 LOCATION

The Project site is approximately 10 km southwest of the community of Napadogan, York County, in east-central New Brunswick, approximately 60 km directly northwest of the city of Fredericton (Figure 1.1). The Project site is located on provincial Crown Land at approximately N46.36667 W67.05000, and is located within the Napadogan Brook watershed. A more detailed site plan of the Project Development Area (PDA) for the Project is shown in Figure 1.2.



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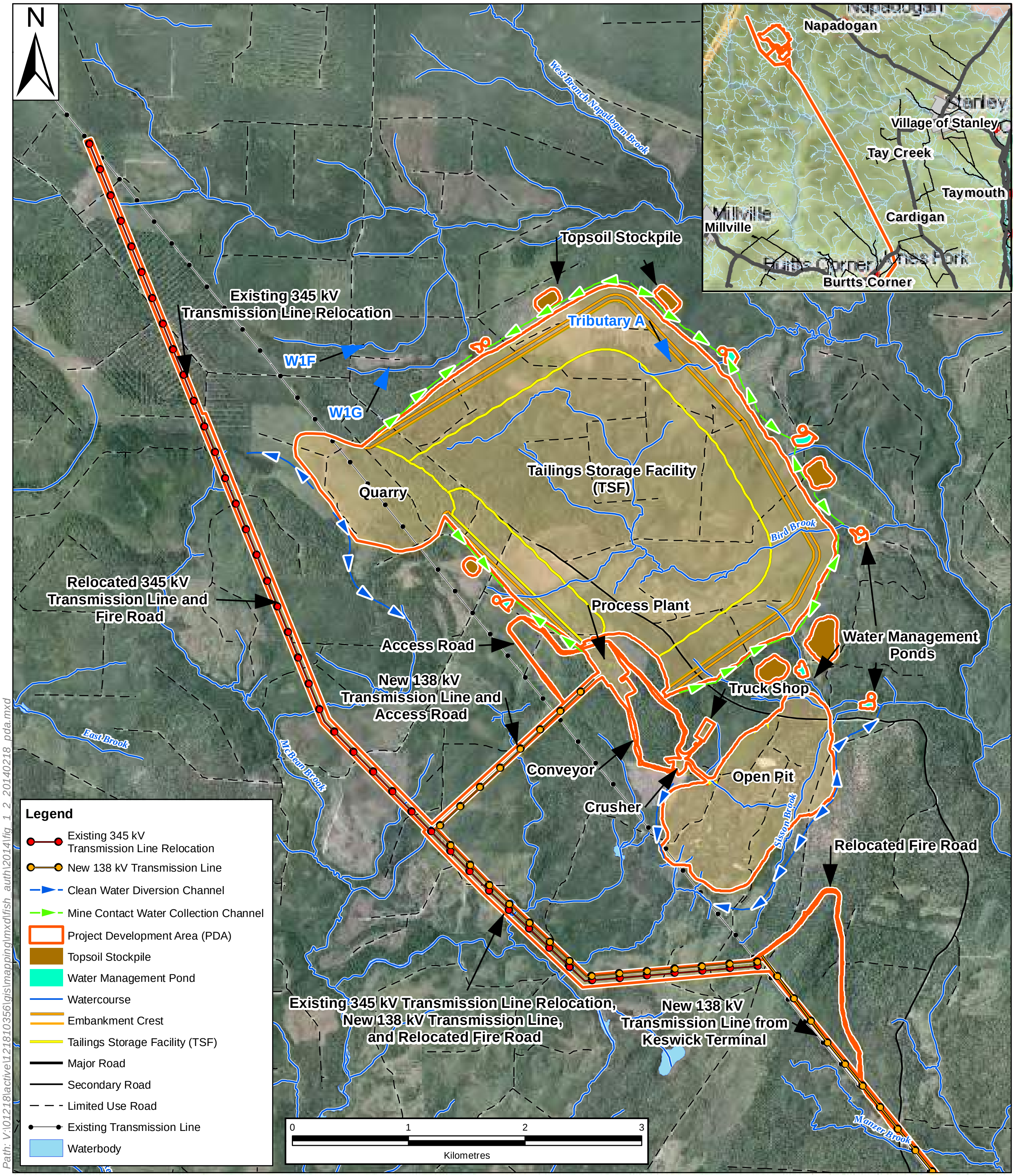
NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC PROJECT AND SHOULD NOT BE USED FOR OTHER PURPOSES.

Project Location Sisson Project: Napadogan, N.B.	Scale: 1:500,000	Project No.: 121810356	Data Sources: SNB NRCAN, ESRI	Fig. No.: 1.1	Stantec
Client: Northcliff Resources Ltd.	Date: (dd/mm/yyyy) 22/03/2014	Dwn. By: JAB	Appd. By: DLM		

Map: NAD83 CSRS NB Double Stereographic



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NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC PROJECT AND SHOULD NOT BE USED FOR OTHER PURPOSES.

Project Development Area (PDA)

Sisson Project:
Napadogan, N.B.

Client: Northcliff Resources Ltd.

Scale: 1:45,000	Project No.: 121810356	
Date: (dd/mm/yyyy) 22/03/2014	Dwn. By: JAB	Appd. By: DLM

Data Sources:
SNB
NRCAN, ESRI

Fig. No.: 1.2

Map: NAD83 CSRS NB Double Stereographic

The watercourses that will be directly affected by the Project are Bird Brook, Sisson Brook, an unnamed tributary ("Tributary A") to West Branch Napadogan Brook, and a small portion of McBean Brook, and some tributaries to these watercourses. Downstream of Bird Brook, West Branch Napadogan Brook and Napadogan Brook (hereinafter referred to as lower Napadogan Brook) will be indirectly affected by the Project due to downstream flow reductions that are associated with the withholding of water within the Project's TSF. These watercourses flow into Napadogan Brook, and then into the Nashwaak River, and are part of the Saint John River system (Figure 1.3).

1.3 CONTACT INFORMATION

Applicant's Contact Information

Louise Steward, P.Eng.
Vice President, Government and Regulatory Affairs
Northcliff Resources Ltd.
on behalf of
Sisson Mines Ltd. as the General Partner of the Sisson Project Limited Partnership
47 Avonlea Court
Fredericton, NB E3C 1N8
Tel: 1-506-455-0530, Fax: 1-506-455-0533
Email: LouiseSteward@northcliffresources.com

Authorized Representative's Contact Information:

Not applicable.

1.4 DESCRIPTION OF PROPOSED UNDERTAKING

The sub-sections below provide a general description of the Sisson Project, its major components that may result in serious harm to fish in watercourses within the Project area, and the methods that will be used during Construction of the Project.

1.4.1 Project Summary

The Sisson Project is a proposed conventional, open pit tungsten and molybdenum mine located near the community of Napadogan, New Brunswick. The mine will operate for an estimated 27 years at an average mining rate of 30,000 metric tonnes per day (t/d) of tungsten- and molybdenum-containing ore. The processed ore will be sent to an ore processing plant to produce tungsten and molybdenum mineral products. The main activities associated with the Project include:

- mining by conventional open pit methods, and storage of tailings and waste rock;
- stockpiling of organics and overburden for future reclamation use;
- on-site processing of ore in an ore processing plant to produce mineral concentrates and tailings, and further processing of tungsten concentrate to a higher-value crystalline tungsten product (ammonium paratungstate) and solid precipitate waste products;

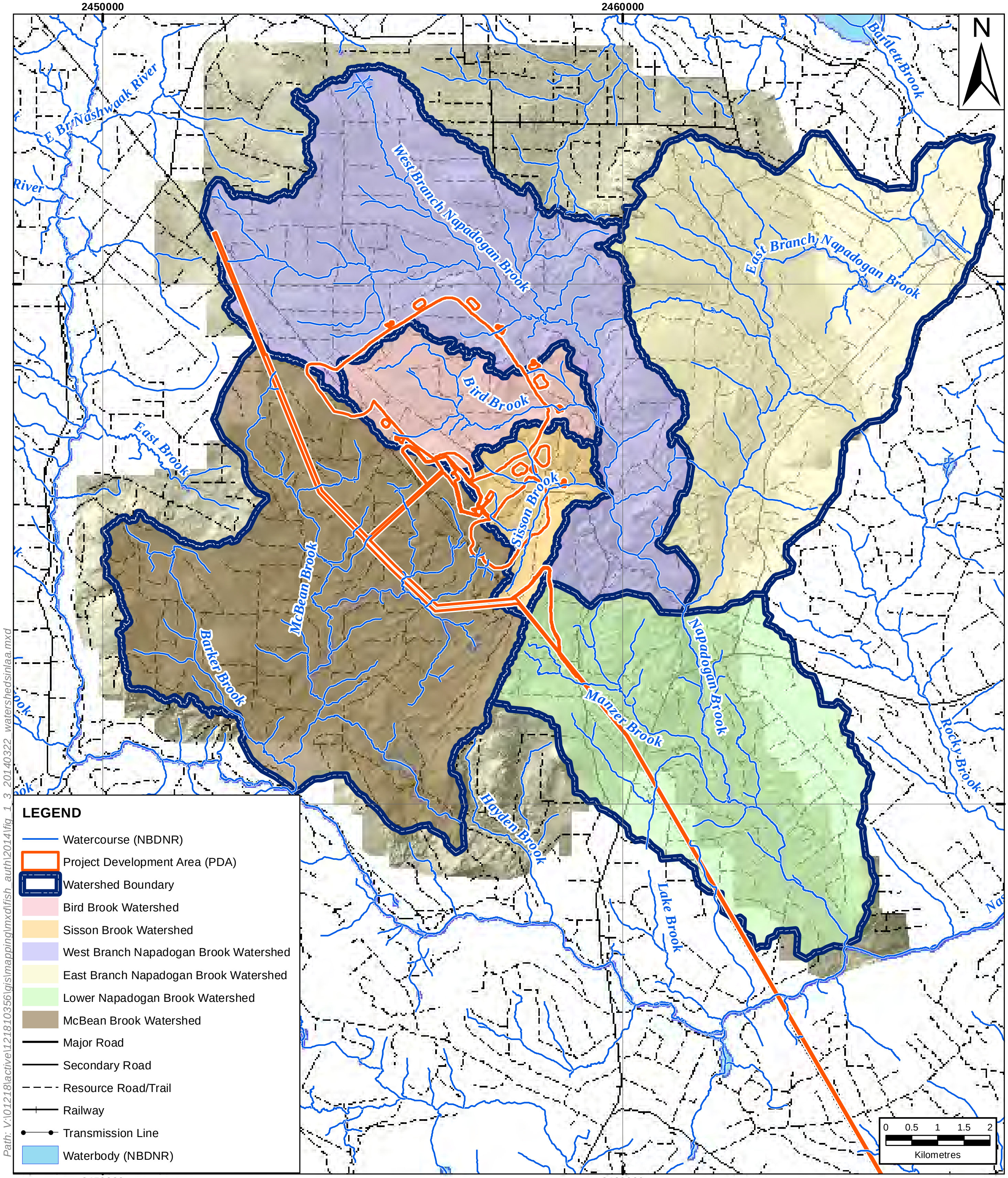
- development and operation of a tailings storage facility (TSF), and associated storage of tailings;
- diversion of clean surface water away from Project facilities (*e.g.*, open pit, TSF);
- collection and storage of all precipitation on the Project site and groundwater flows into the open pit (termed "mine contact water") for re-use in the ore processing plant, and discharge of surplus water, with treatment as needed to meet permitting conditions;
- transportation of the mineral products to off-site buyers; and
- decommissioning of facilities, and reclamation and closure of the site at the end of the Project life.

1.4.2 Major Project Components and Activities

Major phases of Project development are discussed below:

- **Construction:** Construction will proceed for a period of up to 24 months, commencing as soon as the EIA is completed and the applicable permits, approvals or other forms of authorization have been obtained. For the purpose of the Sisson Project Environmental Impact Assessment (EIA) Report (Stantec 2013a), it has been assumed that Construction will begin in the fourth quarter of 2014.
- **Operation:** Operation will commence immediately following Construction and will continue for an approximate period of 27 years. For the purpose of the Sisson Project EIA Report (Stantec 2013a) and this Application for authorization, it has been assumed that Operation will begin in the second half of 2016.
- **Decommissioning, Reclamation and Closure:** Decommissioning of Project facilities and Reclamation of the Project site will occur following the completion of Operation. Closure will commence during the Decommissioning and initial Reclamation period, and will continue until the pit lake fills with water in about 12 years. Post-closure (*i.e.*, after the pit lake is filled) will follow.

An overview of the major Project phases and activities is provided in Table 1.1, and Figure 1.4 shows the Project components at the end of the mine life. The major Project Components anticipated to affect watercourses, namely the open pit mine and tailings storage facility, are described in more detail below. Additional information on other Project components that are not anticipated to directly affect watercourses are described in more detail in Section 3.4 of the Sisson Project EIA Report dated July 2013 (Stantec 2013a).



NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC PROJECT AND SHOULD NOT BE USED FOR OTHER PURPOSES.

Watersheds within the Local Assessment Area (LAA) Sisson Project: Napadogan, N.B.	Scale: 1:100,000	Project No.: 121810356		Data Sources: NBDNR Leading Edge Geomatics Ltd.	Fig. No.: 1.3
	Date: (dd/mm/yyyy) 22/03/2014	Dwn. By: JAB	Appd. By: DLM		
Client: Northcliff Resources Ltd.					

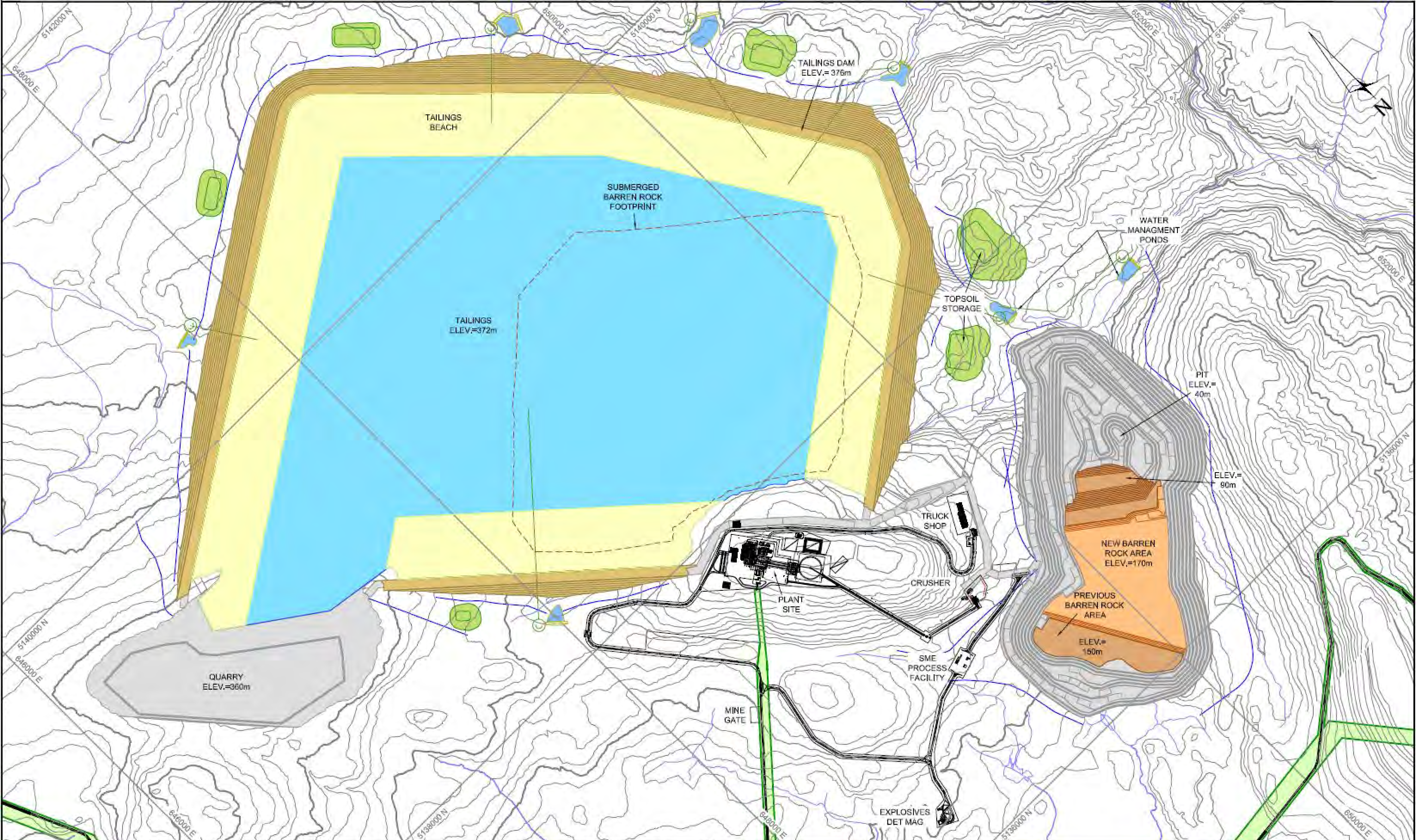
Map: NAD83 CSRS NB Double Stereographic

Table 1.1 Description of Project Phases, Activities, and Physical Works

Project Phase	Activity Category	Project Activities and Physical Works
Construction	Site Preparation of Open Pit, Tailings Storage Facility (TSF), and Buildings and Ancillary Facilities	The Project-related activities associated with preparing the open pit, TSF, and buildings site for physical construction, including: • surveying; • geotechnical investigations; • clearing; • grubbing; • removal and stockpiling of topsoil and overburden; and • grading/leveling.
	Physical Construction and Installation of Project Facilities	The physical construction of buildings and structures associated with the Project, and installation of equipment associated with its operation, including: • construction of surface facilities (*e.g.*, processing plants, electrical substation, primary crusher, ore conveyor, maintenance shop, explosives storage); • quarrying, aggregate crushing, and concrete batch plant; • development of starter pit and initial ore stockpile; • establishment of overburden and soil stockpiles; • construction of engineered drainage and diversion channels; • loss of Bird and Sisson brooks; • TSF preparation; • construction of TSF starter embankments, water management ponds, and ponding of start-up water; • establishment of water management system; and • equipment installation.
	Physical Construction of Transmission Lines and Associated Infrastructure	The physical construction of electrical transmission-related facilities associated with the Project, including: • site preparation (*e.g.*, clearing, development of access); • relocation of existing 345 kV transmission line (*e.g.*, distribution of materials, foundation construction, erection of towers, stringing, reclamation); • construction of new 138 kV transmission line (*e.g.*, distribution of materials, foundation construction, erection of towers, stringing, reclamation); and • construction of electrical substation.
	Physical Construction of Realigned Fire Road, New Site Access Road, and Internal Site Roads	The physical construction of roads associated with the Project, including: • site preparation (*e.g.*, clearing, sedimentation and erosion control, grubbing, cutting and filling, grading); • relocation of Fire Road (*e.g.*, road bed preparation, ditching, finishing); • construction of site access road and internal site roads (*e.g.*, road bed preparation, ditching, finishing); and • construction of watercourse crossings.
	Implementation of Fish Habitat Compensation/ Offsetting Initiatives	The physical construction and/or demolition activities associated with implementing various initiatives that form the basis of the Fish Habitat Compensation/Offsetting Plan for the Project, include: • removal of Nashwaak Lake Culvert (*e.g.*, physical

Table 1.1 Description of Project Phases, Activities, and Physical Works

Project Phase	Activity Category	Project Activities and Physical Works
		removal of the culvert and placement of a woods-road bridge).
Operation	Mining	The activities associated with open pit mining, including: • open pit mine operation (operation of explosives magazine, blasting, extraction of ore and waste rock, on-site transportation of ore to crusher, and, until last mining phase, on-site transportation of waste rock to TSF); • ore crushing and conveyance to processing plant; and • rock quarrying, trucking and crushing as needed.
	Ore Processing	The activities associated with the processing of ore in and production of products, including: • milling/grinding; • flotation; • concentrate dewatering; • tungsten refining; and • packaging.
	Mine Waste and Water Management	The activities associated with the supply of water for the process operation, and the management and storage of surplus water and byproducts from the process operation including: • dewatering of open pit; • tailings storage in TSF; • construction of TSF embankments over life of mine; • waste rock storage in TSF; • collection and management of on-site mine contact water; and • surplus water treatment, release, and monitoring.
	Linear Facilities Presence, Operation, and Maintenance	The physical presence, and operation and maintenance, of Project-related linear facilities, including the 138 kV transmission line, substation, and site roads.
Decommissioning, Reclamation and Closure	Decommissioning	The activities associated with the decommissioning of Project components and facilities at the end of mine life, including: • decommissioning and removal of equipment; and • removal of buildings and structures.
	Reclamation	The activities associated with reclamation of the Project site at the end of mine life.
	Closure	The activities associated with closure of the mine, including the filling of the open pit with water from the TSF and precipitation.
	Post-Closure	The existence of the former TSF and open pit, now filled with water, in perpetuity, and the ongoing treatment and release of surplus water, as applicable.
Note: Construction and relocation of linear facilities (*e.g.*, site access roads) are not included in the Authorization because those activities are not considered to be serious harm.		



NORTHCLIFF SISSON - FEASIBILITY STUDY END OF PERIOD YR_27 LOM			
DATE:	2013/02/08	APPROVED BY:	RMG
SCALE:	1:16 000	FILE:	YR_27 (130208)
DRAWN BY:	DH	PROJECT:	NCS FS 2012

Moose Mountain Technical Services

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CONTOURS AT 5m INTERVALS
INDEX CONTOURS AT 25m INTERVALS

LEGEND

- PIT
- QUARRY
- NEW BARREN ROCK AREA
- PREVIOUS BARREN ROCK AREA
- NEW MID GRADE STOCKPILE
- PREVIOUS MID GRADE STOCKPILE
- NEW INFRASTRUCTURE
- PREVIOUS INFRASTRUCTURE
- TAILINGS DAM
- TAILINGS
- TAILINGS BEACH
- UTILITY RIGHT OF WAY
- TOPSOIL STORAGE
- WATER COURSE
- WATER DIVERSION
- CONTOUR LINES

HDI NORTHCLIFF

1.4.2.1 Open Pit Mine

An open pit mine is an excavation in the ground for the purpose of extracting ore, and which is open to the surface for the duration of the mine's life. To expose and mine the ore it is necessary to remove surface soils (*i.e.*, overburden), and excavate and relocate waste rock (*i.e.*, material that does not contain economically recoverable amounts of the target minerals.

The open pit will cover an area of about 145 ha at its ultimate extent, and will be 300 to 370 m deep (compared to current elevations) upon completion of mining at approximately Year 27.

As currently designed, the open pit will intersect several headwater streams that are tributaries to Sisson Brook, as well as Sisson Brook itself. Some of the smaller headwater streams that are tributaries to McBean Brook to the south of the pit will be also directly affected once the open pit is fully developed. Engineered drainage channels around the open pit will divert some of the Sisson Brook catchment into McBean Brook. Figures of the phased design of the open pit can be found in Section 3.2 of the Sisson Project EIA Report (Stantec 2013a).

1.4.2.2 Tailings Storage Facility (TSF)

The base of the TSF embankments will be native overburden, compacted as required to minimize seepage. The engineered embankments, constructed of non-potentially acid generating (NPAG) quarried rock or local borrow materials, will retain the tailings. Potentially acid generating (PAG) tailings and all waste rock will be stored sub-aqueously in the TSF, encapsulated in the NPAG bulk tailings, to effectively mitigate potential oxidation, acid generation, and metal leaching in the TSF. The TSF embankments and operational procedures are designed to minimize seepage, and otherwise direct seepage to water management ponds (WMPs) located at low points around the TSF embankments. The TSF embankments will be designed and built to meet or exceed standards established in the Canadian Dam Association's "Dam Safety Guidelines" (Canadian Dam Association 2007) as discussed in Section 3.4 of the Sisson Project EIA Report (Stantec 2013a). Though unlikely to occur, a failure of the TSF embankment and resultant release of tailings or process water could adversely affect downstream watercourses and habitats that have substantial ecological and societal value; thus the hazard classification (as per the Dam Safety Guidelines) of the Sisson TSF was therefore set to ensure a design that will protect these values. Technical drawings for the TSF embankment can be found in Figure 1.5. Additional Figures can be found in Section 3.2 of the Sisson Project EIA Report (Stantec 2013a).

The construction of the TSF embankments and infilling of these brooks from the storage of tailings within the TSF will result in the direct loss of fish habitat in parts of Bird Brook and part of a small unnamed tributary to West Branch Napadogan Brook (referred to as "Tributary A"), and will also reduce the catchment area of Bird Brook and Tributary A to West Branch Napadogan Brook.

1.4.3 Construction Methods

The Construction phase will begin following approval of the EIA and the receipt of all required approvals, permits and authorizations for construction of the Project, as well as following the Proponent's decision to proceed to construction. Construction is expected to take place over a period of about 24 months, and will be completed with the initial start-up of the ore processing plant—marking the beginning of the Operation phase.

The following is a brief description of Construction activities that are typical for an open pit mine and associated infrastructure that will affect fish and fish habitat. All Construction activities will be managed by the Environmental Protection Plan (EPP) for Construction as described in Chapter 2 of the Sisson Project EIA Report (Stantec 2013a).

During the first year of Construction, the site will be prepared for development of the open pit, TSF, buildings and ancillary facilities. Site preparation will include clearing, grading, and leveling of the site as required in preparation for foundations and equipment.

Erosion and sedimentation control techniques will be employed throughout the site preparation activities as required to minimize erosion of exposed areas and sedimentation in site surface water. Standard mitigation measures such as the use of silt fences, sediment traps and sedimentation ponds will be used to manage the potential release of sediment to streams. These measures will be implemented through the Environmental Protection Plan (EPP). More detailed information on construction activities and methods is provided below.

1.4.3.1 Clearing

Clearing of the areas for the open pit, primary crusher and ore conveyor, ore processing plant, stockpiles, TSF, site access road, internal site roads, and ancillary facilities will be completed using forest harvesting machinery. Clearing near watercourses will be conducted manually.

The TSF embankment areas will be locally sub-excavated to remove unsuitable material (*e.g.,* soft, loose, or excessively wet soils). This material will be stockpiled for future site reclamation use. The TSF embankment foundation areas will be dewatered and any natural streams will be diverted in engineered channels.

1.4.3.2 Grubbing

Grubbing includes the removal and disposal of stumps and roots remaining after clearing. Grubbing will be conducted using a root rake or similar equipment that is able to remove the roots and stumps of cleared vegetation and leaves the topsoil for salvage. The areas associated with the ore processing plant, the TSF embankments, and other surface facilities (*e.g.,* roadways) will be grubbed, whereas the TSF area itself will not be prepared further beyond clearing and removal of merchantable timber.

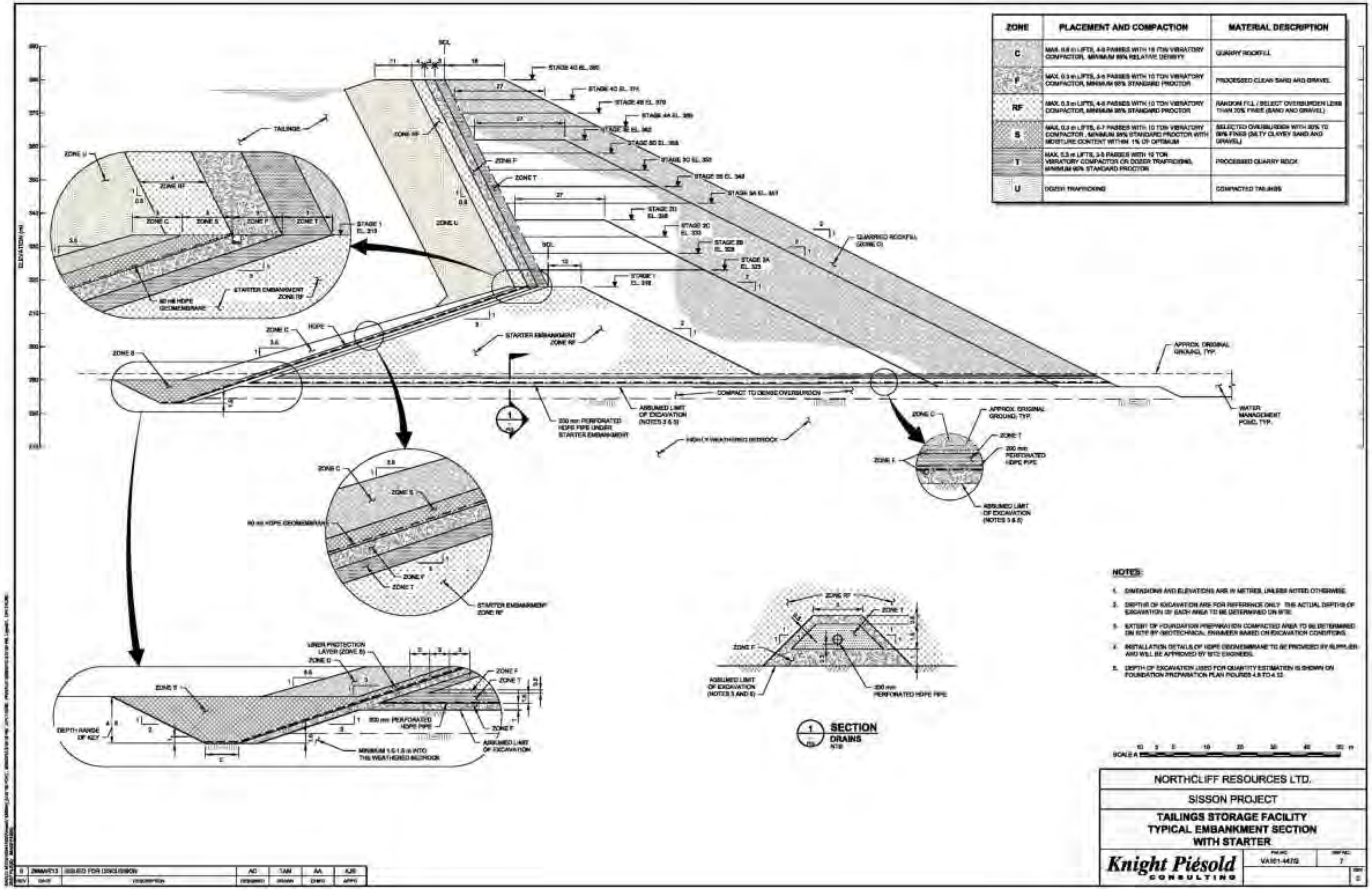


Figure 1.5 **Typical Cross-Section of TSF Embankments**

1.4.3.3 Removal and Stockpiling of Topsoil and Overburden

The overburden in the open pit area generally consists of a veneer of organic matting and topsoil over till. The overburden thicknesses generally range from 0.90 to 4.0 m in depth below ground surface. Topsoil will be an organic material, while overburden will typically be till (*i.e.,* silty sand and gravel).

Topsoil and overburden that must be removed (*e.g.*, from over the mineral deposit and under the TSF embankments) will be stockpiled in various areas surrounding the TSF and other facilities, for reuse during re-vegetation activities associated with progressive reclamation of the site and ultimate site reclamation at the end of mine life. The amount of materials to be collected, construction and operation considerations, space availability, and future intended uses will determine the exact location and size of these stockpiles. The material will be used at closure to provide a growth medium on the tailings beach, TSF embankments, and any other appropriate areas.

1.4.3.4 Grading and Leveling

Once clearing is completed, the Project site (including ore storage areas, ore processing plant and the TSF embankment foundations) will be prepared by grading and leveling of the areas using heavy equipment such as graders, dozers and scrapers.

The ore storage pads will be graded to create the desired grade for drainage capture. The foundation zone will be prepared, and drainage collection works will be installed.

1.4.3.5 Construction of Engineered Drainage and Diversion Channels for the Site

Engineered drainage and diversion channels will be constructed to divert non-contact surface water away from Project facilities wherever possible and generally divert it into another location within the same watershed (*e.g.,* as in Figure 1.2). Water management during the Construction phase will consist of establishing collection ponds, coffer dams, pumping systems, run-off collection ditches, and diversion channels. Some of the water management works will become long-term features of the Project site, and others will be temporary and removed when no longer needed for Construction purposes.

1.4.3.6 Overview of TSF Construction

Construction of the TSF will begin with the construction of small starter dams to collect the water required for the start of Operation. These dams will become encapsulated within the TSF embankments, and the embankments as well as the area inundated by water (and then tailings when Operation begins) will grow over the life of the Project.

Construction of the TSF cannot begin before creating access to and clearing the dam construction sites. Coffer dams will then be installed just upstream of the starter dam locations, and stream flows from above the coffer dams will be pumped around the construction site for discharge downstream. The coffer dams will be sized to ensure that sediment generated upstream will settle out before the water is pumped around the construction sites. Construction of the starter dams, the downstream water management ponds, and then the initial TSF starter embankments, will follow. Within the TSF footprint, timber that is merchantable will be harvested and removed; timber that is not merchantable will be felled and gradually covered with water and then tailings. Other than for the construction of starter dams and embankments, no grubbing or other earth moving within the TSF footprint is required.

1.4.4 Project Schedule

Construction of the Project is estimated to take approximately 24 months following approval of the EIA and the receipt of required permits, approvals, and other forms of authorization. Operation of the Project will be initiated upon completion of construction activities, and will continue for an estimated 27 years, after which Decommissioning, Reclamation and Closure will be initiated. The approximate Project schedule, with estimates for 2014 and beyond, was outlined in Section 1.2.3 of the Sisson Project EIA Report (Stantec 2013a) and is summarized as follows.

- Complete Feasibility Study: first quarter of 2013 (complete).
- Submit EIA Report to federal and provincial governments: third quarter of 2013 (complete).
- EIA/EA decisions received: third quarter of 2014 (estimated).
- Complete initial permitting, approvals and authorizations: fourth quarter of 2014 (estimated).
- Construction: begins fourth quarter of 2014 (estimated).
- Commissioning and Operation: begins second half of 2016 (estimated).

The Project schedule is subject to regulatory timelines that are not controlled by the Proponent; therefore, the schedule outlined above is subject to change as the EIA review, approval and permitting processes unfold. The initiation of construction also depends on financing of the construction costs and a decision by the Proponent to proceed with the Project.

More detailed information on the Project Schedule can be found in Section 1.2.3 and Section 3.1.4. of the Sisson Project EIA Report (Stantec 2013a).

2.0 DESCRIPTION OF FISH AND FISH HABITAT (AQUATIC ENVIRONMENT)

The information below presents a general description of the habitat within the Project area. A more detailed description of the fish habitat contained within the Project area can be found in Section 8.5 of the Sisson Project EIA Report (Stantec 2013a), and the report entitled "Sisson Project: Baseline Aquatic Environment Technical Report" (Stantec 2012a).

2.1 METHODS FOR CHARACTERIZING FISH AND FISH HABITAT

The majority of the aquatic environment field program to characterize existing conditions for the Sisson Project EIA was undertaken in 2011 (Stantec 2012a), and focused primarily on Bird Brook, Sisson Brook, McBean Brook, and Tributary A to West Branch Napadogan Brook. The baseline aquatic technical report included watercourse and watershed analysis, fish habitat overview and rapid fish habitat bio-assessment, detailed fish habitat and qualitative fish surveys, quantitative fish population assessment, as well as other studies pertinent to the Sisson Project EIA Report (Stantec 2013a).

This Application includes a summary of the following pertinent information, sourced from Stantec (2012a) and Stantec (2013a):

- watershed area and location;
- general aquatic habitat characteristics;
- water quality;
- benthic invertebrate community; and
- fish community.

The methods and results for the above components are described in detail in Stantec (2012a).

2.1.1 Watershed Area and Location

Watershed areas and locations were determined from a light detection and ranging (LiDAR) dataset collected by Leading Edge Geomatics Ltd. The LiDAR dataset for the PDA and study area was imported into ESRI ArcGIS, and a site-specific topographic model was developed. Minimum catchment area polygons for the study area were created and aggregated to create watersheds and sub-watersheds for specific streams from the stream network (Stantec 2012a) (see Figure 1.3).

2.1.2 General Aquatic Habitat Characteristics

General aquatic habitat characteristics were determined using a "Rapid Fish Habitat Bio-assessment Survey" approach. These rapid fish habitat bio-assessments were conducted by walking all of the GIS- delineated reaches within the PDA between June 13 and June 29, 2011. The rapid fish habitat bio-assessment method used by the Study Team was based on the methodologies outlined in the United States Environmental Protection Agency (USEPA) publication "Rapid Bioassessment Protocols for use in Streams and Wadeable Rivers" (Barbour *et al.*1999). The Study Team developed a standardized form based on the USEPA methodology (Barbour *et al*.1999) to capture the characteristics important to fish habitat. These characteristics, which are consistent with the characteristics included in the standard DFO/NBDNR habitat classification method and data collection sheet (Hooper *et al*. 1995), and include:

- substrate;
- amount of woody debris;
- embeddedness;
- stream characteristics (*e.g.,* bankfull depth and width); and
- any indicators of fluvial change (*e.g.*, braiding and sand on the stream channel banks).

These characteristics can be used to determine the quantity of fish habitat present (as habitat units, where 1 habitat unit equals 100 m²). The form also captured information on land use in the riparian zone (*e.g.,* evidence of forestry, status of buffer vegetation).

2.1.3 Water Quality

Water Quality was determined via *in-situ* measurement and data logger methods. The field team collected *in situ* water quality data including dissolved oxygen (DO), pH, specific conductivity and water temperature, and took photographs of each reach during the rapid fish habitat bio-assessment surveys and qualitative and quantitative electrofishing. Temperature, DO, and specific conductivity were measured using a YSI 85 water quality meter. The pH of the water was measured using a Hanna pH tester. Both instruments were calibrated daily, or more frequently, following manufacturer's instructions. Water temperature loggers pertinent to this Authorization were also deployed in Sisson Brook (S2A3, 2011-2012), Bird Brook (B3A9, 2011-2012) and West Branch Napadogan Brook (W4A31, 2011-2012) during July and August 2011. *In situ* water quality data were used to characterize the tributaries affected in McBean Brook and Tributary A to West Branch Napadogan Brook, since temperature logger data was not available for these locations.

2.1.4 Benthic Invertebrate Community

Benthic invertebrate community replicate samples (five) were taken at each station where quantitative electrofishing was conducted (as discussed in the next sub-section). Each sample was comprised of a composite of three replicate sub-samples, and sent to a taxonomist for identification. Benthic invertebrate samples were collected using a standard D-frame kick net with 0.5 mm mesh. A standard time of one minute of sampling effort was applied for each sub-sample. The collected sub-samples were combined in a sieve box to remove fines and reduce the volume in the field (Stantec 2012a). The samples were preserved using 95% un-denatured ethanol. Individual indices were calculated and the following endpoints were used to characterize the baseline condition of the benthic invertebrate community:

- taxonomic richness (richness);

- total invertebrate abundance (abundance, number of individuals per m^2);
- Simpson's diversity index (diversity);
- Simpson's evenness index (evenness); and
- Bray-Curtis index of dissimilarity (Bray-Curtis Index).

High richness, abundance, diversity and evenness are all considered to be indicators of good environmental quality. A low Bray-Curtis index when two stations are compared would indicate that the benthic communities are similar (*i.e.,* 0.1), whereas a high Bray-Curtis index would indicate differences between the benthic communities (*i.e.,* 0.9).

2.1.5 Fish Community

Fish community was determined using qualitative and quantitative electrofishing. Qualitative electrofishing was undertaken at 30 stations using a Smith-Root Model LR-24 backpack electrofishing unit and accepted survey protocols (Hooper *et al.* 1995) to determine fish species present at each station. Catch per unit effort (CPUE) was calculated based on the time spent fishing (*i.e.*, seconds of electrical current applied during the electrofishing effort). At two stations (M1M2, M1N1), fish were collected using minnow traps because the habitat was not conducive to electrofishing (*i.e.,* soft substrate, deep water depths). Collected fish were identified to species, and fork lengths were recorded. Photographs were also taken of representatives of each species collected.

Quantitative electrofishing was undertaken using barrier nets to isolate an area of habitat at each station. Within this isolated area of habitat, electrofishing was undertaken as before, except that multiple passes through the habitat were completed and subsequently depleted (*e.g.*, Zippin 1956). The number and characteristics of fish collected during each pass were recorded, so that quantitative fish population estimates (*i.e.*, number of fish per unit of habitat) and their associated confidence interval (CI) could be calculated (Hayne 1949). The total seconds of electrofishing effort were also recorded.

2.2 FISH AND FISH HABITAT RESULTS

2.2.1 Bird Brook

2.2.1.1 Watershed Area and Location

Bird Brook (N46.38773 W67.03748) occupies a catchment area of 8.2 km^2 within the Napadogan Brook watershed (Figure 1.3). The watercourses within the Bird Brook catchment area include 55% first order streams (with a linear length of 7,048 m), 18% second order stream (2,254 m), and 27% third order streams (3,504 m).

2.2.1.2 General Aquatic Habitat Characteristics

There are six first order tributaries to Bird Brook within the PDA. First order stream habitat was generally suitable as rearing habitat for brook trout outside of the headwater sections. Headwater habitats varied from wetland beaver ponds to steep rocky valleys. There are two second order sections of tributaries to Bird Brook within the PDA. Second order watercourses were a mix of habitat for feeding and rearing, and poor quality impounded habitat. The riparian vegetation is intact and provides overhead cover and stable banks.

The main stem of Bird Brook is a third order watercourse. Third order habitat within the PDA contains fish habitat suitable for spawning, feeding and rearing of cold and other fish species.

The substrate of Bird Brook is approximately 55% fines and sand, with the remaining 45% divided among the larger class size categories. The distribution and concentration of fines is determined by the reduced flow velocity caused by beaver dams. In general, the substrate of Bird Brook provides suitable habitat for small fish and eels.

2.2.1.3 Water Quality

In-situ DO readings typically ranged from 7.1 to 9.5 mg/L with the majority of stations being slightly below the Canadian Council of Ministers of the Environment (CCME) Freshwater Aquatic Life (FAL) guideline of 9.5 mg/L for DO levels in early life stages of fish (CCME 1999). DO concentrations in Bird Brook were acceptable for other life stages of fish in every reach. The pH of Bird Brook ranged from 5.4 to 7.0, which is slightly below the CCME (1999) recommended range. Average daily water temperature in Bird Brook collected from temperature loggers was 15.1°C, with the minimum average daily water temperature being 13.1°C and the maximum daily water temperature being 18.1°C. This relatively cold water during summer provides suitable conditions for cold water fish species.

2.2.1.4 Benthic Invertebrate Community

In Bird Brook, the mean richness was 42, mean abundance was 2,491 individuals per m^2, mean diversity was 0.86, mean evenness was 0.21, and the mean Bray-Curtis index was 0.54 (Stantec 2012a). The benthic invertebrate community in Bird Brook exhibits variability between sampling stations. Overall, it is typical of a healthy stream environment and provides a suitable food base for fish.

2.2.1.5 Fish Community

In Bird Brook, the fish assemblage consisted of brook trout, slimy sculpin (*Cottus cognatus*), American eel, and one juvenile Atlantic salmon observed just above the confluence of West Branch Napadogan Brook. The abundance of all fish species captured by qualitative electrofishing in Bird Brook ranged from 2.4 to 7.1 fish per 100 seconds, 1.5 to 7.1 brook trout per 100 seconds, and 0.1 Atlantic salmon per 100 seconds (Stantec 2012a). The density of all fish species captured by quantitative electrofishing in Bird Brook (2 stations) ranged from 56 (CI 54-57) to 99 (CI 91-106) fish per 100 m^2, and 33 (CI 32-35) to 86 (CI 82-90) brook trout per 100 m^2.

2.2.2 Sisson Brook

2.2.2.1 Watershed Area and Location

Sisson Brook (N46.37415 W67.03067) occupies a catchment area of 5.2 km^2 within the Napadogan Brook watershed (Figure 1.3). The watercourses within the Sisson Brook catchment area include 69% first order streams (with a linear length of 5,562 m), 18% second order stream (1,491 m), and 13% third order streams (1,016 m).

2.2.2.2 General Aquatic Habitat Characteristics

There are four first order tributaries to Sisson Brook located within the PDA. A large beaver pond encompasses the majority of the tributary that lies in the centre of the open pit location, with a partial fish passage barrier at its downstream extent. In general, however, fish habitat within the first order tributaries of Sisson Brook contain suitable rearing habitat for brook trout. There are two second order tributaries to Sisson Brook located within the PDA. Based on water quality and habitat measurements, second order tributaries of Sisson Brook contain brook trout habitat that is generally suitable for spawning, rearing and feeding. There is a single third order section of Sisson Brook. This approximately 900 m section of Sisson Brook occurs entirely outside of the PDA. This approximately 4 m wide section, with cobble and gravel dominated substrate, provides habitat that is generally suitable rearing and feeding habitat for brook trout; fish passage upstream is impeded by a 5 m waterfall within 450 m of the confluence with West Branch Napadogan Brook.

The substrate of Sisson Brook is approximately 50% fines and sand, with the remaining 50% divided among the larger class size categories. The distribution and concentration of fines is largely the result of reduced flow velocity caused by beaver dams.

2.2.2.3 Water Quality

In situ DO concentrations typically ranged from 9.3 to 10.4 mg/L with the majority of stations being near or above the CCME FAL guideline of 9.5 mg/L for DO levels in early life stages of fish. DO was acceptable for other life stages of fish in every reach. The pH ranged from 5.6 to 6.7, which is below the CCME (1999) recommended range of 6.5 to 9.0. Average daily water temperature collected from temperature loggers in Sisson Brook was 14.9°C, with the minimum average daily water temperature being 12.5°C and the maximum daily water temperature being 17.8°C. This relatively cold water during summer provides suitable conditions for cold water fish species.

2.2.2.4 Benthic Invertebrate Community

In Sisson Brook, the mean richness was 44, mean abundance was 3,297 individuals per m^2, mean diversity was 0.90, mean evenness was 0.24, and the mean Bray-Curtis index was 0.65 (Stantec 2012a). The benthic invertebrate community in Sisson Brook exhibits variability between sampling stations. Overall, it is typical of a healthy stream environment and provides a suitable food base for fish.

2.2.2.5 Fish Community

Sisson Brook had the lowest diversity of fish species, with only brook trout and American eel. In Sisson Brook, the abundance of all fish species captured by qualitative electrofishing ranged from 0.9 to 2.4 fish per 100 seconds, and 0.9 to 2.4 brook trout per 100 seconds (Stantec 2012a). The density of all fish species captured by quantitative electrofishing (2 sites) in Sisson Brook ranged from 7 (CI 6-8) to 26 (CI 21-30) fish per $100m^2$ and 6.3 (CI 6.2-6.4) to 26 (CI 21-30) brook trout per $100m^2$.

2.2.3 McBean Brook

2.2.3.1 Watershed Area and Location

The three first order tributaries of McBean Brook (N46.36836 W67.06180) located within the PDA occupy a watershed area of 0.5 km^2 within the McBean Brook watershed which is 43 km^2 (Figure 1.3). There is a total length of 415 m of first order tributaries of McBean Brook within the PDA (excluding the linear facilities corridor, where serious harm is not anticipated).

2.2.3.2 General Aquatic Habitat Characteristics

Each of the three tributaries flows into a small beaver impoundment, and each is surrounded by wetland meadow. The channel substrate of these tributaries is primarily organic materials, fines and sand, consistent with the low gradient and slow flow conditions. Channel banks are stable and vegetated with grasses and shrubs and channel form is steady glide or pool except where watercourses are undefined or braided within a wetland.

The substrate of McBean Brook within the open pit portion of the PDA is approximately 92% fines and sand, with the remaining 8% divided among the larger class size categories. The distribution and concentration of fines is determined by the reduced flow velocity caused by beaver dams.

2.2.3.3 Water Quality

In situ DO levels of the tributaries to McBean Brook within the open pit area ranged from 8.0 to 9.2 mg/L with all stations having dissolved oxygen levels below the CCME FAL guideline of 9.5 mg/L for early life stages of fish. DO was acceptable for other life stages of fish in every reach. The pH ranged from 5.9 to 6.3, below the CCME (1999) recommended range of 6.5 to 9.0. *In situ* water temperatures at the time of sampling (dry summer conditions) ranged from 11.7 to 12.6°C. The water quality in the first order tributaries of the PDA portion of McBean Brook, were suitable for cold water and other fish species.

2.2.3.4 Benthic Invertebrate Community

No benthic studies were conducted on the three tributaries directly affected on McBean Brook because it will not be used as a future environmental effects monitoring (EEM) site.

2.2.3.5 Fish Community

In McBean Brook, creek chub (*Semotilus atromaculatus*) and pearl dace (*Semotilus margarita*) were observed in the PDA stations affected by the open pit. In the areas of the open pit, baited minnow traps were used where conditions were not suitable for backpack electrofishing due to water depth and/or soft substrate conditions in wetland or beaver impounded areas. The abundance of all fish species ranged from 0.4 fish per minnow trap hour. No quantitative studies were conducted on the three tributaries directly affected on McBean Brook because it will not be used as a future environmental effects monitoring (EEM) site.

2.2.4 Tributary A to West Branch Napadogan Brook

2.2.4.1 Watershed Area and Location

Tributary A to West Branch Napadogan Brook (N.46.39972 W67.05570) occupies a watershed area of 0.9 km^2 within the West Branch Napadogan Brook watershed (Figure 1.3). There is a total length of 971 m of first order Tributary A of West Branch Napadogan Brook within the PDA where serious harm is anticipated to occur.

2.2.5 General Aquatic Habitat Characteristics

The tributary is mostly riffle and run, with several sections of dead water and evidence of beaver activity throughout. The upper 130 m of mapped watercourse for this tributary was steep grade with no defined channel. The channel substrate of this tributary is primarily boulder and rock. Channel banks are stable and vegetated by a mix of grasses and trees.

The substrate of the Tributary A to West Branch Napadogan Brook within the PDA is approximately 75% boulder and rock, with the remaining 25% divided among the smaller size categories.

2.2.5.1 Water Quality

The DO levels of the Tributary A to West Branch Napadogan Brook within the PDA ranged from 8.5 to 10.3 mg/L with the majority of stations having DO levels above the CCME FAL guideline of 9.5 mg/L for early life stages of fish. The pH ranged from 5.6 to 6.5, which is at or slightly below the CCME (1999) recommended range of 6.5 to 9.0. *In situ* water temperatures at the time of sampling (dry summer conditions) ranged from 9.8 to 12.0°C. Overall, habitat in the lower reaches was suitable for spawning and rearing of brook trout and other fish species.

2.2.5.2 Benthic Invertebrate Community

No benthic studies were conducted on Tributary A to West Branch Napadogan Brook because it will not be used as a future environmental effects monitoring (EEM) site.

2.2.5.3 Fish Community

In Tributary A to West Branch Napadogan Brook brook trout and slimy sculpin were observed. In Tributary A to West Branch Napadogan Brook, the abundance of all fish species captured by qualitative electrofishing was 3.3 fish per 100 seconds, and 2.0 brook trout per 100 seconds (Stantec 2012a). No quantitative studies were conducted on Tributary A to West Branch Napadogan Brook because it will not be used as a future environmental effects monitoring (EEM) site.

2.2.6 West Branch Napadogan Brook

2.2.6.1 Watershed Area and Location

The West Branch Napadogan Brook (N46.36901 W67.02250) occupies a catchment area of 38.9 km^2 within the Napadogan Brook watershed (Figure 1.3). The watercourses within the West Branch

Napadogan Brook catchment area include 55% first order streams (with a linear length of 29,825 m), 19% second order stream (9,943 m), 7% third order streams (3,904 m), and 19% fourth order streams (10,459 m).

2.2.6.2 General Aquatic Habitat Characteristics

The main stem of West Branch Napadogan Brook is mostly riffle-run habitat. The channel substrate is rock and boulder with minor components of small substrates. Channel banks are stable and vegetated with grasses and shrubs.

2.2.6.3 Water Quality

In situ DO levels on the main stem of West Branch Napadogan Brook downstream of Bird Brook ranged from 9.7 to 10.4 mg/L with all stations having DO levels above the CCME FAL guideline of 9.5 mg/L for early life stages of fish. The pH ranged from 6.4 to 7.0, two out of three stations were within the CCME (1999) recommended range of 6.5 to 9.0. Average daily water temperature in West Branch Napadogan Brook collected from temperature loggers was 15.9°C, with the minimum average daily water temperature being 13.7°C and the maximum daily water temperature being 18.0°C. Overall, habitat in the lower reaches was suitable for spawning and rearing of brook trout and other cool water species.

2.2.6.4 Benthic Invertebrate Community

In West Branch Napadogan Brook downstream of Bird Brook, the mean richness was 44, mean abundance was 2,314 individuals per m^2, mean diversity was 0.93, mean evenness was 0.33, and the mean Bray-Curtis index was 0.66 (Stantec 2012a). The benthic invertebrate community in West Branch Napadogan Brook downstream of Bird Brook exhibits variability between sampling stations. Overall, it is typical of a healthy stream environment and is able to provide a good food base for fish.

2.2.6.5 Fish Community

In the main stem of West Branch Napadogan Brook downstream of Bird Brook, Atlantic salmon, brook trout, slimy sculpin, American eel, white sucker (*Catostomus commersoni*), blacknose dace (*Rhinichthys atratulus*) and sea lamprey (*Petromyzon marinus*) were observed. In the main stem of West Branch Napadogan Brook downstream of Bird Brook, the abundance of all fish species captured by qualitative electrofishing ranged from 2.4 to 4.4 fish per 100 seconds, 0.2 to 0.9 brook trout per 100 seconds, and 0.9 to 1.5 Atlantic salmon per 100 seconds (Stantec 2012a). In the main stem of West Branch Napadogan Brook downstream of Bird Brook the density of all fish species captured by quantitative electrofishing (2 sites) ranged from 18 to 30 (CI 27-33) fish per 100 m^2, 1.1 (CI 0.9-1.3) to 3 brook trout per 100 m^2, and 12 to 22 (CI 21-22) Atlantic salmon per 100 m^2.

3.0 DESCRIPTION OF POTENTIAL ENVIRONMENTAL EFFECTS ON FISH AND FISH HABITAT

The information below outlines the direct and indirect environmental effects of the Project that will result in serious harm to fish that are part of commercial, recreational or Aboriginal (CRA) fisheries. Direct loss arises from the permanent loss of fish habitat in a watercourse as it is replaced by a Project-related facility, feature, or component. Indirect loss is a temporary or permanent loss of a portion of a watercourse through means other than being covered by a Project-related facility, feature, or component; indirect loss can occur from a loss of catchment area, a reduction in flow, or other mechanism.

The direct and indirect loss of fish habitat was estimated using watershed and catchment area field and modeling data collected as part of extensive aquatic field surveys carried out in the PDA, as documented in the Baseline Aquatic Environment Technical Report (Stantec 2012a). As part of these programs, all watercourses within the PDA were surveyed in their entirety, and measurements of bankfull width, watercourse length, and other data were recorded for each reach of these watercourses. The total surface area of the watercourses within the PDA was calculated from these measurements and using a geographic information system (GIS) supplemented by LiDAR data. The total direct loss of fish habitat was assumed to be represented by the total surface area of the watercourse lost.

To calculate the indirect loss of habitat area as a result of downstream flow reductions, a one-dimensional, steady-flow HEC-RAS model was developed to estimate the area of habitat that exists along the length of Napadogan Brook from above Bird Brook to its confluence with the Nashwaak River for a variety of baseline and projected future flow conditions. The model was created using 106 surveyed transects on West Branch Napadogan Brook and Napadogan Brook. The HEC-RAS model was run for seven flow scenarios for the baseline conditions case as well as for the future conditions case. Habitat areas were estimated for the flow simulations by multiplying the simulated wetted perimeter at each surveyed transect by half the upstream and downstream distance between transects. The changes to available fish habitat were calculated by summing the differences between the estimated areas for the baseline conditions case and the future conditions case (Conservation Ontario 2005). The methods presented are described in more detail in Stantec (2012b).

The construction of Project components will result in an 86% reduction in the catchment area of Bird Brook, a 90% reduction in the catchment area to Sisson Brook, a 26% reduction in the catchment area of Tributary A to the West Branch Napadogan Brook, and a 1% reduction in the catchment area of McBean Brook.

3.1 DIRECT ENVIRONMENTAL EFFECTS

There are fish residing in all of the watercourses where direct environmental effects are expected (*i.e.*, Sisson Brook, Bird Brook, a portion of McBean Brook, and Tributary A to West Branch Napadogan Brook), with brook trout being the predominant species in all four watercourses. There is potential for Construction activities to result in the direct mortality of these fish, particularly during the Site Preparation of the TSF where the infilling of watercourses occurs. Direct mortality of fish may also occur in the watercourses within the open pit area as these are drained. The fish species and life stages that are part of a CRA fishery, and that are likely to be directly affected, are juvenile stages of OBoF Atlantic salmon, juvenile and adult stages of American eel, and all life stages of brook trout, creek chub, pearl dace and slimy sculpin.

Specifically, serious harm will result to fish that are part of a CRA fishery from the permanent destruction of fish habitat as a result of site preparation of the open pit and TSF during Construction. The construction of the TSF embankments and infilling of these brooks from the storage of tailings within the TSF will result in the direct loss of fish habitat area and therefore productive capacity, from parts of Bird Brook and Tributary A to West Branch Napadogan Brook. The areas occupied by the open pit will result in the direct loss, and therefore productive capacity in parts of Sisson Brook and three headwater tributaries to McBean Brook. Direct loss will also occur from of the loss of various watercourse fragments of Sisson Brook between the TSF and the open pit. The confidence of the predictions for serious harm as a result of direct environmental effects to fish and/or fish habitat occurring is high. The magnitude of the environmental effect is high, as the fish habitat within the PDA will be permanently lost.

Construction activities will directly reduce brook trout, creek chub, pearl dace, and slimy sculpin nursery, rearing and spawning habitat areas and reduce juvenile and adult American eel rearing and habitat within the PDA.

Beyond that occurring during Construction of the Project, there is no further direct loss of fish habitat during the subsequent Operation or Decommissioning, Reclamation and Closure phases of the Project (Stantec 2013a).

The geographical extent of the direct environmental effects is expected to be 366 habitat units (Table 3.1).

Table 3.1 Direct Fish Habitat Loss by Major Project Component

Project Component	Affected Watercourse	Type of Loss	Area Lost, Requiring Compensation/Offsetting	Rationale	Offsetting and Authorization
Open Pit	Sisson Brook	Direct	112	Permanent direct habitat loss = serious harm.	*Fisheries Act* Section 35(2)
	McBean Brook	Direct	2	Permanent direct habitat loss = serious harm.	*Fisheries Act* Section 35(2)
Tailings Storage Facility (TSF)	Bird Brook	Direct	172	Permanent direct habitat loss from deposition of tailings = serious harm.	*MMER* Schedule 2 amendment
	Bird Brook	Direct	72	Permanent direct habitat loss from construction of TSF embankment = serious harm.	*Fisheries Act* Section 35(2)
	Sisson Brook	Direct	2	Permanent direct habitat loss from construction of TSF embankment = serious harm.	*Fisheries Act* Section 35(2)

Table 3.1 Direct Fish Habitat Loss by Major Project Component

Project Component	Affected Watercourse	Type of Loss	Area Lost, Requiring Compensation/Offsetting	Rationale	Offsetting and Authorization
	Tributary A to West Branch Napadogan Brook	Direct	6	Permanent direct habitat loss from construction of TSF embankment = serious harm.	*Fisheries Act* Section 35(2)
Total Direct Habitat Loss, Required for Compensation/Offsetting			**366**		

3.2 INDIRECT ENVIRONMENTAL EFFECTS

Indirect environmental effects resulting in serious harm to CRA fisheries are anticipated to result from the Project. Substantial reductions in catchment area within Sisson Brook, Bird Brook, and Tributary A of West Branch Napadogan Brook watersheds are expected to result in indirect environmental effects to the residual segments of these streams due to the substantial reduction of flows in them, arising from a loss of catchment area within these watersheds. The reduction in mean annual flow in lower Napadogan Brook at various phases of the Project life is also anticipated to pose indirect environmental effects. For the purposes of this assessment, reductions in mean annual flow that are less than 10% are assumed to not cause serious harm to CRA fisheries (DFO 2013c).

The indirect environmental effects on the residual stream segments of Bird Brook and Tributary A to West Branch Napadogan Brook will be permanent over the life of the Project. The indirect environmental effects in Sisson Brook and lower Napadogan Brook will change over the Project life, as described below. However, for the purposes of assessing serious harm to fish in Sisson Brook, the maximum predicted flow reductions have been assumed. Indirect environmental effects are expected to result in serious harm because of reductions in fish habitat as a result of reductions in overall stream flow and subsequent reductions in stream wetted perimeter (*e.g.*, stream bottom to support aquatic processes).

The geographical extent of the combined indirect environmental effects is expected to be 178 habitat units (Table 3.2). It is anticipated that 123 habitat units will be lost to watercourses in the Project area as a result of reductions in catchment area, and 55 habitat units will be lost within lower Napadogan Brook as a result of reductions in mean annual flow.

There are fish residing in all of the watercourses where indirect environmental effects are expected, with brook trout being the predominant species in all four of the residual stream watercourses, and juvenile Atlantic salmon being the predominant species in the main stem of lower Napadogan Brook in areas where mean annual flow will be sufficiently reduced to cause serious harm.

The fish species and life stages that are likely to be indirectly affected are juvenile and adult stages of American eel, and all life stages of brook trout, white sucker, creek chub, pearl dace, slimy sculpin, Atlantic salmon and sea lamprey.

Table 3.2 Indirect Fish Habitat Loss by Major Project Component

Project Component	Affected Watercourse	Type of Loss	Area Lost, Requiring Compensation/Offsetting	Rationale	Offsetting and Authorization
Residual Stream Segments	Sisson Brook	Indirect	36	Serious harm due to substantial reduction in catchment area of residual stream segment.	*Fisheries Act* Section 35(2)
	Bird Brook	Indirect	77	Serious harm due to substantial reduction in catchment area of residual stream segment.	*Fisheries Act* Section 35(2)
	Tributary A to West Branch Napadogan Brook	Indirect	10	Serious harm due to substantial reduction in catchment area of residual stream segment.	*Fisheries Act* Section 35(2)
Downstream Flow Reductions	Lower Napadogan Brook	Indirect	55	Serious harm due to indirect loss due to mean annual flow reductions downstream >10%.	*Fisheries Act* Section 35(2)
Total Indirect Habitat Loss, Required for Compensation/Offsetting			**178**		

3.2.1 Bird Brook and Tributary A to West Branch Napadogan Brook

During Operation and Closure, water management has the potential to result in serious harm to Bird Brook and Tributary A to West Branch Napadogan Brook residual watercourses by permanently altering flows, altering fish habitat area, water quality, productivity, the benthic macroinvertebrate community, fish passage, fish health, and fish populations. The primary environmental effects mechanisms on these residual stream segments are a result of reduction in catchment area, and consequent reduction in flows in the residual stream segments.

Operation and Closure activities will reduce the amount of brook trout and slimy sculpin rearing and spawning habitat in Tributary A to West Branch Napadogan Brook and the amount of brook trout and slimy sculpin rearing and spawning habitat, and American eel and Atlantic salmon rearing habitat in Bird Brook. Although one Atlantic salmon parr was found at the most downstream site on Bird Brook located approximately 350 m from the West Branch Napadogan Brook, it is unlikely that much spawning occurs within Bird Brook as no fry were observed by electrofishing surveys.

3.2.2 Sisson Brook and Lower Napadogan Brook

During Operation and Closure, water management has the potential to result in serious harm to fish habitat in the residual portion of Sisson Brook and in lower Napadogan Brook. Serious harm will likely result from altering flows, altering fish habitat area, water quality, productivity, the benthic macroinvertebrate community, fish passage, fish health, and fish populations. The primary environmental effects mechanisms on the residual stream segment of Sisson Brook and lower Napadogan Brook during Operation include:

- a reduction in catchment area of the watersheds due to the presence of Project facilities, thereby reducing flows in the residual segments of Sisson Brook, and consequently lower Napadogan Brook;
- the withholding of water within the TSF in Years 1 to 7 of Operation, thereby reducing flows in lower Napadogan Brook; and
- the re-direction of water from the TSF to the open pit during Closure in Years 28-39, such that there is no release of treated water during either of these time periods, thereby reducing flows in lower Napadogan Brook.

(Note: Year 1 means the first year of the Operation phase of the Project).

In Years 8 to 27 of Operation, lower Napadogan Brook and the residual segment of Sisson Brook will experience an increase in flow relative to other years as treated water will be released. Following Closure (Year 39 and in perpetuity), surplus water (treated as necessary) will again be released to the residual segment of Sisson Brook and lower Napadogan Brook. As noted above, for the purposes of assessing serious harm to fish in Sisson Brook and lower Napadogan Brook, the maximum predicted flow reductions have been assumed.

The confidence of the predictions for indirect loss to fish and/or fish habitat occurring during Operation and Closure is moderate. The magnitude of the indirect environmental effects during Operation and Closure is medium/high (Stantec 2013a).

Operation activities will reduce brook trout, Atlantic salmon, creek chub, pearl dace, slimy sculpin, white sucker nursery, rearing and spawning habitat. They will also reduce American eel rearing habitat.

4.0 MEASURES AND STANDARDS TO AVOID OR MITIGATE SERIOUS HARM TO FISH

Throughout the feasibility design for the Project, the Proponent and its design consultants have considered various opportunities to minimize the magnitude and extent of the environmental effects of the Project on the aquatic environment and other valued environmental components (VECs), and further opportunities will continue to be considered as the detailed design and development of the Project are carried out.

4.1 MEASURES TO AVOID SERIOUS HARM

The following mitigation measures (summarized in Table 8.5.8 of the EIA Report (Stantec 2013a)), through careful design and planning, have or will be employed to avoid or reduce the environmental effects of the Project on the Aquatic Environment:

- TSF Site Selection and Design;
- Mine Waste and Water Management;
- Construction Methodologies and Timing;
- Fish Relocation; and
- Fish Habitat Offsetting Plan.

Serious harm to fish and fish habitat could not be avoided for the open pit, as the Project location is fixed by the ore body. There are no technically and economically feasible alternative means of carrying out the Project using alternate locations and methods of mining. The ore body at the Project site is near surface, with only 0.9 m to 4.0 m of overburden, so that underground mining is not a technically and economically feasible alternative. The only technically and economically feasible means of mining this ore body is by open pit.

4.1.1 TSF Site Selection and Design

The site selection process for the TSF, and its design and construction methods, are considered as mitigation for the potential change in the Aquatic Environment; they are summarized below and described in more detail in Section 3.3.3 of the EIA Report (Stantec 2013a). Along with the various factors considered for selecting the TSF location as described in Section 3.3.3 of the EIA Report (Stantec 2013a), the selected TSF location had the added benefits of being entirely within a single watershed (Napadogan Brook), and did not affect any lakes. In addition, the northwestern embankment of the TSF was moved inward to avoid contact with two tributaries to the West Branch Napadogan Brook (W1F and W1G) (Figure 1.2), thereby avoiding these watercourses compared to the TSF footprint initially proposed in the *CEAA* Project Description (Stantec 2011).

A detailed evaluation of potential options for locating and managing tailings, waste rock, and other waste materials arising from the Project was completed in support of the feasibility study. As part of this work, Knight Piésold and other consultants evaluated various TSF site locations, tailings technologies, and TSF embankment construction materials (EIA Report Section 3.3.3, Stantec 2013a).

A TSF Site Alternatives Analysis was carried using methods provided in Environment Canada's "Guidelines for the Assessment of Alternatives for Mine Waste Disposal" (Environment Canada 2013). The analysis examined the various TSF locations considered by the Proponent, and recommended a preferred location for the TSF in consideration of known environmental, socioeconomic, and engineering constraints. A standalone report is being prepared to meet the requirements of these guidelines, and it will be separately submitted to Environment Canada in the near future in support of the *MMER* Schedule 2 amendment process.

As discussed in the *CEAA* Project Description (Stantec 2011), four main alternatives for locating the TSF were considered (EIA Report, Section 3.3.3.3, Stantec 2013a), as shown in Figure 4.1 and as summarized as follows.

- Bird Brook (Site 1) is relatively close (3.3 km) to the proposed ore processing plant. Compared to the other alternatives, it has a relatively large "footprint" but does take good advantage of the natural topography and it does not encroach on any lakes. It does cover much of the upper reaches of Bird Brook and one arm of West Branch Napadogan Brook, but does drain entirely to Napadogan Brook. Its proximity to the process plant means that the lengths of access roads, tailings and water pipelines, and power lines between the TSF and the plant site would be comparatively short.

- Barker Lake (Site 2), located approximately 5.8 km to the southwest of the proposed ore processing plant location, has the advantage of constraining hills on its west side. This alternative would be more costly to operate than Site 1 due to the distance from the process plant with the attendant additional environmental effects related to greater distances for trucking and infrastructure. More importantly, it would entail covering a lake and drains entirely to the Upper Nashwaak River watershed. Thus, Site 2 is undesirable relative to Site 1 due to greater environmental effects and higher costs.

- Trouser Lake (Site 3), located approximately 4.1 km to the south of the proposed ore processing plant location, has the advantage of constraining hills on east side. However, it would result in the elimination of lakes (known to support a recreational fishery) and drains entirely to the Upper Nashwaak River watershed. This alternative would be more costly to operate than Site 1 due to the distance from the process plant with the attendant additional environmental effects related to greater distances for trucking and infrastructure. These environmental effects, coupled with the location in the Upper Nashwaak River watershed and the covering of lakes, make this alternative undesirable relative to Site 1 due to greater environmental effects and higher costs. Additionally, the route of the relocated transmission line and relocated Fire Road will need to pass through the site.

- Chainy Lakes (Site 4), located approximately 6.1 km to the south of the proposed ore processing plant location, has the advantage of constraining hills on its northeast and southeast sides. However, it would result in the elimination of lakes (known to support a recreational fishery) and drains entirely to the Upper Nashwaak River watershed. This alternative would be more costly to operate than Site 1 due to the distance from the process plant with the attendant additional environmental effects related to a greater distances for trucking and infrastructure. These environmental effects, coupled with the location in the Upper Nashwaak River watershed and the covering of lakes, make this alternative undesirable relative to Site 1 due to greater environmental effects and higher costs.

Of these four alternatives, Bird Brook (Site 1) was preferred for environmental reasons, as well as technical and economic reasons. In early 2011, the Proponent refined this site into two alternatives, Site 1b and Site 1c (Figure 4.1), each of which takes up less land area than the initially envisaged Site 1 and affects much less aquatic habitat. As developed through the feasibility study, and as supported by the analysis of environmental, technical and economic factors (EIA Report, Section 3.3.3, Stantec 2013a), TSF Alternative 1b (Site 1b) was selected as the preferred location for the TSF.

4.1.2 Mine Waste and Water Management

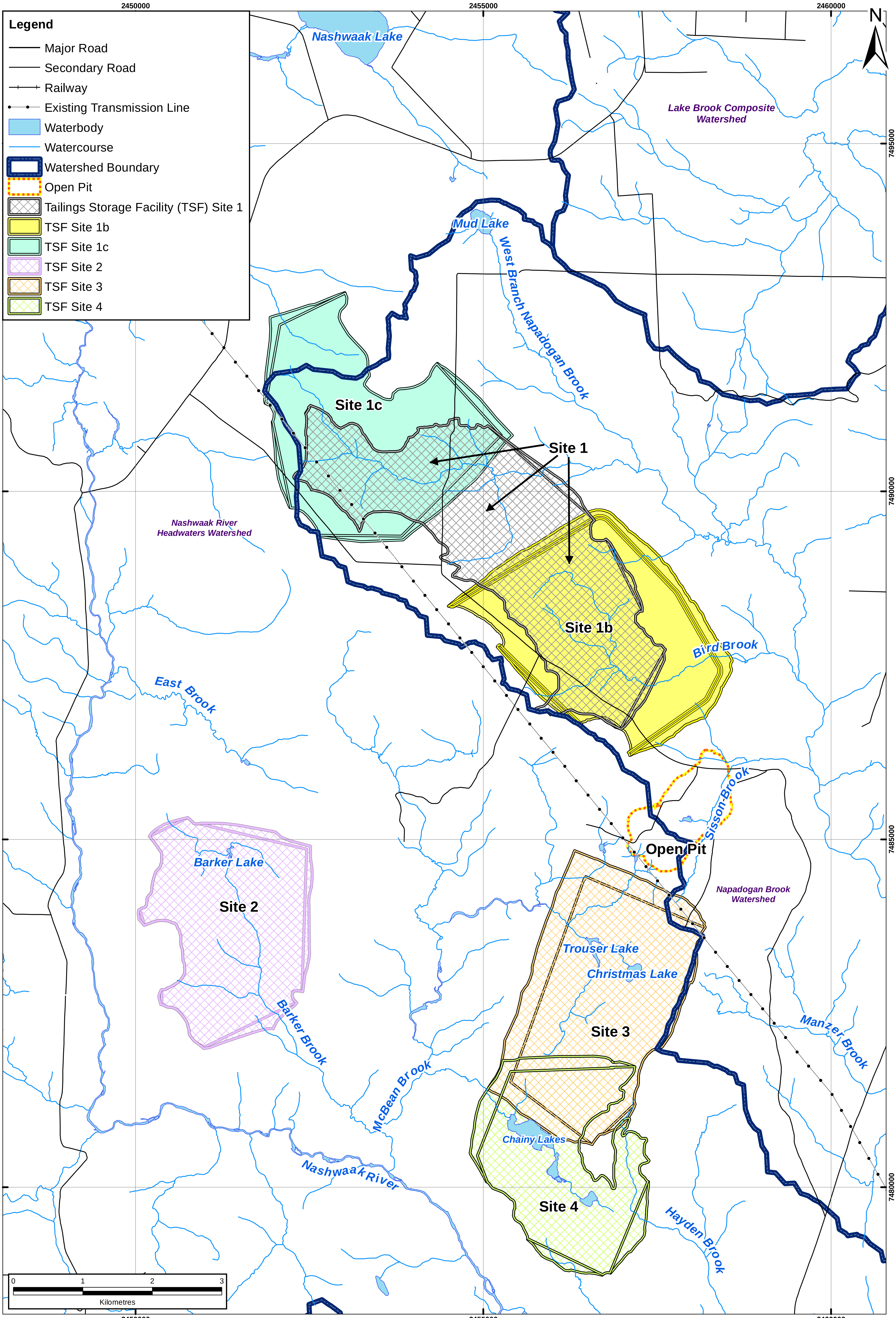
Water Management includes but is not limited to reclaiming and reuse of water contained in the TSF for ore processing, operation of a water treatment plant, and seepage management.

To mitigate serious harm from indirect environmental effects on residual stream segments and downstream flow reductions, the Proponent will maintain existing drainage patterns to the extent possible, comply with the Watercourse and Wetland Alteration (WAWA) permits, recycle water from the TSF for use in the ore processing to minimize Project demands on the environment for water, and to reduce the production of contact water, construct engineered drainage and diversion channels to divert non-contact water around the Project facilities wherever possible.

Part of Sisson Brook will be diverted into McBean brook and thereby partially restore some lost flow in the McBean Brook watershed as a result of the lost headwater portions of the small tributaries to McBean Brook (EIA Report, Section 8.4.4.3.1, Stantec 2013a).

4.1.3 Construction Methods and Timing

Erosion and sedimentation control techniques will be employed throughout the site preparation activities as required to minimize erosion of exposed areas and sedimentation in site surface water which may affect fish and fish habitat. Standard mitigation measures such as the use of silt fences, sediment traps and sedimentation ponds will be used to manage the potential release of sediment to streams. Regular inspection and maintenance of erosion and sediment control measures and structures will occur during construction, and any damage to those structures will be repaired.



NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC PROJECT AND SHOULD NOT BE USED FOR OTHER PURPOSES.

Location of Alternatives for the TSF Sisson Project: Environmental Impact Assessment (EIA) Report, Napadogan, N.B.	Scale: 1:50,000	Project No.: 121810356	Data Sources: NBDNR, SNB NHN, NB Aquatic Data Warehouse	Fig. No.: 4.1	Stantec
Client: Northcliff Resources Ltd.	Date: (dd/mm/yyyy) 16/05/2013	Dwn. By: JAB	Appd. By: DLM		

Map: NAD83 CSRS NB Double Stereographic

Engineered drainage and diversion channels will be constructed to divert non-contact surface water and precipitation away from the Project site wherever possible. This will reduce the amount of water being sequestered on the site and allow surface water input into nearby watercourses mitigating some of the water sequestration. Water management will consist of establishing collection ponds, coffer dams, pumping systems, run-off collection ditches, and diversion channels. Some of the temporary works such as coffer dams and by pass diversion channels will be removed once the initial starter embankments have been constructed. Some of the water management works will become long-term features of the Project site, and others will be temporary and removed when no longer needed for Construction purposes.

Construction of the TSF will first require creating access to and clearing the dam construction sites. Coffer dams will then be installed just upstream of the starter dam locations, and stream flows from above the coffer dams will be pumped around the construction site for discharge downstream. The coffer dams will be sized to ensure that sediment generated upstream will settle out before the water is pumped around the construction sites to prevent effects on fish, and to prevent sediment from accumulating in spawning or rearing habitats. Construction of the starter dams, the downstream water management ponds, and then the initial TSF starter embankments, will follow. Other than for the construction of starter dams and embankments, no grubbing or other earth moving within the TSF footprint is required.

Machinery used in construction will be well maintained and free of fluid leaks and machinery will be refueled and fuel will be stored so as to prevent it from entering watercourses. Machinery will be operated in a way that protects stream beds and minimizes disturbances to the watercourses, until such a time as the fish are removed and appropriate sediment control structures are in place.

Additional information on Site Preparation Mitigation can be found in Section 3.4 of the EIA Report (Stantec 2013a).

4.1.4 Fish Relocation

During the early stages of the construction of the TSF and within the future area of the open pit, it will be necessary to relocate fish residing in Bird Brook, Sisson Brook, McBean Brook and Tributary A of West Branch Napadogan Brook, to the extent possible, to minimize the potential for direct mortality to occur from construction activities. Due to the large area, varying habitats where fish need to be removed, and difficultly removing fish from some areas, it is unlikely that every fish will be removed despite best efforts to do so. Fish removal will be prioritized, with fish removal focusing on SOCC and SAR species (*i.e.*, Atlantic salmon and American eel) and fish of current recreational and aboriginal importance (*i.e.,* brook trout), hereafter referred to as "priority" species. Other fish species within the PDA that do not support CRA fisheries (*e.g.*, pearl dace and common shiner) will be removed if and when reasonably possible. All reasonable efforts will be made to relocate fish within the affected watercourses to nearby watercourses within the Napadogan or adjacent watersheds that contain suitable habitat, as appropriate. Construction activities within the PDA are not expected to affect habitat that is limiting for any of the fish species currently residing therein.

4.1.4.1 TSF Area

A TSF preparation plan has been prepared (Section 3.4.1.2.7 of the Sisson Project EIA Report, Stantec 2013a) which outlines methods that can be employed, subject to approval, to relocate fish from watercourses within the area of the TSF, and thus avoid direct fish mortality from construction activities. Removal of fish from the relevant brook sections will be undertaken when weather and hydrological conditions allow for safe and effective operation of the equipment while avoiding peak salmonid spawning periods—likely over the June through September period. Captured fish will be released downstream of the starter dam and water management pond sites, or into other release sites in the Napadogan Brook watershed or adjacent watersheds that contain suitable habitat. To prevent fish from returning upstream, and if the coffer dams are not in place by late September, barrier nets or other suitable means will be established just downstream of the locations of the water management ponds. Once the coffer dams are in place and the upstream brooks are deemed fish-free, the upstream brook beds within the TSF footprint will be filled in with non-deleterious materials such as local borrow or quarried material where access permits. Suitable means will be employed to allow groundwater discharge along the brook beds (*e.g.*, the bottom layer of fill will be coarse material and/or a drainage pipe will be laid in the bed).

The fish removal approach outlined below assumes that the coffer dams will not be in place at the time of initiating fish removal activities. Should these be in place, the fish removal process will follow the same general approach but the execution will be considerably simpler as fish will not be able to ascend past the coffer dams. Fish will first be removed from the areas where the coffer dams will be placed prior to coffer dam construction. Fish removal will then take place directly above the coffer dams and proceed in an upstream fashion. If the coffer dams are not in place, fish removal will start in the headwaters of each watercourse and move in a downstream direction. Fish removal will entail isolating sections of watercourse using porous barriers (*e.g.,* dams made of sand bags and fitted with a screened PVC pipe) to allow for continuous flow of water and to prevent fish returning to areas already fished out. These porous barriers, and fish removal, will move sequentially downstream until each watercourse is determined to be free of fish.

It is anticipated that a minimum of three electrofishing passes will be required to remove fish from within each stretch of watercourse. Agreement will be required with DFO on what will be considered an acceptable "end point" (*i.e.,* after what type and level of effort a section of watercourse will be deemed to be "fish-free"). In fish-bearing waters where electrofishing is not possible (*e.g.*, flooded wetland), alternate methods of capture such as fyke nets, seine nets, dip nets, and minnow traps will be used.

Captured fish will be placed in buckets of water for transfer to oxygenated tanks of water mounted on transport vehicles stationed at access points nearby. These vehicles will convey the captured fish to approved discharge points below the construction sites for release downstream or into other release sites in the Napadogan Brook watershed or adjacent watersheds that contain suitable habitat. Data on fish species composition, length and weight will be collected at selected locations within the fish removal area to obtain an estimate of the fish populations and community composition within the PDA.

Electrofishing will be conducted by crews consisting of a lead biologist, electrofishing technicians, and "porters" to carry fish in buckets to vehicle access points. Other crews will be responsible for porous barrier placement, for verifying that watercourse sections are free of fish, and for transporting captured fish to the discharge locations and releasing them.

The fish removal activities outlined above will be resourced and scheduled to be complete by the end of September. The porous barriers, barrier nets, or other suitable measures, may need to be kept in place until the coffer dams are installed to ensure that fish cannot return to the stretches of watercourses from which they have been removed. It is expected that installation of the coffer dams will be completed over the October-December period, and that the upstream, fish-free watercourses will be filled in during the winter months when flows are at a minimum and the ground is frozen enough that equipment can readily move around.

Fish will be relocated to areas outside of the PDA within the Napadogan watershed or adjacent watersheds that contain suitable habitat. A Scientific Collection Permit and Introduction and Transfers Permit for fish will be required from DFO to remove and relocate fish. Consultation with DFO and New Brunswick Department of Natural Resources (NBDNR) will be required to determine suitable release strategies and locations for captured fish.

4.1.4.2 Open Pit Area

Fish removal from the area of the open pit will follow the same general procedures discussed above except that there will be no need to adjust the procedures to account for the timing of construction of coffer dams.

4.1.5 Fish Habitat Offsetting Plan

Fish habitat compensation/offsetting is the primary mitigation for offsetting the unavoidable direct and indirect serious harm to fish due to the loss of fish habitat area. Compensation/offsetting is envisioned by the *Fisheries Act* where there are no alternative mitigation measures that are technically and economically feasible that would mitigate any significant adverse environmental effects of a project.

Section 5.0 contains the Offsetting Plan for fish habitat offsetting as a result of serious harm and loss of fish habitat within the PDA.

4.2 MONITORING MEASURES TO AVOID SERIOUS HARM

To confirm the residual environmental effects of Project-related changes in stream flows on the Aquatic Environment, the stream flow at the existing hydrometric stations will be observed. The measured flows will be compared to the equivalent pre-Project stream flow rates calculated from the Narrows Mountain Brook station operated by Environment Canada. Knight Piésold (2012) has demonstrated a strong correlation of pre-Project flows at the Project hydrometric stations to the Narrows Mountain Brook (NMB) station.

As part of the Water Resources Monitoring Program, monitoring will be conducted to ensure the Project meets applicable legislation, regulations and guidelines. Construction sites will generate TSS in run-off, and best management practices will be instituted to prevent the discharge of excess TSS to the streams as outlined in the EPP. Water quality monitoring in the TSF water management ponds (WMPs) and groundwater wells will begin during Operation, and continue Post-Closure until such time that the water quality is acceptable and the termination of monitoring can be justified.

In terms of the Aquatic Environment, all elements of the *Metal Mining Effluent Regulations* (*MME*R) described below are part of the regulatory compliance monitoring. The Province of New Brunswick may impose other or additional requirements in permits and authorizations and these will be incorporated into the program as appropriate. The regulatory compliance monitoring studies will consist of three main components, pursuant to *MMER,* as follows:

- deleterious substance monitoring consisting of pH and acute lethality testing (*MMER* Sections 12-17);
- effluent and water quality monitoring studies comprising of effluent characterization, sub-lethal toxicity testing and water quality monitoring (*MMER*, Schedule 5, Part 1); and
- biological monitoring studies in the aquatic receiving environment to determine if mine effluent is affecting fish, fish habitat or the use of fisheries resources (*MMER*, Schedule 5, Part 2).

4.3 CONTINGENCY MEASURES FOR MITIGATING SERIOUS HARM

Fish removal from the PDA is a measure that will mitigate serious harm to fish. If fish removal cannot be conducted before fall, it may be possible to carry out fish removals during the winter low flow period, since fish removal is a fish rescue activity that is generally permitted by DFO to be conducted at any time of year.

The mitigation measures described previously in this document are comprehensive and have been designed to mitigate serious harm to CRA fisheries. Reducing the environmental effects of the Project is a combination of federal and provincial regulations, mitigation proposed in the EIA, an Offset Plan, and an EPP. Section 9.0 of the EIA report (Stantec 2013a) contains an extensive follow-up and monitoring program that will confirm environmental effects and contingency measures will be discussed with regulators at that time.

4.4 RESIDUAL SERIOUS HARM TO FISH

Serious harm to CRA fisheries will result from the permanent destruction of fish habitat during the construction phase of the Project. Construction activities will result in the direct loss of fish habitat area in parts of Bird Brook, part of Sisson Brook, and part of a small unnamed tributary to West Branch Napadogan Brook (referred to as Tributary A) due to the construction of the TSF embankments and infilling of these brooks from the storage of tailings within the TSF during Operation. Construction activities will result in the direct loss of fish habitat area in Sisson Brook in areas occupied by the open pit, and the direct loss of some McBean Brook headwaters in the area of the open pit. Construction activities will also result in the loss of various watercourse fragments of Sisson Brook where they occur between the TSF and the open pit.

The direct environmental effects of serious harm, defined as the death of fish or any permanent alteration to, or destruction of, fish habitat to fish that are part of a CRA fishery, is expected to be 366 habitat units (Table 4.1).

Construction and operation activities will result in the indirect loss of 178 habitat units due to reduced stream flow in residual stream segments of Sisson Brook, Bird Brook and Tributary A of West Branch Napadogan Brook, and due to reductions in mean annual stream flow in lower Napadogan Brook (Table 4.1). In the residual stream segments, serious harm will result from the permanent reduction in upstream catchment areas, the consequent reduction of stream flows thus altering fish habitat area, water quality, productivity, the benthic macroinvertebrate community, fish passage, fish health, and fish populations. In lower Napadogan Brook, serious harm will likely occur as a result of mean annual flow reductions of greater than 10%. This flow reduction will alter fish habitat area, productivity, the benthic macroinvertebrate community, fish passage, fish health, and fish populations.

While under the *Fisheries Act* as amended in 2012, the focus is on sustaining the productivity of CRA fisheries, the amount of habitat units affected by a project, and in an offsetting project, remains an indicative metric. By this metric, the total required Offsetting arising as a result of the Sisson Project is 544 habitat units.

Table 4.1 Summary of Project Information

Project Phases, Activities, and Physical Works	Mitigation / Compensation Measures	Recommended Follow-up or Monitoring	Residual Serious Harm to Fish Requiring Authorization and Offsetting
Construction • Site Preparation of Open Pit, TSF, and Buildings and Ancillary Facilities. • Physical Construction and Installation of Project Facilities. • Physical Construction of Realigned Fire Road, New Site Access Road and Internal Site Roads.	• Fish habitat offsetting. • Relocation of fish. • Maintain existing drainage patterns to the extent possible. • Comply with the Wetland and Watercourse Alteration (WAWA) permit. • Implement erosion and sedimentation control during Construction • Siting of Project facilities	• Monitor TSS in discharge from construction sites to verify predictions and confirm compliance and identify need for further mitigation. • Monitor water quality of discharge from starter pit dewatering to evaluate treatment requirements, if any.	Direct loss of 366 habitat units
Operation • Mine Waste and Water Management.	• Fish habitat offsetting. • Erosion and sedimentation control during earth moving activities. • Design water management structures to reduce erosion and assure adequate water conveyance in extreme events. Recycle water from the TSF for use, and to reduce the production of contact water. • Treat (as required) surplus mine contact water • Construct engineered drainage collection channels to collect TSF embankment run-off and seepage. • Install and operate groundwater pump-back wells to collect some groundwater seepage for return to the TSF. • Implement an adaptive management plan integrated with Follow-up and Monitoring Program to identify the need for and install groundwater monitoring wells below the TSF WMPs to monitor the groundwater quality. • Construct engineered drainage and diversion channels to divert non-contact water. • Construct and operate a water treatment facility to treat surplus water from the Project before discharge, as required. • Adaptive management measures to further reduce seepage in the event that Follow-up and Monitoring Program identifies further mitigation is required.	• Monitor to verify the seepage from the TSF. • Monitor WTP effluent for compliance. • Verify water temperature modeling. • Observe stream flow at the existing hydrometric stations and compare to the equivalent pre-Project stream flow rates. • Undertake comparative fish passage survey during low-water conditions • Carry out a spawner survey for adult Atlantic salmon in Napadogan Brook. • Deleterious substance, pH, and acute lethality testing (*MMER* Sections 12-17) • Effluent characterization, sub-lethal toxicity testing and water quality monitoring (*MMER*, Schedule 5, Part 1) • Biological monitoring studies of fish, fish habitat, benthic macroinvertebrates, and the usability of fisheries resources (*MMER*, Schedule 5, Part 2).	Indirect loss of 178 habitat units

Source: Stantec (2013a).

5.0 OFFSETTING PLAN/FISH HABITAT COMPENSATION PLAN

The following represents the information that is required to offset "serious harm to fish" as defined under Section 35(2) of the *Fisheries Act* and the Fish Habitat Compensation Plan as specified in Section 27.1 of *MMER*, for Schedule 2 tailings impoundment areas. The irrevocable letter of credit in the agreed amount to complete the Offsetting Plan is attached to the Application form.

5.1 IMPLEMENTATION OF MEASURES TO OFFSET SERIOUS HARM

To offset the serious harm as a result of the Sisson Project, the Proponent proposes to remove an existing water-level control dam and road culvert on the Nashwaak River just below its exit from Nashwaak Lake to facilitate the passage of various fish species. The location of the Nashwaak Lake culvert is shown in Figure 5.1. The structure is a timber "box" with steel beams supporting the road deck (Photo 1). It is presently owned by NBDNR.

Photo 1 Barrier to Fish Passage Structure at Entrance to Nashwaak Lake.

The water plunges from the flat bottom of the structure, with an air space behind the water, thereby creating a vertical leap barrier. Immediately downstream is a series of cascading steps that do not provide sufficient depth for fish to make the leap (Plante, F. Personal communication, October 24, 2013). For these reasons, the structure is considered to be a partial to full barrier to upstream fish passage, thereby preventing most fish species within the Nashwaak River from accessing the habitat in Nashwaak Lake.

It is proposed that the existing water-level control dam and road culvert be removed, and replaced with a standard "woods road" bridge. The proposed bridge structure would consist of a structural steel frame bearing on concrete, timber crib, or gabion abutments, with a timber driving surface (see Figure 5.2). The approach slopes currently consisting of timber cribbing may be left in place; however, during removal of the existing structure they may be damaged and need to be removed.

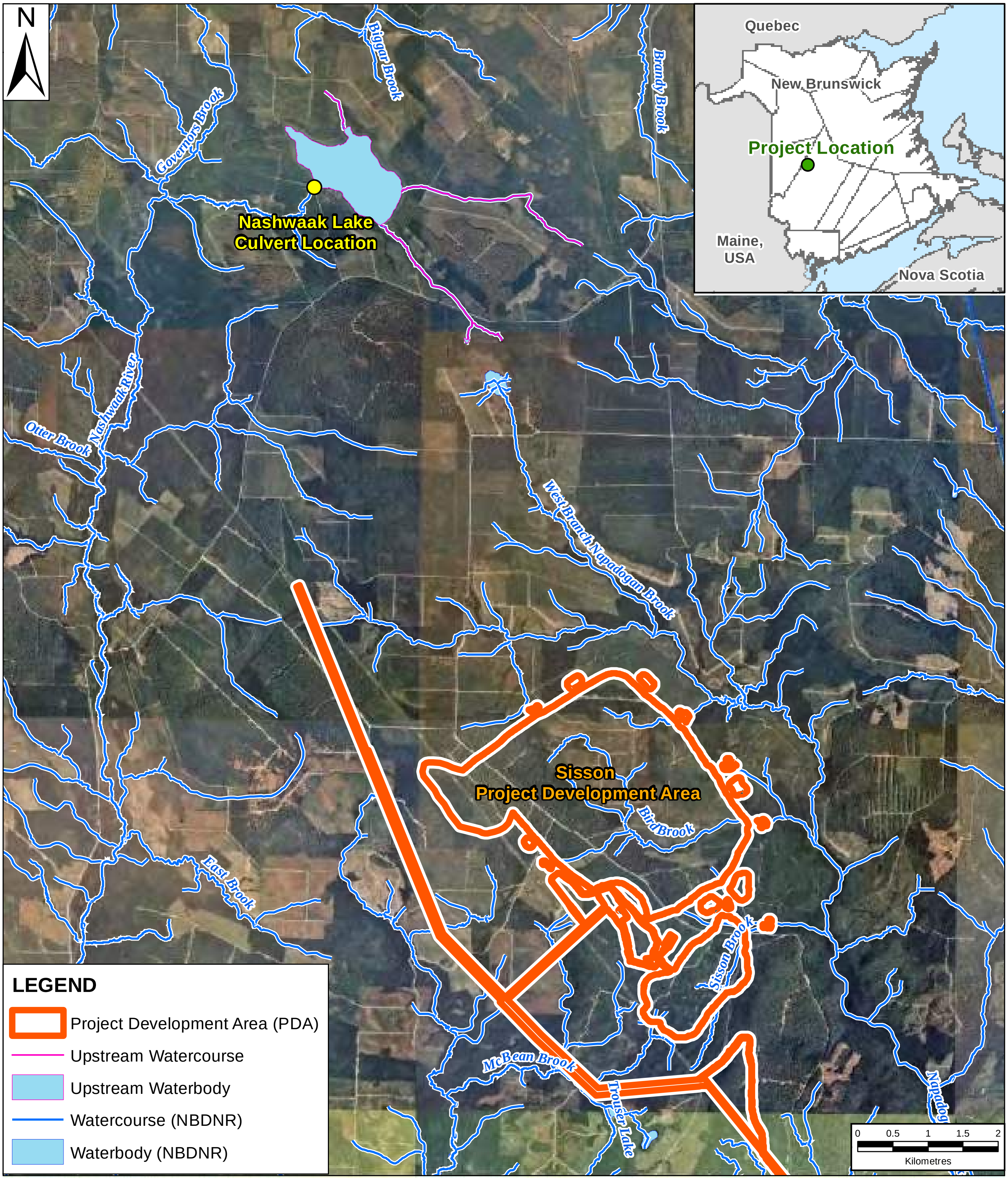
5.2 HOW MEASURES OFFSET SERIOUS HARM

The offsetting plan for the removal of the existing water-level control dam and road culvert at Nashwaak Lake meets all of the "Guiding Principles" for fisheries protection (DFO 2013a). At this time, no fisheries management objectives for New Brunswick have been specifically defined; however, local priorities do include the removal of anthropogenic barriers to fish migration, such as the removal of the existing water-level control dam and road culvert at Nashwaak Lake. In terms of productivity, the removal of the existing water-level control dam and road culvert will increase ecological productivity as defined in DFO (2012) as "the capacity of a given habitat or area". Therefore, for the purposes of the Sisson Project and the required Offsetting, fish productivity is inferred from the quantity of fish habitat, which is available to all CRA fish species.

Nashwaak Lake is located within the Nashwaak River watershed, the same watershed as the Project. The project is considered by DFO to provide "in-kind" offsetting as it offsets for habitat lost to brook trout, and possibly other species which are present within the area where serious harm is occurring. The Offsetting Plan proposes the existing water-level control dam and road culvert will be replaced with a clear span bridge which will provide the opportunity for the unimpeded movement of alewife, brook trout, possibly Atlantic salmon and other species between the Nashwaak River and the lake and its first and second-order tributaries. The majority of habitat upstream of the existing water-level control dam and road culvert is different from the PDA, in that it is lacustrine, and the habitat within the PDA is riverine; however brook trout are found in lake habitats and will likely benefit.

Nashwaak Lake (Figure 5.1) is a natural water body, with freshwater input from two first-order watercourses and one second-order watercourse. The lake has a maximum depth of 8.5 m (28 feet, as shown in Figure 5.3), with a fairly uniform trough-like bottom contour running in a northwest to southeast direction. There is a relatively shallower bay on the northern side of the lake. The lake has a diverse fish community which includes both resident and stocked brook trout.

The largest increase in the productivity of CRA fish species that is anticipated from the removal of the existing water-level control dam and road culvert at Nashwaak Lake is due to the additional habitat that will be available for the spawning of alewife (*Alosa pseudoharengus*) and rearing of early life stages of juveniles. Although alewife and blueback herring (*Alosa aestivalis*) are commonly called "gaspereau", it is commonly understood that blueback herring do not spawn in lakes, and therefore it is likely that only alewife will benefit.



NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC PROJECT AND SHOULD NOT BE USED FOR OTHER PURPOSES.

Nashwaak Lake Culvert Sisson Project Napadogan, New Brunswick	Scale: 1:75,000	Project No.: 121810356		Data Sources: NBDNR SNB	Fig. No.: 5.1
Client: Northcliff Resources Ltd.	Date: (dd/mm/yyyy) 20/11/2013	Dwn. By: JAB	Appd. By: DLM		

Map: NAD83 CSRS NB Double Stereographic

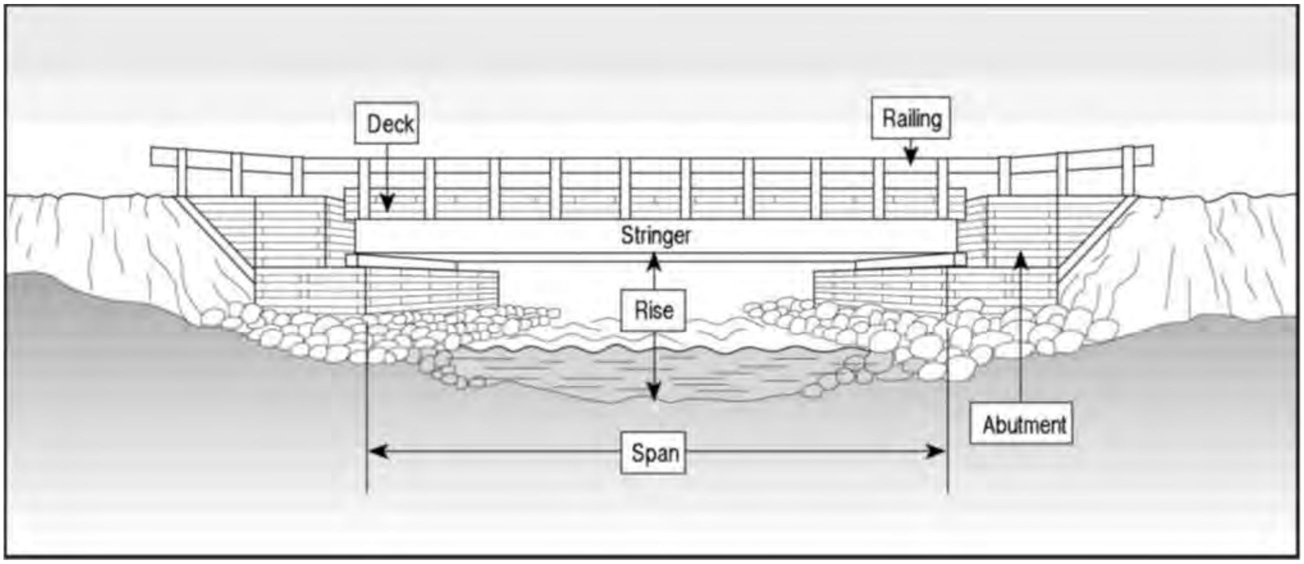


Figure 5.2 Typical 1 lane "woods road" Bridge

Alewife are a commercially important species, used fresh or salted for human consumption, and used as bait, fish meal and fish oil (Pardue 1983). Within the maritime region the larger commercial fisheries for gaspereau (<1000 t annually) occur in the Saint John River and Miramichi River (DFO 2001). In the Saint John River and most of Atlantic Canada, the majority of the gaspereau run is made up of alewife (DFO 2001). Alewives spawn in large rivers, small streams, ponds and lakes (Pardue 1983). Spawning substrates include gravel, sand, detritus, and submerged vegetation with sluggish water flows and water depths of 15 cm to 3 m (Pardue 1983).

It is likely that alewife did spawn in Nashwaak Lake prior to the downstream development of water control dams and road crossing structures (Seymour, P. Personal communication, November 5, 2013). With the recent removal of Barker Dam, the only other known potential fish passage impediment between Nashwaak Lake and the Saint John River is the Lower Lake Dam on the main stem of the Nashwaak River.

Brook trout may make use of the deeper areas of the lake as cold water refugia during summer months, and may also reside there during winter months. They may also make use of the habitat within the lake for spawning or rearing. Brook trout will also likely use the habitat found in the tributaries which flow into the lake for spawning and rearing, or for thermal refuge during summer months.

The proposed offsetting plan provides additional benefits to fisheries productivity by allowing alewife, a species that was likely historically present in Nashwaak Lake, to access spawning and rearing habitat in the lake. Allowing alewife access into Nashwaak Lake may also increase lake productivity by increasing marine nutrients through excretion and morality each year, with the potential to affect food web dynamics and nutrient cycling with in the lake (Walters 2009). It may also improve CRA fisheries productivity by increasing or improving access to additional lacustrine habitat for brook trout, and additional habitat for Atlantic salmon within the tributaries flowing into Nashwaak Lake. The removal of the Nashwaak Lake culvert will generate self-sustaining benefits in the long-term as the culvert removal is permanent and will allow access for CRA species into perpetuity.

The Offsetting will begin during Project Construction in order to reduce the delays associated with offsetting at a later time, as the majority of serious harm will occur during the Construction phase of the Project. The removal and replacement of the culvert will take place during the first year of the Offsetting plan and the associated monitoring will take place the following year. The purpose of this Offsetting Plan is to generate self-sustaining benefits to fisheries productivity by improving access to the lake and its associated tributaries as habitat for migratory fish species into perpetuity.

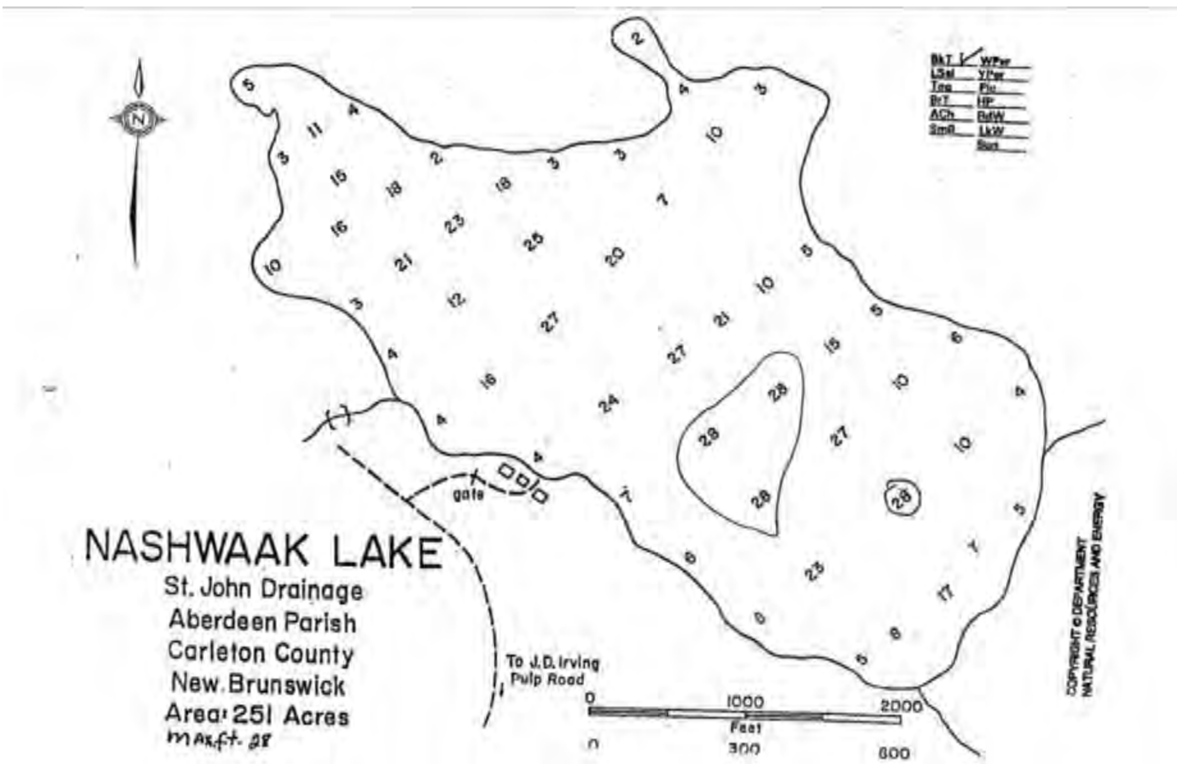


Figure 5.3 Bathymetry of Nashwaak Lake (Source: P. Seymour, NBDNR)

5.2.1 Estimate of the Offsetting/Habitat Compensation Credit

To estimate the amount of offsetting/habitat compensation that would be achieved by restoring fish passage at this location, existing aerial imagery and GIS was used to calculate the total surface area of the lake, and the lengths of the tributaries. The width of the tributaries was assumed to be 3 m, which is consistent with first-order streams in this region. Using this methodology, the total surface area of the Nashwaak Lake itself is estimated as 11,238 habitat units, and the total combined surface area of the three tributaries and outlet is 199 habitat units. The combined total area is thus 11,437 habitat units.

Given that the lake presently provides habitat for a number of fish species, it is unlikely that a full credit would be granted for this entire area. For example, when considering the Dunbar Stream Falls project, DFO suggested that the credit for providing access to Atlantic salmon would equal 25% of the upstream habitat area. Applying the same factor to the Nashwaak Lake culvert project, a more likely offsetting/habitat compensation credit is estimated at 2,859 habitat units (25% of 11,437), to be confirmed with DFO. Thus, in terms of the productivity measure represented by habitat units, the habitat offsetting/habitat compensation from the removal of the existing water-level control dam and road culvert at Nashwaak Lake and its replacement with an open span bridge is more than five times the amount required for the Sisson Project. Thus, the removal of the existing water-level control dam and road culvert will likely allow sufficient increases in productivity to account for any uncertainty associated with the offsetting and any time lags associated with implementing the offsetting during the Construction phase of the project.

Overall, the watershed areas in which serious harm is expected to occur as a result of the Project (Bird Brook, Sisson Brook, and Tributary A to West Branch Napadogan Brook) make up approximately 11% of the Napadogan watershed, and less than 1% of the total Nashwaak River watershed. Therefore the potential loss of productivity on a sub-watershed scale to the Nashwaak River is small.

5.3 MEASURES TO AVOID ADVERSE ENVIRONMENTAL EFFECTS ON FISH DURING OFFSETTING

Construction and erosion and sedimentation control methods for the culvert removal and bridge installation will follow the Guidelines for Roads and Watercourse Crossing (NBDNR 2004). Attempts will be made to eliminate or reduce sediment-related problems by using erosion control (*e.g.*, silt barriers, hay bales, erosion control blankets), and preventing deleterious substances from entering streams during the culvert removal and during the bridge installation, minimizing disturbance to the stream channel, retaining existing vegetation, re-vegetating, and stabilizing the site to prevent post-construction erosion (*e.g.*, riprap).

To avoid adverse environmental effects on fish, the area of construction will be blocked with mesh barrier nets to prevent fish from entering the construction area. The fish between the barrier nets will then be removed using multiple pass electrofishing techniques and transported upstream. The culvert removal and bridge construction will be done in the dry, with temporary coffer dams restricting water flow through the area, and pumps will pump water around the construction area.

5.4 PROPOSED MONITORING MEASURES TO ASSESS OFFSETTING

Subject to confirmation with DFO, prior to the removal of the existing water-level control dam and road culvert, a fish passage analysis will be undertaken to collect existing information to assist in natural channel design within the area of the bridge replacement, collect hydrometric data on a range of stream flows, develop a relationship between velocity and stage to calibrate the Hydrologic Engineering Centers River Analysis System (HEC-RAS) model (USACE 2010), build a flow model (*i.e.*, using HEC-RAS) to simulate water profiles and assist in the fish passage assessment, and compare modelled water profiles to published swimming speeds for alewife. Alewife is a weaker swimming species than brook trout and will be used as the study species for the fish passage evaluation. Swimming speeds for alewife are available in Castro-Santos (2005), and range from 5 to 20 body lengths per second. The fish passage analysis will provide information to assist in ensuring the channel is adequate for fish passage after the water-level control dam and culvert removal is replaced with a bridge. Photographs will be taken to document the removal of the water-level control dam and road culvert and its replacement with a woods-road bridge.

Following the removal of the existing water-level control dam and road culvert and its replacement with a clear span bridge, subject to confirmation with DFO, a topographical survey of the channel, formerly located beneath the existing water-level control dam and road culvert will be collected, and the data will be inputted into HEC-RAS to predict water velocity and depth, and to validate the initial fish passage assessment predictions. A memo will also be prepared summarizing the obstruction removal and monitoring component of the Offsetting Plan. The Offsetting will be considered successful if the velocities from the fish passage evaluation are suitable for the passage of alewife during flows typical of those experienced during May and June when they are migrating. If the velocities are sufficient for successful passage, no further monitoring would be required.

5.5 TIMELINE FOR THE IMPLEMENTATION OF THE OFFSETTING

The Offsetting Plan would be implemented during Construction of the Project, after the *Fisheries Act* Authorization has been approved. Monitoring would be conducted in the year following the completion of the offsetting plan. As an example, if the culvert is removed and replaced with a bridge in 2015, the fish pass performance monitoring will take place in 2016. Since a range of flow conditions can be predicted from the hydraulic model, there is no requirement to determine if the monitoring time frame was adequate.

Assuming the *Fisheries Act* Authorization was approved in late 2014, then the proposed timeline of the Offseting Plan could be comprised of receiving the appropriate permits (Q1 2015), pre-construction fish passage assessment and channel design (Q2 2015), obtaining a license of occupation from NBDNR (Q2 2015), removal of the culvert and bridge installation (Q3 2015), post-construction fish passage monitoring (Q3 2016), and report of the Offsetting results evaluation (Q4 2016).

5.6 CONTINGENCY MEASURES FOR OFFSETTING

All attempts will be made to ensure that the Offsetting Plan is successful. The bridge and stream bed will be engineered to allow fish passage, therefore we anticipate that the prospect of the new bridge and channel not allowing fish passage as intended is extremely low.

In the event that the post-construction monitoring indicates that water velocities are not suitable for fish passage, the Proponent may need to make in-water modifications to the new bridge area such as reducing the slope of the ascent, or moving boulders or creating a series of pools beneath the bridge to assist in fish passage. If this is required, the Proponent will re-conduct the fish passage evaluation to determine if those modifications were sufficient to improve fish passage.

5.7 COST OF IMPLEMENTING OFFSETTING PLAN

The estimated costs associated with the implementation of the offsetting plan include (Table 5.1):

- environmental permitting (*e.g.*, Watercourse and Wetland Alteration Permit);
- pre-construction fish passage analysis and channel design beneath the new bridge location;
- hydraulic design of the bridge crossing;
- the construction costs associated with removing and replacing the existing water-level control dam and road culvert with a standard "woods road" bridge (Stantec 2013b);
- during construction, removal of fish from the area upstream and downstream of the water-level control dam and road culvert to prevent serious harm to fish in the vicinity of the Offsetting;
- post-construction fish passage monitoring; and
- associated reporting.

The estimated costs of the Offsetting Plan include costs associated with the associated contingency plans.

Table 5.1 High Level Costs Associated with Implementing the Offsetting Plan

Activity	Estimated Cost
Permitting for culvert removal and replacement	$2,000
Removal of fish from area around Nashwaak Lake Culvert	$4,000
Pre-Construction Fish Passage Analysis	$40,000
Hydraulic Design of Bridge Crossing	$5,000
Construction associated with existing water-level control dam and road culvert at Nashwaak Lake with a standard "woods road" bridge	$80,000
Post-Construction Monitoring	$11,000
Contingency Costs (30%)	$43,000
Total	**$185,000**

5.8 LAND ACCESS

The Nashwaak Lake culvert is located on Crown land (PID 13003473). Land access will be managed in consultation with NBDNR and the Crown Timber Licensee for the property. A license of occupation will likely be required from NBDNR to enable the replacement of the Nashwaak Lake culvert. The removal of the culvert and installation of the bridge could take up to two weeks depending on the type of bridge abutments. Some camps may access Nashwaak Lake via the Nashwaak Lake culvert crossing but there are alternate roads around the lake, based on aerial imagery, so it is unlikely that the removal of the culvert would cause a major disruption to camp owners. Notice of the construction will be provided to the cottagers prior to the removal of the culvert.

6.0 CONCLUSION

This information contained within this report represents the information requirements for authorization of the Sisson Project under the *Fisheries Act* and to support the listing the Project tailings storage facility (TSF) in Schedule 2 of the *Metal Mining Effluent Regulations*. The information requirements for a Section 35(2) *Fisheries Act* Authorization are described in Schedule 1 of the *Applications for Authorization under Paragraph 35(2)(b) of the Fisheries Act Regulations* under the *Fisheries Act*.

The Sisson Project is an open-pit molybdenum and tungsten mine located near Napadogan, New Brunswick and proposed by Sisson Mines Ltd. The Sisson Project is expected to result in serious harm to CRA fisheries in Sisson Brook, Bird Brook, Tributary A to West Branch Napadogan Brook, lower Napadogan Brook, and three small headwater tributaries in McBean Brook. There are fish residing in all of the watercourses where effects are expected. Serious harm will result to fish and fish habitat that are part of CRA fisheries from the permanent destruction of fish habitat during the Construction phase from site preparation of the Open Pit and TSF, and due to flow reductions during the Construction and Operation phases in residual streams and lower Napadogan Brook. The Project is anticipated to result in serious harm arising from direct environmental effects to 366 habitat units and indirect environmental effects to 178 habitat units, for a total of 544 habitat units.

An Offsetting Plan contained within this document proposes to offset the serious harm as a result of the Project by removing the existing water control structure and road culvert at Nashwaak Lake and replacing it with a woods road bridge. The combined total area in the lakes and its tributaries upstream of the offsetting project is 11,437 habitat units. Prior to the 2012 amendments to the *Fisheries Act*, DFO would typically offer a 25% credit for these now-available habitat units, or 2,859 habitat units. This is more than five times the affected habitat units due to the Sisson Project. It is acknowledged that under the amended *Fisheries Act*, the focus is on sustaining the productivity of CRA fisheries and not just replacing habitat. However, in terms of productivity, the removal of the existing water-level control dam and road culvert will increase ecological productivity as defined in DFO (2012) as "the capacity of a given habitat or area". The number of habitat units aside, the offsetting project will permit access to Nashwaak Lake by alewife, a lake-spawning species, which the existing Nashwaak culvert prevents, and may well also provide benefits to brook trout, possibly Atlantic salmon, and other fish species.

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