CN Milton Logistics Hub -
Letter of Intent to Implement Offsetting Measures

FINAL REPORT

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Abbreviations

BIT	Brampton Intermodal Terminal
CCME	Canadian Council of the Ministers of the Environment
CEAA	Canadian Environmental Assessment Agency
CEAA, 2012	*Canadian Environmental Assessment Act, 2012*
CN	Canadian National Railway Company
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species at Risk in Ontario
CVC	Credit Valley Conservation
CH	Conservation Halton
CRA fishery	Commercial, Recreational, or Aboriginal fishery
DFO	Fisheries and Oceans Canada
DO	dissolved oxygen
EA	Environmental Assessment
EIS	Environmental Impact Statement
EIS Guidelines	Guidelines for the Preparation of an Environmental Impact Statement – Milton Logistics Hub Project (July 2015)
ESA	*Endangered Species Act*
GTHA	Greater Toronto and Hamilton Area
km	kilometres
LAA	Local Assessment Area

Abbreviations Cont'd

LIO	Land Information Ontario
LOI	Letter of Intent
m	metres
MNRF	Ontario Ministry of Natural Resources and Forestry (post-2014)
MTO	Ontario Ministry of Transportation
NHIC	Natural Heritage Information Centre
OMAFRA	Ontario Ministry of Agriculture, Food, and Rural Affairs
OSAP	Ontario Stream Assessment Protocol
PDA	Project Development Area
PSQG LEL	Provincial Sediment Quality Guideline Lowest Effect Level
RAA	Regional Assessment Area
SAR	Species at Risk
SARA	*Species at Risk Act*
Stantec	Stantec Consulting Ltd.
TDR	technical data report
TRCA	Toronto and Region Conservation Authority
USEPA	United States Environmental Protection Agency
YOY	young-of-the-year

Glossary

Aboriginal	A collective name for the original peoples of North America and their descendants. The Canadian constitution recognizes three groups of Aboriginal peoples: First Nations, Métis and Inuit (INAC 2015).
Aboriginal fisheries	Fish harvested by Aboriginal groups for subsistence, social or ceremonial purposes (*Fisheries Act*).
Brampton Intermodal Terminal	CN's largest intermodal terminal by volume, located within the City of Brampton, Ontario.
Canadian Environmental Assessment Act, *2012*	An Act respecting the environmental assessment of certain activities and the prevention of significant adverse environmental effects.
commercial fisheries	Fish harvested under license for the purpose of sale (*Fisheries Act*).
EIS Guidelines	Refers to the document entitled Guidelines for the Preparation of an Environmental Impact Statement – Milton Logistics Hub Project (CEAA 2015).
fish	Includes (a) parts of fish, (b) shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and (c) the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals (*Fisheries Act*).
fish habitat	Spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly to carry out their life processes (*Fisheries Act*).
Greater Toronto and Hamilton Area	A contiguous urban region consisting of the Regions of Halton, Peel, York and Durham and Cities of Hamilton and Toronto.
Local Assessment Area	The maximum area within which environmental effects from project activities and components can be predicted or measured with a reasonable degree of accuracy and confidence. It consists of the Project Development Area and adjacent areas where project-related environmental effects are reasonably expected to occur based on available information and professional judgment.

Glossary Cont'd

mainline	Track that is used for through trains or is the principal artery of the railway system from which branch lines, yards, etc. are connected.
mitigation measures	Measures for the elimination, reduction or control of the potential adverse environmental effects of a designated project and includes restitution for any damage to the environment caused by those effects through replacement, restoration, compensation or any other means (CEAA 2013).
monitoring	Periodic or continuous surveillance or testing, according to a pre-determined schedule, of one or more environmental components. Monitoring is usually conducted to determine the level of compliance with stated requirements or to observe the status and trends of a particular environmental component over time (CEAA 2013).
pad tracks	Type of yard tracks primarily used to accommodate the loading and unloading of intermodal railcars.
Project	Intermodal terminal (the Terminal), including the realignment and extension of the existing mainline tracks, collectively known as the Milton Logistics Hub.
Project Development Area	Encompasses the immediate area in which project activities and components may occur and as such represents the area within which direct physical disturbance may occur as a result of the Project, temporary or permanent.
rail yard or terminal yard	Area in which the yard tracks are located.
recreational fisheries	Fish harvested under license for personal use or sport (*Fisheries Act*).
Regional Assessment Area	The area within which residual environmental effects from project activities and components may interact cumulatively with the residual environmental effects of other past, present, and future (i.e., certain or reasonably foreseeable) physical activities. The Regional Assessment Area is based on the potential for interactions between the Project and other existing or future potential projects.
Residual environmental effects	An environmental effect of a designated project that remains, or is predicted to remain, after mitigation measures have been implemented (CEAA 2013).

Glossary Cont'd

service tracks	Type of yard tracks used to hold railcars; where railcars are staged for their next movement.
stormwater management ponds	A storage facility that temporarily detains stormwater and releases it gradually to manage the quality and quantity of stormwater run-off.
Terminal	Project components, excluding the doubling of the mainline.
yard tracks	Tracks branching off from the mainline and located within the rail/terminal yard; comprised of pad tracks and service tracks; used for switching, making up trains, or storing railcars.

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1.0 INTRODUCTION

The Canadian Nation Railway Company (CN) proposes to construct and operate an intermodal terminal (the Terminal) and complete the realignment / extension of the existing mainline tracks in the Town of Milton, Ontario. This undertaking is collectively known as the Milton Logistics Hub (the Project).

CN retained Stantec Consulting Ltd. (Stantec) to lead the completion of the Milton Logistics Hub Environmental Impact Statement (December 7, 2015) (EIS) under the *Canadian Environmental Assessment Act*, 2012 (*CEAA, 2012*) (which has now been replaced by the *Impact Assessment Act*). As part of the environmental assessment (EA) process, Stantec was tasked to conduct a fish and fish habitat assessment for the Project to determine the presence of fish habitat that supports a commercial, recreational or Aboriginal fishery (CRA fishery) as defined under the *Fisheries Act*. Data and observations collected during the fisheries study informed the assessment of potential environmental effects of the Project and are presented in the *Milton Logistics Hub Technical Data Report - Fish and Fish Habitat* (Appendix E.4 of the EIS) (*the Fish and Fish Habitat TDR*), located in Appendix E.4 of the EIS package. A copy of this report was provided to DFO by the Canadian Environmental Assessment Agency (CEAA) as part of the conformity review process.

This revised Letter of Intent (LOI) report provides an update to the original LOI (dated December 1, 2016) that was submitted to DFO in support of the Application for Authorization under the *Fisheries Act*. New fish and fish habitat protection provisions came into force on August 28, 2019; however, the application will continue to be processed under the *Applications for Authorization under Paragraph 35(2)(b) of the Fisheries Act Regulations* as the application was deemed complete prior to February 23, 2020 (DFO 2020). This revised report reflects comments provided by DFO during the Joint Review Panel hearing and refinements made during detailed design. It presents a description of the existing conditions, an effects assessment of the proposed Project, proposed mitigation and offsetting measures and supporting fish and fish habitat data. This information is intended to satisfy information requirements under Section 35(2)(b) of the *Fisheries Act*.

1.1 AGENCY CONSULTATION

Consultation with agency staff, municipalities, Aboriginal communities and other Project stakeholders occurred during the preparation of the EIS as a component of the *CEAA, 2012* process. In addition to notices, public meetings and general correspondence, meetings were held with Conservation Halton (CH) to review and discuss preliminary plans for the Project, including proposed in-water work, mitigation and restoration opportunities prior to submission of the EIS to the Canadian Environmental Assessment Agency (CEAA) in December 2015.

Following submission of the EIS, communications with Fisheries and Oceans Canada (DFO) were held regarding the preparation and submission of the original Letter of Intent and this subsequent update to support a request for Authorization for the work. **Table 1.1** provides a summary of key agency consultation that has occurred in regard to fish and fish habitat during the EA process to date.

Table 1.1: Key Agency Consultation

Date	Attendees/Addressees	Purpose
March 11, 2015	Conservation Halton, Halton Region, Town of Milton, and CN	CN had meetings with the Town of Milton, Region of Halton and Conservation Halton regarding the Project design, existing site constraints and proposed mitigation, restoration and enhancement opportunities.
October 5, 2015	Conservation Halton, Halton Region, Town of Milton, CN, Stantec, and AECOM	Meeting to review and discuss approach and plans for the proposed Terminal, including overview of background data, subwatershed study, channel realignments, proposed mitigation, design options and offsetting opportunities.
February 19, 2016	DFO, CN, and Stantec	Conference call to gain further understanding of *Fisheries Act* approval process, since DFO had been contacted by CEAA as part of the EA process.
May 2, 2016	DFO and Stantec	Conference call to have preliminary discussion with DFO regarding approach to Application for Authorization and offsetting approaches, and additional information requirements.
February 6, 2017	DFO	Letter to CN confirming receipt of the Request for Authorization and confirming the need for a Letter of Credit to complete the application.
March 8, 2017	DFO	Letter to the Canadian Environmental Assessment Agency outlining DFO's position on additional information requirements, as well as confirming their position that the Project will not cause significant adverse environmental effects.
August 29, 2017	DFO, CN and Stantec	Conference call to review the project, need for Indian Creek / Tributary A channel realignments, existing conditions, proposed realignment features, restoration and enhancement features, summary of calculations, mitigation and follow-up.
December 6, 2017	DFO, CN and Stantec	Meeting to review the project, need for Indian Creek / Tributary A channel realignments, existing conditions, proposed realignment features, restoration and enhancement features, summary of calculations, mitigation and follow-up.

Table 1.1: Key Agency Consultation

Date	Attendees/Addressees	Purpose
July 6, 2018	DFO, CN and Stantec	Conference call to review the project, need for Indian Creek / Tributary A channel realignments, existing conditions, proposed realignment features, restoration and enhancement features, and a summary of calculations.
July 27, 2018	DFO	Letter to the Canadian Environmental Assessment Agency responding to CN's Information Response package #4 and #5.
May 29, 2019	DFO	Letter to the Joint Review Panel outlining DFO's views on the potential adverse environmental effects of the Project, the predicted effectiveness of proposed mitigation measures, the appropriateness of the proposed follow-up programs, and recommendations.
June 28, 2019	CN	Presentation to the Joint Review Panel on a description of the Project's effects on fish and fish habitat within Indian Creek and its Tributaries, indicating that further details would be addressed through discussions with DFO and issuance of an Authorization under the *Fisheries Act*.
June 28, 2019	DFO	Presentation to the Joint Review Panel on DFO's review of the Project information, confirming that with the application of appropriate mitigation measures, finalization and implementation of offsetting plans, and with follow up and monitoring programs, the productivity of the fisheries can be maintained.
June 28, 2019	Conservation Halton	Presentation to the Joint Review Panel seeking further analysis of existing conditions, revised culvert designs and additional water quality mitigation.
November 7, 2019	DFO, CN and Stantec	Conference call to discuss the next steps regarding the Request for Authorization, including applicability of the *Fisheries Act* transitional provisions, CN's approach to update the Letter of Intent and submission of the outstanding Letter of Credit.
January 29, 2020	CN	Email to DFO outlining the cost estimates for construction and monitoring of the fish habitat mitigation and offsetting measures for inclusion in the Letter of Credit.
February 4, 2020	DFO	Email from DFO confirming the cost estimates to be included in the Letter of Credit.
February 4, 2020	DFO	Letter from DFO regarding the status of the application for the *Fisheries Act* Authorization. The letter confirmed that upon receipt of the Letter of Credit from CN prior to February 23, 2020, the application will be deemed complete and it will continue to be processed under the *Applications for Authorization under Paragraph 35(2)(b) of the Fisheries Act Regulations*.

Table 1.1: Key Agency Consultation

Date	Attendees/Addressees	Purpose
February 11, 2020	CN	A copy of the two draft Letters of Credit (one for construction, one for monitoring) provided to DFO for review in advance of receiving the final versions.
February 11, 2020	DFO	Email from DFO confirming the language of the two draft Letters of Credit and requesting the expiry date be 2023 to reflect the start date and duration of construction.
February 19, 2020	CN	Letters of Credit submitted to DFO in support of the Request for Authorization.
March 30, 2020	CN	Email updated design drawings for the channel realignment to reflect detailed design
November 20, 2021	DFO	DFO provided a list of questions for clarification and/or information seeking clarification of time lag effects, channel sequencing, timing for in-water works, request to extend the duration of monitoring program, and request for final design drawings.
January 7, 2021	Stantec	Stantec provided responses to the questions for clarification and/or information sought by DFO to assist in resuming the review of the CN Milton Logistics Hub Application for a Fisheries Act Authorization.
February 8, 2021	DFO, CN and Stantec	Call to discuss update on DFO's review of the CN Milton Logistics Hub Application for a Fisheries Act Authorization and indigenous consultation, specifically regarding anticipated timing. Stantec provided a copy of the offsetting plan summary submitted to the indigenous communities by CN for reference.
April 5, 2021	Stantec	CN provided DFO with copies of the Issued for Tender design drawings for the channel realignment and culvert designs.
May 17, 2021	DFO, CN and Stantec	Call to review and confirm final submission documents for reference in DFO Authorization and to clarify next steps in process with respect to final plans and confirmation of schedule / contractor means and measures, and potential conditions of approval.

CN initiated the formal consultation process for the Project through its public announcement on March 19, 2015 and with the official opening of the Public Information Centre on March 28, 2015. Consultation included a variety of activities, including the release of public notifications, a project website, meetings and email correspondence. CN held a public open house on July 16, 2015 with an additional series of five open houses held between September 18 and October 31, 2017. Additional details regarding consultation associated with the Project in general is provided in EIS *Appendix D: Record of Consultation* and in the updated consultation material

prepared and submitted to CEAA on February 9, 2018 (CEAR #620) and to the Joint Review Panel on May 29, 2019 (CEAR #799).

1.2 AGENCY INPUT DURING THE REVIEW PANEL HEARING

In updating this Letter of Intent and in preparing the detailed designs for the Project, CN has considered the information provided by DFO, Conservation Halton and the Halton Region Municipalities during the Review Panel hearing. The information provided to the Panel and presented during the hearing was summarized in the Review Panel's Environmental Assessment Report released to the Minister of the Environment on January 27, 2020.

CN and DFO both indicated that with the application of appropriate mitigation measures, finalization of offsetting plans, and implementation of follow-up and monitoring programs, the Project will not result in significant adverse environmental effects, and the productivity of the fisheries within Indian Creek and its tributaries can be maintained.

Conservation Halton and the Halton Region Municipalities expressed concern that the proposed channel realignments and installation of culverts beneath the Terminal could create barriers to fish passage and that the stormwater management ponds could cause thermal effects, where the proposed realignment and enhancements would not adequately compensate for the loss of fish habitat.

It was the Panel's conclusion that the proposed fish habitat compensation (offsetting) would satisfactorily offset effects on fish and fish habitat and that the productivity of the fishery would be maintained over the long term. This conclusion was based on the assumption that in addition to CN's commitments regarding mitigation and offsetting measures to satisfy DFO, additional mitigation measures related to the stormwater management are also implemented (as per Section 7.1 of the Panel Review Report). Further mitigation measures may be identified through the permitting process in consultation with DFO.

1.3 LIST OF PLANS AND DOCUMENTS

The proposed works for the Project are shown in the following documents:

- **Appendix A**: Figures
- **Appendix B**: Project Design Drawings

These plans and supporting documents are consistent with the information provided in the Milton Logistics Hub TDR - Channel Realignment (Appendix E.2 of the EIS), the *Fish and Fish Habitat TDR* (Appendix E.4 of the EIS) and the *Milton Logistics Hub TDR - Hydrology and Surface Water Quality Baseline Study and Effects Assessment* (Appendix E.15 of the EIS) (Stantec 2015), which were prepared and submitted in support of the EIS. The plans are also substantially the

same as the information originally submitted in support of the Application for Authorization under the *Fisheries Act* in 2016, although they have been refined through detailed design to reflect comments received during the EA process.

The following is a summary of refinements made to the various plans and designs since submission of the original Letter of Intent in December 2016:

- changes to the design of the proposed culverts conveying Tributary A beneath the Terminal from a twin-cell to a single-cell design, and incorporation of a low flow channel and resting pools
- refinements to the design of Tributary A to reflect the design of Stormwater Management Pond #1 (SWM#1)
- refinements to the design of proposed riparian wetlands and oxbow / riparian enhancement features along Indian Creek
- revision to the location of the outlet for Stormwater Management Pond #2 (SWM#2)
- incorporation of the design drawings for the conveyance of Tributary C beneath the noise barrier, CN mainline and around the proposed Lower Base Line grade separation

These refinements have been incorporated into the description and effects assessment provided below. Overall, these refinements address comments received from DFO, CH and Halton Region during the EA review process and result in more fish habitat being created as a result of the proposed works relative the predictions made in the EIS (2015) and LOI (2016). Further discussion in this regard is provided below.

1.4 PROJECT DESCRIPTION

1.4.1 Purpose of the Project

The purpose of the Project is to construct and operate an intermodal terminal to meet CN's growing operational and commercial needs. Given that the economy, including transportation and warehousing, has grown by 20% between 2001 and 2011 (Hemson Consulting Ltd. 2012), the Project positions CN to serve the growing demand for logistics support in the GTHA and western Ontario markets (Strategic Projections Inc. 2013).

Intermodal is the transportation of containers by rail, truck and ship. It provides the ability to offer different modes of transportation and options for shippers and is the fastest growing mode of transportation in North America (Strategic Projections Inc. 2013).

Typically, intermodal containers are used to transport finished products, either imported internationally or transported domestically, throughout North America. These products include, but are not limited to, items such as toys, furniture, appliances, clothing, electronics, household goods, automotive parts and maintenance products, lawn care equipment, cosmetics/health

care, or food products. Moving finished products in containers provides the logistic service industry and retailers, such as major box stores, with greater flexibility in shipping products and distributing them to the consumers. With containers primarily transporting common household goods, the growth in intermodal volumes tends to follow the growth in population centres.

The GTHA represents Canada's biggest population centre and has been experiencing rapid growth resulting in expansion towards the towns and regions surrounding Toronto, particularly toward the west. CN provides intermodal services to the region through its Brampton Intermodal Terminal (BIT) which connects the GTHA with its network of 20 domestic terminals and seven CN-served container ports across North America. BIT, which is Canada's largest inland intermodal terminal, handles approximately 1 million containers annually. With 50% of CN's intermodal volumes flowing through BIT, this facility is a key component of CN's rail distribution network.

BIT is also a component of the Ontario-Quebec Continental Gateway and Trade Corridor, which is a federal-provincial partnership created between the governments of Canada, Ontario and Quebec in 2007. This partnership is focused on developing a sustainable, secure and efficient multimodal transportation system to support economic growth between the two provinces and to facilitate international trade with the U.S.

To protect its future obligation to support growing traffic volumes, CN made the strategic decision in 1999 to acquire approximately 1,000 acres of land in South Milton. Expansion projects and productivity initiatives at BIT deferred the immediate requirement to develop the land for intermodal use. After investing over $50 million to support the growing volumes at BIT, this facility is now approaching capacity with limited opportunities for significant expansion. A land review confirmed that sufficient and suitable land could not be acquired around BIT (Cushman & Wakefield 2015). Additional capacity is required to enable CN to continue to support the growing demand for intermodal services in the GTHA.

To address the need to support long-term growth, CN made a strategic decision to move forward with plans to develop a satellite intermodal terminal in the western portion of the GTHA, where CN's growing customer base is locating. Several sites in the area were evaluated, as outlined in the Milton Logistics Hub - Site Selection Study (EIS, Appendix F), with CN's South Milton property being the best available location to satisfy CN's operational and commercial needs.

1.4.2 Project Description

As presented in Section 1.2 of the EIS, the Project consists of the construction and operation of an intermodal terminal and the realignment / extension of the existing mainline tracks in the Town of Milton, Ontario. Figure 1 (**Appendix A**) presents the preliminary design of the Terminal and the proposed Project components contained within the Project Development Area (PDA).

It is estimated that approximately 650 trucks per day will be entering and subsequently exiting the Terminal at the beginning of operation and approximately 800 trucks per day each way at full operation. Truck access to the Terminal will be through a CN-owned private access road off Britannia Road. The access road will include a new two-lane overpass to enable truck access over the CN mainline and yard tracks, which will accommodate trucks entering and exiting the Terminal.

Berms and barriers will be constructed, as required, to minimize any potential for effects on the community.

A 2,500 square metre (m^2) administration building with an attached 1,200 m^2 maintenance garage will be built on the site. Employee access to the administration building will be provided through a new entrance off Tremaine Road. A stormwater collection and drainage system will be installed that includes storm sewers, oil grit separators and stormwater management (SWM) ponds to manage run-off, while drainage ditches will convey external drainage around the Terminal.

Portions of Indian Creek and Tributary A will be realigned to avoid and mitigate the potential impacts of development and operation of the Terminal. These sections will be enhanced to improve existing fish habitat and revitalize riparian and floodplain areas. A portion of Tributary C will be realigned to avoid and mitigate the potential impacts of the noise barrier, CN mainline, and the proposed Lower Base Line grade separation.

1.4.3 Overview of Proposed Works with the Potential to Affect Fish and Fish Habitat

Various activities and proposed Project components will affect the following watercourses that support CRA fisheries:

- Indian Creek – channel realignment and associated enhancements
- Tributary A – channel realignment, removal of the existing culvert under the CN tracks, installation of new culverts beneath the Terminal and gate area, and installation of a new culvert beneath the proposed access road
- Tributary C – replacement of the culvert under the CN tracks and installation of a new culvert beneath the proposed noise barrier

Figures illustrating project components that affect watercourses are provided in **Appendix A**. Updated project design drawings are provided in **Appendix B** and are substantially the same as those presented in Appendix E.2 of the EIS.

A reach in each of Indian Creek, Tributary A and Tributary C will be altered (i.e., realigned) to accommodate the Project. The proposed creek realignments consist of alterations to the

existing longitudinal profiles and cross-sections of the watercourses, which affect the following watercourse reaches:

- a 1,075 m reach of Indian Creek (permanent flow; warmwater fish population)
- a 735 m reach of Tributary A (intermittent flow; warmwater fish in lower reaches)
- a 250 m reach of Tributary C (intermittent flow; roadside ditch)

Indian Creek

The proposed footprint of the Project will require the realignment of Indian Creek, resulting in the removal of 1,075 linear m of Indian Creek and replacement with a new 570 m channel designed using natural channel design principles. The new channel will include instream habitat structures, riparian habitat enhancements, and offline wetlands connected to the new channel to provide fish rearing and feeding habitat opportunities. In addition to the replacement channel and riparian enhancements, mitigation and offsetting plans for Indian Creek include habitat enhancement along an additional 300 m reach of Indian Creek located upstream of the realigned portion. Further details are discussed in **Section 4** and design drawings are included in **Appendix B**.

Tributary A

Design drawings for the proposed culverts that will convey Tributary A under the access road, existing CN mainline and proposed terminal work pads are included in **Appendix B** (Culverts 1, 2A and 2B).

The existing set of two 1.5 m corrugated steel pipe (CSP) culverts conveying Tributary A beneath the existing mainline will be removed and the existing reach of Tributary A from the mainline to the downstream end of the existing on-line agricultural pond will be realigned. Tributary A flows will be conveyed beneath the proposed terminal workpad and gate access by two consecutive 2.3 m high x 4.0 m wide single-cell precast concrete box culverts, as follows:

- Culvert 2A beneath the Terminal (192 m long)
- Culvert 2B beneath the truck entrance gate (92 m long)

Originally, these two concrete box culverts were designed as twin-cell culverts with one side conveying low flows. However, to address Conservation Halton recommendations to span Tributary A (i.e., single-cell instead of twin-cell design), the design of the culverts was revised to a single-cell design with a low flow channel and resting pools incorporated into the design. The resting pools will consist of 5 m long sections of cast in place concrete with a 0.5 m increase in depth in these sections, spaced approximately every 30 m to 43 m.

The two culverts will be connected by a 140 m long open grassed channel. The channel will also include resting pools for fish spaced approximately every 30 m to 43 m.

Downstream of the outlet from Culvert 2B, the Tributary A channel will be realigned using natural channel design principles to convey flows around the existing on-line agricultural pond and proposed SWM Pond #1 to where it will reconnect with the existing Tributary A channel upstream of Tremaine Road. The existing on-line agricultural pond will be taken offline and the area naturalized.

In addition, a new 30 m long CSP culvert (Culvert 1) will also be installed on Tributary A beneath the proposed access road to convey flows, although this reach of Tributary A is not considered to be a CRA fishery (see Culvert 1 design drawings in **Appendix B**).

Tributary C

Works to construct a section of the proposed acoustic barrier will result in alterations to a 30 m long reach of Tributary C through the installation of a culvert (Culvert 6) beneath the acoustic barrier (See **Figure 3.8, Appendix A**).

To accommodate the Lower Base Line grade separation, the existing CSP culvert conveying Tributary C flows beneath the mainline and a reach of Tributary C (which acts as a roadside ditch at this location) (see **Figure 3.9, Appendix A**) will be realigned and directed through Culvert 7. This design is consistent with the information provided in response to the Panel's Information Request 3.45 (CEAR #613). The proposed 75 m long circular concrete culvert has a diameter of 2.4 m and will replace the existing 23 m long CSP culvert beneath the mainline. Details of scour protection at the culvert inlet and outlet are included in the Culvert 7 design drawings in **Appendix B**. The Tributary C culverts were designed to convey existing flows around the new grade separation in order to maintain flow to downstream fish habitat.

1.4.4 Design Objectives

The design objectives for the watercourse realignments, as well as the associated enhancement work planned as part of the habitat offsetting plan, encompass the following geomorphological and biological considerations:

- relocate sections of Indian Creek, Tributary A, and Tributary C affected by the Project
- remove the remnants of the existing on-line agricultural pond near the downstream end of Tributary A
- apply natural channel design principles to appropriately design and dimension the realigned channels, incorporating natural bed morphology (pools, riffles) and planform geometry for Indian Creek and Tributary A

- design new channel reaches such that the proposed channel realignments do not excessively aggrade or degrade
- convey existing flows such that flood elevations are not increased
- provide for fish migration and passage
- provide aquatic and riparian habitat that is functional over a range of flows

The proposed design of the channel realignments, restoration and enhancement measures follow the recommendations set forward in the Bronte Creek Watershed Study (CH 2002a). The watershed study was prepared through consultation with DFO, and included the discussion on the potential CN Intermodal facility project as a means to improve existing conditions within the Indian Creek watershed, specifically stating the following:

> *"Should the proposed CN Intermodal facility proceed, opportunities to improve and enhance existing conditions along the watercourse [Indian Creek] should be examined. This study should encompass the following:*

- increase the existing riparian habitat to improve water quality and thermal regime
- enhance and protect forest habitats to increase corridors and linkages
- improve stream morphology where stream is or will be altered
- remove or retrofit on-line agricultural ponds
- ensure there is no effect on flood plain storage or flood conveyance
- implement stormwater management for quality and quantity, and
- match the pre- and post-development rising limbs on the flow hydrographs to minimize erosion" (CH 2002a, p. 51)

These objectives and opportunities identified in the Bronte Creek Watershed Study guided the development of the proposed channel realignments, mitigation measures, restoration and enhancement measures and offsetting plans for the Terminal.

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2.0 METHODS

2.1 STUDY AREA

The spatial boundaries for the Project are defined below with respect to Project activities and components:

- Project Development Area (PDA): The PDA has been defined as the area of physical disturbance directly associated with the Project footprint (i.e., land that will be physically disturbed for the purpose of the Project, either permanently or temporarily). The PDA is located on CN property and is constituted by a 10 m buffer around all project components, as depicted on **Figure 2, Appendix A**.
- Local Assessment Area (LAA): The LAA for fish and fish habitat includes all watercourses in the PDA, and 100 m upstream and 300 m downstream of potential alterations to a watercourse (**Figure 2, Appendix A**). The LAA also includes the riparian area within 30 m of each watercourse bank. Several regulatory guidance documents in Canada indicate that a typical LAA is the area within 30 m of a facility (NEB 2014; BCWLAP 2004; NBDELG 2012). There is potential for Project-specific effects to extend outside the PDA, and outside the 30 m referenced in these documents. Therefore, the boundaries of the LAA were developed based on protocols used for linear infrastructure projects in Ontario and Alberta (MTO 2009; AENV 2001a; AENV 2001b) that provide more conservative guidance on the potential area of measurable effect for activities that have similar potential effects to those associated with the Project.
- Regional Assessment Area (RAA): The RAA for potential effects on fish and fish habitat includes watercourses in the Indian Creek subwatershed to the confluence with Bronte Creek and the main channel of Bronte Creek down to the confluence with Mount Nemo Creek (**Figure 2, Appendix A**). This RAA provides the context for assessing the type, degree and magnitude of effects on fish and fish habitat that may occur in the PDA and LAA. A regional context is important to understand the broader ecosystem so that local changes with potential for ecosystem wide effects (such as barriers to fish migration) can be properly identified assessed and mitigated.

2.2 DESKTOP REVIEW AND DATA SOURCES

Known watercourses in the PDA, LAA, and RAA, including streams, creeks, rivers, ponds and other bodies of water, were identified using imagery and geo-referenced data (1:20,000 scale or larger) distributed by the Ontario Ministry of Natural Resources and Forestry (MNRF) through Land Information Ontario (LIO). Watersheds and subwatersheds in the RAA were identified using CH data, including mapping at various scales.

Available digital imagery (including satellite and air photos with 15 cm resolution) was used to identify additional potential watercourses in the LAA and PDA where field investigations would be conducted. Surface features with evidence of channel definition (upstream or downstream from the PDA), were considered potential watercourses and therefore potential fish habitat. Primary data sources included the following:

- LIO Database
- MNRF data – watercourse name, flow regime, thermal regime, historical fish community data
- Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA) data – drain classifications (OMAFRA 2015)

These features were targeted during field surveys for confirmation and refinement.

Descriptions and maps found in the Bronte Creek Watershed Study and the Bronte Creek and Supplemental Monitoring Long Term Environmental Monitoring Program (CH 2002a, 2002b and 2009) were used to determine applicable watershed and subwatershed boundaries.

2.3 FIELD SURVEYS

Fish and aquatic habitat assessments were designed and undertaken following the guidance provided by CEAA, in a document entitled: Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act, 2012* - Milton Logistics Hub Project - Canadian National Railway Company (EIS Guidelines) (July 2015).

Potential watercourses identified in the LAA during the background data review were assessed in the field in May, July and August 2013, and in June, July, September, and October 2015 by teams of qualified aquatic biologists from AECOM and Stantec. Further investigation of headwater features was completed in April and May 2017. The objectives of the field assessments were to:

- confirm the presence or absence of watercourses identified through the review of background data
- identify additional watercourses potentially affected by the Project, which were not documented in background data
- document the biophysical characteristics and water quality of identified watercourses potentially affected by the Project
- characterize fish habitat in representative reaches
- sample the fish community at representative locations

Identified watercourses potentially affected by the Project are shown on **Figure 1** and **Figure 2**, **Appendix A**.

2.3.1 Fish Community Sampling

Fish communities were sampled in July 2013 by AECOM, with further sampling conducted by Stantec in September and October 2015.

In 2013, fish were sampled with a Smith-Root LR24 backpack electrofisher and dip nets. Field methods followed the *Ontario Stream Assessment Protocol (OSAP), version 3* (Stanfield et al. 2013) for a single unblocked pass at two locations on Tributary A and three locations on Indian Creek (**Figure 2**, **Appendix A**).

Sampling conducted in 2015 was completed using a Smith-Root LR-20B backpack electrofisher, dip nets, and a bag seine. Field methods followed the *OSAP, version 3* (Stanfield et al. 2013) for multiple-pass with block nets. Sampling was conducted over a 360 m long reach of Indian Creek and a 150 m long reach of Tributary A.

The 2013 and 2015 fish sampling data were combined with historical data to characterize the local fish community of the watercourses in the PDA and LAA. The combined data provided sufficient information to characterize the qualitative composition of the fish community in these watercourses.

2.3.2 Fish Habitat

Habitat characteristics at representative reaches were recorded for each watercourse confirmed in the LAA during field investigations. Additional observations were recorded at two road crossings in the RAA to provide supporting characterization downstream of the LAA.

Site investigations were conducted by AECOM on July 4, 2013 using methods described in the *OSAP, version 3* (Stanfield et al. 2013). AECOM completed supplemental investigations on August 28, 2013 to assess mapped headwater features using the Credit Valley Conservation (CVC) and Toronto and Region Conservation Authority (TRCA) *Evaluation, Classification and Management of Headwater Drainage Features: Interim Guidelines 2009* (CVC and TRCA 2009). Assessed characteristics included presence of water flow and origin, wetted width, wetted depth, bank height, bed form and materials, stability and connectivity.

Detailed habitat mapping for watercourses in the LAA (including the PDA) was completed by Stantec on June 3 and 4, and July 27, 2015 using an approach adapted from Stanfield *et al.* (2013) and the Ontario Ministry of Transportation (MTO) *Environmental Guide for Fish and Fish Habitat* (MTO 2009). These methods are generally accepted as appropriate assessment protocols, in the absence of applicable federal legislation or guidelines. Transects across the watercourse were established based on guidelines in Stanfield *et al.* (2013) and MTO (2009). Ten transects were established across Indian Creek and eight transects were established across

Tributary A in the LAA. Additional habitat assessment was completed for Tributary C, at three locations in the PDA.

Transects were spaced at approximately 200 m intervals along each watercourse throughout the LAA in order to provide cross-sectional data representative of the assessed reaches and were based on accepted guidance and protocols for undertaking these studies (**Figures 3.1 to 3.7**, **Appendix A**). Physical characteristics were also documented in Tributary B, as the information was not available from previous field surveys.

The following data were recorded at each transect:

- channel width (i.e., bankfull width)
- wetted width
- water depth at 25%, 50% and 75% of wetted width
- substrate composition (percentage of boulder, cobble, gravel, fines, organics)
- bank description, including height, slope and visual stability
- functional in-water and riparian cover type and abundance

The following watercourse characteristics were also recorded at transects (where applicable):

- watercourse morphology (run, riffle, pool or flat)
- presence of aquatic vegetation
- barriers to fish movement
- water velocities at evenly spaced stations across one transect

Using the habitat data collected during field investigations, habitat quality for critical life stages of small-bodied and large-bodied fish was also assessed in the LAA. Results are included on the field sheets, where habitat in each reach in the LAA was classified for use as spawning, rearing, migration and overwintering habitat as either absent (none), low, moderate or good (Appendix B of the Fish and Fish Habitat TDR).

During the 2015 field surveys, photographs were taken at each transect, at numerous locations throughout the LAA, and at two locations in the RAA (Indian Creek crossing of Bell School Line and Appleby Line) to document watercourse characteristics observed during the surveys. The Photographic Record is included in **Appendix C** of this report

As part of the habitat survey, *in situ* surface water quality data were collected at Transect 1 in Indian Creek and Transect A1 in Tributary A (**Figure 3**, **Appendix A**) during the June 2015 survey.

3.0 RESULTS

3.1 OVERVIEW

The Project RAA for fish and fish habitat includes the Indian Creek subwatershed and a short stretch of Bronte Creek (**Figure 1**, **Appendix A**). The Indian Creek subwatershed is located in the Bronte Creek watershed, which flows into western Lake Ontario and is the second largest watershed in the CH jurisdiction, draining an area of over 300 km^2 (CH 2009).

Indian Creek is a major tributary to Bronte Creek and drains in a generally southeastern direction, from the base of the Niagara Escarpment and converges with Bronte Creek, approximately 5 km downstream of the LAA. Bronte Creek also drains in a southeastern direction flowing into Lake Ontario approximately 23 km from its confluence with Indian Creek.

Tributary A originates upstream of Britannia Road in agricultural fields. It continues eastward from Britannia Road through the northwest corner of the PDA and then turns north to flow outside the PDA. In this reach outside the PDA it continues past the Halton Region Waste Management Facility, turns south to cross First Line, flows through a woodlot, and then under the CN tracks back into the PDA. Inside the PDA it continues across agricultural fields into an on-line agricultural pond before entering Indian Creek on the west side of Tremaine Road (**Figure 1, Appendix A**).

Tributary B is mapped (LIO 2015) as an intermittent water feature for fish and fish habitat and occurs entirely in the LAA. It originates as a network of swales near the approximate center of the PDA and converges with Indian Creek at a location approximately 500 m to the south.

Tributary C was identified using aerial photo interpretation. The feature originates outside the LAA and PDA, approximately 100 m southeast of Lower Base Line and 1 km northeast of the CN mainline. It is an intermittent watercourse that flows through the PDA and LAA, converging with Indian Creek outside of the PDA, approximately 200 m southwest of the intersection of Tremaine Road and Lower Base Line.

3.2 FISH COMMUNITY

3.2.1 Regional Assessment Area

The following description of the RAA is based on background data, which are generally applicable to a broad area including the LAA and PDA.

Habitat in the greater Bronte Creek watershed is suitable to support a diverse fish community consisting of coldwater, coolwater and warmwater species. Background data indicate 26

species of fish have been recorded in the Bronte Creek reach from Lowville to Lake Ontario. Species commonly encountered in Bronte Creek include (CH 2002b and 2009):

- Rainbow Trout (Oncorhynchus mykiss)
- Chinook Salmon (Oncorhynchyus tshawytscha)
- Northern Hog Sucker (*Hypentelium nigricans*)
- River Chub (Nocomis micropogon)
- Rock Bass (Ambloplites rupestris)
- Pumpkinseed (Lepomis gibbosus)
- Common Shiner (*Luxilus cornutus*)
- Bluntnose Minnow (*Pimephales notatus*)
- Creek Chub (Semotilus atromaculatus)

Indian Creek is a tributary to Bronte Creek. It is classified as a warmwater watercourse and is documented as supporting a fish community dominated by warmwater fish species. Species commonly encountered in Indian Creek include (CH 2009):

- Blacknose Dace (Rhinichthys atratulus)
- Bluntnose Minnow
- Brook Stickleback (*Culaea inconstans*)
- Creek Chub
- Fantail Darter (Etheostoma flabellare)
- White Sucker (Catostomus commersonii)

All of these representative species can be expected to occur in the RAA and many of the warmwater species were encountered in the LAA during field work for the Project (refer to Section 3.2.2 for fish species captured during field investigations).

Though limited by high in-water temperatures, White Sucker, Rainbow Trout and Chinook Salmon may enter Indian Creek from Bronte Creek to spawn (CH 2002b). Young-of-the-year (YOY) Rainbow Trout have been observed in Indian Creek approximately 6.5 km downstream of the LAA and PDA at Appleby Line (CH 2009).

CH describes Indian Creek as a permanently flowing watercourse, despite the potential for reaches to dry out during summer months (CH 2002b). Indian Creek is located in a predominantly agricultural setting where riparian vegetation is sparse and there is minimal groundwater contribution to baseflow. The majority of Indian Creek's baseflow originates from precipitation events and wetland features located at the base of the Niagara Escarpment,

upstream of the LAA in the RAA suggesting that minimal or no groundwater upwelling occurs in the LAA. This is consistent with the *Milton Logistics Hub TDR – Hydrogeology* (Appendix E.6 of the EIS) (Stantec 2015) that indicates downward vertical hydraulic gradients exist beneath Indian Creek and its associated tributaries and wetlands (i.e., limited groundwater discharge conditions).

The limited riparian vegetation, limited groundwater input and surficial run-off from the surrounding agricultural land-use contribute to Indian Creek's warmwater thermal regime.

Benthic invertebrate indices for Indian Creek generally indicate an impaired system that is dominated by silt and clay substrates, although Indian Creek has a fair to good score on the Index of Biotic Integrity (CH 2009). Despite the degraded water quality in Indian Creek compared to other reaches in the Bronte Creek watershed, it is able to support a diverse warmwater fish community, including some species which are considered less tolerant to poor conditions (e.g., Smallmouth Bass (*Micropterus dolomieu*) and Rainbow Darter (*Etheostoma caeruleum*) (CH 2002b).

Previous monitoring studies completed by CH concluded that habitat and channel structure do not influence biotic health as greatly in Indian Creek as in other Bronte Creek subwatersheds (CH 2009). However, habitat diversity and structure decrease with proximity to Bronte Creek. Water quality also tends to decrease as Indian Creek approaches its confluence with Bronte Creek (CH 2009). The decrease in water quality is likely linked to cumulative effects from upper reaches of the watercourse and its tributaries as described above (CH 2002b and 2009). Additionally, it is not uncommon for reaches of Indian Creek to experience dry conditions during summer months (CH 2009). As a result, the Bronte Creek Watershed Study (CH 2002b) ranks aquatic ecosystem health as poor for the Indian Creek subwatershed.

As noted in **Section 1.4.3**, the Bronte Creek Watershed Study (CH 2002a, b) identifies and encourages opportunities to improve existing aquatic conditions.

3.2.2 Local Assessment Area and Project Development Area

Characterization of the LAA (which includes the PDA) is based on a combination of background data specific to the LAA and field work conducted for the Project in 2013 and 2015.

3.2.2.1 Background Data

In 2013, two AMEC reports compiled data for studies (including fish community sampling in 2001, 2005, 2007, and 2008) conducted for the Sixteen Mile Creek Subwatershed Study (AMEC 2013a), which encompasses the Project RAA, and detailed study of lands abutting the LAA, called the "Boyne Survey Lands" (AMEC 2013b). Both of these studies were part of the background data review.

AMEC (2013a) assessed watercourses based on a combination of factors, such as fisheries, stream flow and morphology. Tributary A was classified as 'seasonal' aquatic habitat and that fish collections in November 2001 (historical data as reported in AMEC 2013a, Table 3.5.3, p. 74, site B-35) captured Bluntnose Minnow, Fathead Minnow (*Pimephales promelas*) and Pumpkinseed at a survey station downstream of the CN mainline. Upstream between Bronte Road and Britannia Road, no fish were captured in fish surveys completed in 2001 and 2008 (AMEC 2013a).

Management recommendations for seasonal watercourses in AMEC's 2013 studies were as follows (AMEC 2013a, 2013b):

- replicate on-site surface flows
- maintain external flows; or if catchment drainage has been removed, restore lost functions through enhanced lot level controls, as feasible
- use natural channel design techniques to replace existing habitat features to maintain overall fish productivity of the reach
- the drainage feature must connect to downstream habitat

3.2.2.2 Field Data

In 2013, the following fish species were captured in Indian Creek during field work for the Project (Appendix D of the Fish and Fish Habitat TDR).

- Bluntnose Minnow
- Common Carp (Cyprinus carpio)
- Common Shiner
- Creek Chub
- Largemouth Bass (*Micropterus salmoides*) (YOY)
- Pumpkinseed
- Rainbow Darter
- Rock Bass

In 2013, the following fish species were captured in Tributary A during field work for the Project (Appendix D of the Fish and Fish Habitat TDR).

- Bluegill (Lepomis macrochirus)
- Brook Stickleback (YOY)
- Largemouth Bass (YOY)

- Pumpkinseed
- White Sucker (YOY)

During subsequent 2015 fish community sampling, the following fish species were captured in Indian Creek:

- Bluntnose Minnow
- Common Shiner
- Creek Chub
- Green Sunfish/Pumpkinseed hybrid (Lepomis cyanellus x Lepomis gibbosus)
- Johnny Darter (Etheostoma nigrum)
- Longnose Dace (Rhinichthys cataractae)
- Rainbow Darter
- Rock Bass
- Smallmouth Bass
- Spottail Shiner (*Notropis hudsonius*)
- Stonecat (Noturus flavus)
- White Sucker

Detailed fish data collected in 2015 are presented in Appendix B of the Fish and Fish Habitat TDR.

No fish were captured during 2015 fish community sampling in Tributary A.

A consolidated list of fish species recorded in Indian Creek and Tributary A during surveys is presented in **Table 3.1**:

Table 3.1: Consolidated List of Fish Species Recorded During Project Surveys

Common Name	Scientific Name	Year
Indian Creek		
Bluntnose Minnow	*Pimephales notatus*)	2013, 2015
Common Carp	*Cyprinus carpio*	2013, 2015
Common Shiner	*Luxilus cornutus*	2013
Creek Chub	*Semotilus atromaculatus*	2013, 2015
Green Sunfish/Pumpkinseed hybrid	*Lepomis cyanellus x Lepomis gibbosus*	2015
Johnny Darter	*Etheostoma nigrum*	2015

Table 3.1: Consolidated List of Fish Species Recorded During Project Surveys

Common Name	Scientific Name	Year
Largemouth Bass	*Micropterus salmoides*	2013
Longnose Dace	*Rhinichthys cataractae*	2015
Pumpkinseed	*Lepomis gibbosus*	2013
Rainbow Darter	*Etheostoma caeruleum*	2013, 2015
Rock Bass	*Ambloplites rupestris*	2013, 2015
Smallmouth Bass	*Micropterus dolomieu*	2015
Spottail Shiner	*Notropis hudsonius*	2015
Stonecat	*Noturus flavus*	2015
White Sucker	*Catostomus commersonii*	2015
Tributary A		
Bluegill	*Lepomis macrochirus*	2013
Brook Stickleback	*Culaea inconstans*	2013
Largemouth Bass	*Micropterus salmoides*	2013
Pumpkinseed	*Lepomis gibbosus*	2013
White Sucker	*Catostomus commersoni*	2013

The seventeen species captured in both watercourses are consistent with the warmwater designations of Indian Creek and Tributary A, and with species identified in historical surveys from stations located upstream and downstream of the LAA (CH 2009; AMEC 2103a, 2013b).

3.3 FISH HABITAT

Based on the background data and detailed field work completed in 2013 and 2015, each watercourse within the LAA was categorized as one of the following types (adapted from Irwin et al. 2013, CVC and TRCA 2009):

- **Permanent –** water features that typically flow or hold water for most of the year but can dry up during drought conditions. The watercourse bed is typically located below the water table and groundwater and/or permanent water features are the primary source of flow.
- **Intermittent –** a seasonally flowing watercourse, or a seasonally wet water body, with poor to well-defined bed and banks and evidence of annual scour or deposition.
- **Headwater feature –** typically a low-lying depression with no defined channel, often cultivated, that does not provide direct or indirect habitat values for fish but might convey flow seasonally or following precipitation events.

3.3.1 Indian Creek

Approximately 1,460 m of Indian Creek was assessed during field investigations in 2015 (**Figure 3**, **Appendix A**). Twenty different morphological reaches were identified. Ten transects were established to provide cross sectional data, representative of the morphological reaches. The first three transects were established at 100 m intervals, with the remaining seven transects set at 200 m intervals. Morphology throughout the reaches consisted primarily of runs (965 m or 70% of assessed reaches), and riffles (495 m or approximately 30% of assessed reaches). Occasional pools were present in the reaches dominated by runs (**Figures 3.1 to 3.7**, **Appendix A**).

General habitat characteristics of the assessed reaches of the main branch of Indian Creek are provided in **Table 3.2**, with *in situ* water quality data provided in **Table 3.3**. Detailed biophysical field data summary sheets for these reaches are included in Appendix B of the Fish and Fish Habitat TDR.

Table 3.2: Indian Creek Characteristics; Stantec Field Observations, June 2015

Morphology Type	Channel Width (m)	Wetted Width (m)	Water Depth (m)	Predominant Substrate	Channel Stability	Predominant Riparian Vegetation/Crown Closure	Predominant In-water Cover
INDIAN CREEK- MAIN CHANNEL							
Run	6.0-12.0	3.25-10.0	0.35-0.70	Fines	Moderately Stable	Grasses/0%[2]	Aquatic Plants/water depth and clarity
Riffle	5.0-15.0	2.25-4.0	0.2-0.35	Cobbles[1]	Moderately Stable	Grasses/0%[2]	Aquatic Plants
INDIAN CREEK- TRIBUTARY A							
Run	1.0-2.75	0.75-1.5	0.2-0.3	Fines	Moderately Stable	Grasses/0%	Aquatic Plants
Riffle[3]	2.50	1.25	0.15	Large Gravel	Moderately Stable	Grasses/0%	Various[4]
Pool	3.0-5.0	1.5-3.0	0.15-0.4	Fines	Moderately Stable	Grasses/0%	Aquatic Plants

NOTES:

1. Substrate composition varied considerably throughout riffle morphologies in Indian Creek. Two of the four observed riffles were dominated by cobble substrate, but the two remaining riffles were dominated by gravel and fines.
2. Crown closure was predominantly 0% with the exception of isolated areas near the downstream limit of the LAA where deciduous trees provided 1-20% canopy cover.
3. A single reach of riffle morphology was identified in Tributary A.
4. In-water cover in the Tributary A riffle included almost equal measure woody debris, boulders, water depth/clarity and aquatic plants.

Table 3.3: *In situ* Water Quality Results (Stantec Field Measurements, June 2015*)

	Indian Creek- Main Channel Transect 1 (June 3, 2015)	Indian Creek- Tributary A Transect 1 (June 4, 2015)
Time	11:40	11:10
Air Temperature (°C)	12.5	12.1
Water Temperature (°C)	18.3	18.4
Conductivity (µS/cm)	1031	1004
pH	8.21	7.93
Dissolved Oxygen (mg/L)	10.9	10.6

NOTE:

* Water quality at the moment when the measurements were taken; data should not be used as a sole indicator of water quality.

Field observations in 2015 indicate that the main channel of Indian Creek is a permanently flowing watercourse with moderate quality spawning, rearing, foraging, and overwintering habitat for large-bodied and small-bodied fish throughout the PDA. Features contributing to the quality of fish habitat include the following:

- diverse morphological characteristics
- deep pools that provide cover and foraging opportunities
- diverse, coarse substrate materials that provide diverse habitat for several life functions and life stages
- undercut banks and overhanging herbaceous vegetation that provide cover and foraging opportunities
- aquatic vegetation present throughout the LAA that supports various life processes and life stages of several fish species

No obstructions to fish movement or migration were observed in Indian Creek in the PDA or LAA.

Supplemental field investigations were carried out on Indian Creek in the road allowance where it crosses Bell School Line and Appleby Line before Indian Creek converges with Bronte Creek. This road crossing is approximately 3 km downstream of the LAA. No barriers to fish movement or migration were observed in the RAA and none are known to occur between Lake Ontario and the LAA, based on information contained within the Bronte Creek Watershed Study (CH 2002a). There is the potential for reaches of Indian Creek to experience dry conditions (CH 2002b) which might cause occasional impediments to fish passage during drought conditions. However, Indian Creek is best characterized as a permanently flowing watercourse. Occasional seasonal barriers to fish movement will not significantly impair overall habitat function and productivity.

Within the PDA, Indian Creek is part of, and supports a CRA fishery as defined under the *Fisheries Act*.

3.3.2 Tributary A

Approximately 940 m of Tributary A were assessed in the PDA, with Tributary A divided into three reaches (**Figures 3.4, to 3.6**, **Appendix A**). Three transects were located in Reach 1 - downstream of Britannia Road and upstream of the CN mainline tracks (**Figure 3.6**, Appendix A), four transects were located in Reach 2 - downstream of the CN mainline tracks and upstream of the online pond (**Figures 3.4 and 3.5**, **Appendix A**), and one transect was located in Reach 3 - downstream of the online pond and upstream of Tremaine Road (**Figure 3.4**, **Appendix A)**.

General habitat characteristics of morphological reaches of Tributary A are provided in **Table 3.2** and *in situ* water quality data are included in **Table 3.3**. Detailed biophysical field data summary sheets for these reaches are included in Appendix B of the Fish and Fish Habitat TDR.

3.3.2.1 Tributary A - Reach 1

Between Britannia Road and First Line, two upper branches of Tributary A (**Figure 3.6**, **Appendix A**) were predominantly low, wet areas in agricultural fields with ephemeral flows through dense cattails, bulrushes and grasses containing no defined channel, as shown in the Tributary A Photographic Record in **Appendix C**.

The feature crosses First Line (leaving CN property), from which point a straightened, channelized feature flows southeast adjacent to First Line for approximately 1.2 km beside the Halton Region Waste Management Facility. Near the southern limit of the Waste Management Facility, the watercourse channel turns 90 degrees and continues southwest across First Line onto private property. Roadside observations indicate that the feature is a wide, unchannelized feature downstream of this location and it conveys ephemeral flows. Tributary A continues for approximately 850 m through private property before entering CN property immediately upstream (northeast) of the PDA (**Figure 3**, **Appendix A**).

Although water is conveyed through this upstream reach of Tributary A to downstream reaches, the reach of Tributary A between Britannia Road and the CN tracks is not part of, and does not support, a CRA fishery as defined under the *Fisheries Act*. Reach 1 (i.e. upstream of the CN tracks) was assessed as not providing fish habitat that supports a CRA fishery.

3.3.2.2 Tributary A - Reach 2

During field investigations, channel morphology in Tributary A downstream of the CN tracks to the agricultural pond (**Figures 3.4** and **3.5**, **Appendix A**) consisted primarily of runs (720 m or 90% of assessed reaches), with the remainder split almost equally between riffles (40 m) and pools (30 m). Tributary A to Indian Creek has an intermittent flow regime.

Reaches of intermittent or diffuse flow would likely create obstructions to fish movement and migration in Tributary A. Despite Tributary A's intermittent flow regime, a variety of fish species in a range of age classes (adults and YOY) were caught during electrofishing surveys conducted in 2013 for the Project. The species list included YOY Largemouth Bass, which were captured in Reach 2 (see **Figure 2**, **Appendix A** for sampling locations). Permanent water levels in the on-line agricultural pond likely act as a seasonal refuge for a variety of fish species in a range of age classes. Reach 2 was assessed as providing fish habitat that supports a CRA fishery.

3.3.2.3 Tributary A - Reach 3

During 2015 field work, Tributary A in the LAA downstream of the agricultural pond exhibited negligible canopy cover, low diversity of channel morphology, low diversity of substrate material, intermittent flow, silty substrate, and was assessed as providing low to moderate quality fish habitat for the performance of life functions such as spawning, overwintering, rearing and migration. Reach 3 (i.e. downstream of the agricultural pond to the confluence with Indian Creek) was assessed as providing fish habitat that supports a CRA fishery.

3.3.3 Tributary B

Tributary B was assessed in the field in 2013. The observed characteristics were consistent with a surface depression or discontinuous drainage (as described in CVC and TRCA 2009). Tributary B was classified as a "simple contributing system to downstream fish habitat, with intermittent flow" (AECOM 2013).

In July 2015, an additional survey was conducted on Tributary B (**Figure 3.7**, **Appendix A**) to confirm conditions and obtain photographs of the channel ((Tributary B Photographic Record, **Appendix C**). Although there is a mapped watercourse at this location, the flow path was characterized by a shallow valley (low-lying depression) through an agricultural field. No defined channel was observed. Numerous large, round straw bales were situated along the flow path, which was lined by reed canary grass and various species of terrestrial vegetation. The channel through the agricultural field terminates approximately 50 m upgradient of Indian Creek and ends in an area that is actively ploughed. Surficial drainage flows overland through the meadow south of the agricultural field and converges into a short (25 m long) channel that directs flow to Indian Creek near transect TB2. This 25 m long channel likely conveys ephemeral flows, however the lack of connection between the lower 25 m and the upper area would preclude fish movement upstream. Tributary B is not functioning as fish habitat that supports a CRA fishery.

3.3.4 Tributary C

Habitat assessments were completed at three locations on Tributary C in the PDA. The three assessment sites were completed southeast of Lower Base Line. One assessment site was located approximately 220 m northeast of the CN tracks and 80 m southeast of Lower Base Line. The second assessment site was located approximately 150 m southwest of the CN tracks, adjacent

to Lower Base Line. The third assessment site was located immediately southeast of the intersection of Tremaine Road and Lower Base Line.

At the first assessment location, a dry, straightened, channelized feature was observed during field investigations. Dense grasses were present in-channel. The riparian area consisted predominantly of grasses and herbaceous species such as teasel (*Dipascus* sp.) The second assessment site was characterized by standing water and dense, short grasses in a straightened channel. The riparian area at the second assessment site consisted of shrubs and trees, with occasional patches of herbaceous understorey. Characteristics of the third assessment site differed substantially from the previous two, with high banks, predominantly cobble and gravel substrate, and denser canopy cover observed during field investigations. Water was observed at this location, but was only present interstitially within the coarse substrate material and was not deep enough to permit water quality or fish sampling.

Reaches of intermittent or diffuse flow would likely create obstructions to fish movement and migration in Tributary C. Site access restrictions did not permit observations downstream of the LAA to determine the presence of physical barriers to fish movement, passage or migration.

Tributary C in the LAA (**Figures 3.8** and **3.9**, Appendix A) is an intermittent, straightened, channelized watercourse that was assessed as providing low quality fish habitat for the performance of life functions such as spawning, overwintering, rearing and migration.

3.4 WATER QUALITY

During 2015 field investigations, the sampled reaches of Indian Creek and Tributary A had high conductivity. The United States Environmental Protection Agency (USEPA) reports that inland fresh waters capable of supporting diverse fish communities have conductivities ranging between 150 and 500 µmhos/cm (µmhos/cm are an equivalent unit to the µS/cm reported in **Table 3.3**) (USEPA 2012). Conductivity outside this range could indicate that the water is not suitable for certain species of fish or macroinvertebrates. The conductivity measurement in **Table 3.3** is a single point-in-time observation. However, the reporting of high conductivity is consistent with the summary information from the Milton Logistics Hub TDR - Hydrology and Surface Water Quality Baseline Study and Effects Assessment (Appendix E.15 of the EIS) (Stantec 2015) presented below, and is consistent with observations made by CH of an impacted system suffering from impaired water quality (CH 2002a, 2002b and 2009).

Water quality sampling was conducted in support of the Milton Logistics Hub Technical Data Report - Hydrology and Surface Water Quality Baseline Study and Effects Assessment (Appendix E.15 of the EIS) (Stantec 2015). The objective of the surface water baseline study was to describe and present the available information and characterize the baseline conditions of climate, hydrology, surface water and sediment quality in the LAA. The following is a summary of the results of the baseline study:

- Water quality sampling results for Indian Creek and Tributary A are consistent with trends in the regional water quality data. Results show elevated total phosphorus, aluminum and iron concentrations with transient and marginal exceedances of both Provincial Water Quality Objectives and Canadian Water Quality Guidelines for some metals. Water quality data are presented in Tables 4.5 and 4.6 in the Milton Logistics Hub TDR - Hydrology and Surface Water Quality Baseline Study and Effects Assessment (Appendix E.15 of the EIS) (Stantec, 2015).
- Copper and nickel concentrations in sediment exceeded Provincial Sediment Quality Guideline Lowest Effect Levels (PSQG LELs) in Indian Creek and Tributary A, while chromium concentrations exceeded the PSQG LEL in Tributary A.
- Sediment samples from Indian Creek and Tributary A did not exceed either the Canadian Council of the Ministers of the Environment (CCME, 2001) Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (CSQG-PAL) Interim Sediment Quality Guideline (ISQG) or Probable Effect Level (PEL) criteria for any of the monitored parameters.
- CH considers this reach of Indian Creek to be impaired, historically having had substantial issues with water quality.

In situ water quality measurements, observations made during aquatic field assessments, and information presented in the Milton Logistics Hub TDR - Hydrology and Surface Water Quality Baseline Study and Effects Assessment (Appendix E.15 of the EIS) (Stantec 2015) concur with assessments presented in background data, indicating that water quality within the LAA is impaired or impacted.

The Milton Logistics Hub TDR – Hydrogeology (Appendix E.6 of the EIS) (Stantec 2015) includes observations of downward vertical hydraulic gradients beneath Indian Creek and its associated tributaries, suggesting that these features function to provide groundwater recharge and are therefore not fed by groundwater upwellings. This is consistent with the warmwater thermal regime and associated warmwater fish communities of Indian Creek and Tributary A. Analysis of temperature data collected in support of the Milton Logistics Hub TDR – Hydrology and Surface Water Quality Baseline Study and Effects Assessment (Appendix E.15 of the EIS) (Stantec 2015) corroborates thermal regime classifications provided in the reviewed background data (CH 2002a, 2002b and 2009).

3.5 HEADWATER INVESTIGATION SUMMARY

Headwater tributaries were assessed at eight locations during field investigations conducted in 2013 (May, July and August) and 2017 (April and May).

Headwater features (Figure 2, Appendix A) consisted of surface depressions or discontinuous drainage (some with no defined drainage feature) with poor definition, an absence of riparian vegetation (i.e., active agricultural fields), and flows limited to periods following storm events (and presumed snow / frost melt conditions). The function of these features is to convey surface

flows from storm events from the agricultural fields to either Tributary A or Indian Creek. The features were dry in April and May 2017, as well as during late summer observations in August 2013.

As such, these headwater features were classified as either "simple contributing" drainage features or "no drainage feature observed" (AECOM 2013; CVC and TRCA 2009; Stantec 2017).

Therefore, these features were excluded when determining the extent of the LAA. Further detail regarding observed characteristics of these features is provided in Appendix D of the *Fish and Fish Habitat TDR* and in response to the Joint Review Panel's Information Request 1.1 (CEAR #574).

The field survey concluded that the eight unnamed headwater features contribute indirectly to downstream reaches of Indian Creek that support fish habitat. DFO's Fisheries Protection Policy Statement (DFO 2013) recognizes that some waterbodies that are part of or support CRA fisheries might not contain fish or support fish habitat.

Based on the above, the eight headwater tributaries are not considered fish habitat and are not part of a CRA fishery.

3.6 AQUATIC SPECIES AT RISK

No aquatic species at risk (SAR) were encountered during fish community sampling conducted in the LAA in 2013 and 2015, and no records of aquatic SAR occurring in the LAA were found in the review of background data.

MNRF's Natural Heritage Information Centre (NHIC) database (MNRF 2015) contains records for one aquatic SAR in the RAA, Silver Shiner (*Notropis photogenis*), with one historical record from 1983. This is consistent with 2015 aquatic DFO SAR maps (DFO 2015), which identifies the presence of an aquatic SAR in Bronte Creek (i.e., the downstream end of the RAA). The confluence of Indian Creek and Bronte Creek is approximately 5 km outside of the LAA. No SAR were found or are known to occur within the PDA or LAA for the Project.

Silver Shiner is listed as *threatened* by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (2011) but is listed as special concern under Schedule 3 of *Species at Risk Act* (*SARA*) and is not subject to the SARA prohibitions associated with species listed under Schedule 1. Silver Shiner is designated as *threatened* by the Committee on the Status of Species at Risk in Ontario (COSSARO 2008) and is protected under the provincial *Endangered Species Act 2007 (ESA*).

Preferred habitat of the Silver Shiner includes cool to warm, clear waters of medium to large watercourses, over bottoms of cobble and boulders (COSEWIC 2011). Key issues affecting this species include deteriorating water quality (turbidity, pollution and impoundments) and

changes to watercourse gradients (typically resulting from impoundments) (COSEWIC 2011). The high turbidity and impacted water quality within the LAA and PDA are unsuitable for Silver Shiner. As such, it is unlikely that the species would occur in the LAA or PDA.

3.7 SUMMARY

The fish community and habitat data collected at the Project site in 2013 and 2015 were generally consistent with those reported in the background documents (CH 2002a, 2002b and 2009; AMEC 2013a and 2013b). The fish community is dominated by warmwater species and no SAR, or species with highly specialized habitat requirements were encountered or anticipated in the LAA. One historical (1983) record of a fish provincially and federally regulated SAR (Silver Shiner) was found in the RAA well outside of the LAA, and habitat conditions in the LAA are not suitable for this SAR.

The fish community, physical habitat and background water quality data indicate a moderate to low habitat quality throughout the LAA.

After a review of background data and the field work conducted for the Project, Stantec has identified the main branch of Indian Creek in the LAA as moderate quality fish habitat. This rating is based on published guidance from DFO, MNRF, various Ontario Conservation Authorities, and generally accepted practices and standards for assessing fish habitat in Ontario, and is generally consistent with ratings from CH (2002a, 2002b and 2009). The relative diversity of fish species and age classes recorded, including centrarchids (sunfish and bass) and darters (known to be intolerant to pollution and siltation) (Scott and Crossman 1998) suggests moderate quality physical habitat conditions suitable for a range of species and life stages. However, impaired water quality, the general lack of specialized or limiting habitat features (such as ground water inputs), and poor riparian cover diversity present limitations to fish species diversity and productivity.

After a review of background data and the field work conducted for the Project, Stantec rates the reaches of Tributary A downstream of the CN tracks as low quality fish habitat. As with the rating given to Indian Creek, this rating is based on published guidance from DFO, MNRF, various Ontario Conservation Authorities, and generally accepted practices and standards for assessing fish habitat in Ontario. Characteristics of Tributary A indicate intermittent flow and dry channel conditions during some summer months. Poor quality spawning, rearing, and foraging habitat was observed in Tributary A. The low rating is due to the intermittent flow and substrates consisting predominantly of silt. Fish community data collected for the Project (Appendix D of the Fish and Fish Habitat TDR) indicate that Tributary A functions as rearing habitat for Largemouth Bass and White Sucker. While this would normally indicate a higher quality habitat ranking, fish community composition in Tributary A is influenced by the on-line agricultural pond in the lower reaches of the watercourse, as well as its proximity to Indian Creek. Since Tributary A to Indian Creek is intermittent, fish captured in the watercourse are likely only present seasonally

or less frequently and have migrated upstream from the main stem of Indian Creek or from the on-line agricultural pond when it contains water.

As the on-line agricultural pond is an anthropogenic alteration to the system, the rearing habitat potential is judged to be artificial and is not factored into the quality ranking of Tributary A. The anthropogenic pond contains potential poor quality spawning, rearing, and foraging habitat for Largemouth Bass and potential poor quality rearing or foraging habitat for White Sucker and small-bodied fish. The poor quality stems from low water levels that fluctuate with runoff events and therefore creates unstable habitat conditions, or occasionally the absence of water during summer months. Despite providing occasional refuge, this might preclude the regular use of this feature by most fish as a result of potentially low dissolved oxygen (DO) levels and high water temperatures. In addition, the negative thermal, sediment loading, and eutrophication effects of the pond outweigh the poor quality habitat functions and it is a prime candidate for removal and habitat enhancement that will benefit the overall fishery. The effects of anthropogenic on-line agricultural ponds are specifically identified in the Bronte Creek Watershed Report (CH 2002a) as opportunities for rehabilitation. This on-line pond in particular was identified for removal and rehabilitation as a subwatershed management goal (CH 2002a).

Upstream of the CN tracks, in Tributary A, flows are ephemeral and there is poor to no channel definition. This area is classified as a headwater feature and does not support a CRA fishery.

Tributary B is a shallow valley (low-lying depression) through an agricultural field with no defined channel. This tributary functions to convey flows from the agricultural fields downstream to Indian Creek. Tributary B is not currently functioning as fish habitat that supports a CRA fishery.

Tributary C is a straightened, channelized intermittent water feature that could support fish on a seasonal basis, but would provide low quality habitat during those periods when the feature contains water.

Both Indian Creek and Tributary A downstream of the CN tracks support a CRA fishery.

3.8 CONCLUSIONS

The following conclusions are based on background data and field investigations conducted during 2013, 2015 and 2017 for the Project. Based on this information, Stantec concludes that:

- The reaches of Indian Creek in the LAA for the Project provide moderate quality fish habitat that supports a CRA fishery.
- Tributary A (downstream of the existing CN tracks in the LAA) provides poor quality fish habitat that supports a CRA fishery.

- Tributary A (upstream of CN tracks), Tributary B and the assessed headwater features do not support a CRA fishery.
- Tributary C, within the PDA and LAA provides low quality fish habitat on a seasonal basis that supports a CRA fishery.
- The on-line agricultural pond that is part of Tributary A provides poor quality fish habitat that supports a CRA fishery, but the negative thermal, sediment loading and eutrophication effects of the pond outweigh the poor quality habitat functions and it is a prime candidate for removal and habitat enhancement that will benefit the overall fishery, as described in the Bronte Creek Watershed Study (CH 2002a).
- There are no aquatic SAR, or suitable habitat for aquatic SAR, known to occur in the LAA.

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4.0 EFFECTS ASSESSMENT

As presented in Table 6.11 of the EIS and copied as **Table 4.1** below, components for which a check has been entered in the cell have the potential to cause serious harm to fish:

Table 4.1: Potential Project-Environment Interactions and Effects on Fish and Fish Habitat

Project Components and Physical Activities	Potential Environmental Effects			
	Change in Fish Habitat	Change in Fish Movement, Migration and Fish Passage	Change in Fish Mortality	Change in Water Quality
CONSTRUCTION				
Site Preparation and Grading Activities	–	–	–	✓
Track Construction and Signals Installation	–	–	–	–
Terminal Infrastructure	✓	✓	✓	✓
Grade Separations	–	–	–	–
Utilities	–	–	–	–
Watercourse Realignments, Restoration and Naturalization	✓	✓	✓	✓
Construction Equipment and Operation	–	–	✓	✓
Air Contaminant Emissions	–	–	–	–
Acoustic Emissions	–	✓	–	–
Solid Waste Management and Recycling	–	–	–	–
OPERATIONS				
Truck Entrance/Exit (Gate)	–	–	–	–
Train Operations	–	✓	–	✓
Lift Operations	–	–	–	–
Equipment Maintenance	–	–	–	✓
Water Management	–	–	–	✓
Site Buildings, Linear Facilities and Associated Infrastructure	–	–	–	✓
Operation Labour Requirements	–	–	–	–

Table 4.1: Potential Project-Environment Interactions and Effects on Fish and Fish Habitat

Project Components and Physical Activities	Potential Environmental Effects			
	Change in Fish Habitat	Change in Fish Movement, Migration and Fish Passage	Change in Fish Mortality	Change in Water Quality
Air Contaminant Emissions	–	–	–	–
Acoustic Emissions	–	✓	–	–
Solid Waste Management and Recycling	–	–	–	–

NOTES:
✓ = Potential interactions that might cause an effect.
– = Interactions between the project and Fish and Fish Habitat are not expected.

An assessment of residual effects to fish and fish habitat was conducted, based on the presence and quality of fish habitat (as defined by the *Fisheries Act*), fish community composition, and habitat associations for important life processes at different times of the year. For each potential effect, the pathways to that effect are examined and mitigation approaches are identified that can minimize the effect. Finally, a discussion of the residual effect following mitigation or offsetting, as applicable, is provided for each effect discussed.

Appendix D presents DFO's Pathways of Effects (POEs), a summary of mitigation and residual effects related to Project activities. Habitat losses and gains within the PDA are discussed below for each watercourse.

4.1 ASSESSMENT OF CHANGE IN FISH HABITAT

4.1.1 Project Pathways

Activities associated with the construction of water management facilities, site buildings and associated infrastructure, watercourse realignments or temporary crossings have the potential to alter the riparian vegetation, stability of the watercourse or waterbody bed and banks, and in-water habitat. Habitat might potentially be removed or altered during watercourse realignment, channelization or infilling.

Work in or near water involving excavation and soil disturbance could potentially increase the rate of sediment input (particularly of fines) to the watercourse or waterbody, temporarily increasing the sediment load. Excavation near or in a watercourse or waterbody that disrupts the existing bed and banks might result in temporary or longer-term degradation of habitat quality in the affected area. The extent of this effect is determined by physical factors (e.g., channel width, flow characteristics, substrate types) and construction timing. Another factor is

the sensitivity of aquatic habitats relative to their importance in sustaining the resident aquatic biota. Sensitive habitat generally includes areas that are important for completing essential life processes, such as spawning, rearing, migrating and overwintering.

Riparian vegetation and bank stability are important watercourse and waterbody characteristics because they influence the rate of riparian soil erosion, provide filtration of overland flow from the surrounding land, and provide cover, cooling shade and food (e.g., terrestrial invertebrates) for fish. Loss of riparian habitat as a result of construction activities might reduce cover, increase water temperature and negatively affect invertebrate populations.

Recreational and commercial fish species in the RAA have diverse habitat requirements. While many species in the RAA are relatively tolerant to turbid waters, several species require clear water in which to complete critical life process. Construction activities might increase sediment input and mobilize sediment downstream in the watercourse, which might cover spawning substrate or otherwise alter fish habitat.

During operation, riparian vegetation management (including potential use of herbicides to control noxious or invasive riparian vegetation) has the potential to result in changes in fish habitat.

4.1.2 Mitigation Measures

In order to fulfill the design objectives, a combination of realignment and reconstruction of Indian Creek, Tributary A and Tributary C is required. These design objectives include the following mitigation measures to address geomorphological and biological considerations:

- Apply natural channel design principles to appropriately design and dimension the realigned channels, incorporating natural bed morphology (pools, riffles) and planform geometry
- Design the channel realignments such that they do not excessively aggrade or degrade
- Convey existing flows such that flood elevations are not increased, bankfull frequency is maintained, and downstream channel morphology is not altered
- Design the channels to be free of barriers to fish migration
- Provide aquatic and riparian habitat that is functional over a range of flows

During construction, DFO Measures to Protect Fish and Fish Habitat (DFO 2019) should be followed, to reduce the risk of effects on fish and fish habitat (e.g., timing windows for in-water construction activities, fish relocations, sediment and erosion controls, operation of machinery, etc.). These design objectives and considerations are intended to satisfy requirements under the *Fisheries Act* to mitigate or offset potential serious harm caused by Project-related activities. Specifically, habitat altered or destroyed as a result of Project-related activities during construction will be offset by:

- Direct measures in the PDA:
- Creation of new, diverse habitat through the construction of a natural channel
- Creation of supplementary habitat through the development of offline, but connected wetlands for fish rearing and feeding habitat
- An increase in diversity of habitat types (e.g., grass spawning areas with suitable hydrology to permit egg deposition, maturation and movement of YOY back to the main branch)
- In-water habitat enhancement measures in areas of poor or degraded habitat (i.e., upstream of the realignment reach)
- Indirect measures in PDA, LAA, and RAA:
- Improved water quality through the removal of an on-line agricultural pond and construction of a SWM system (increase in water quality, decrease in average water temperature)
- Increased riparian cover along the watercourse (decreased average water temperature, increased bank stability, increased cover, increased and more diversified allochthonous inputs)
- Naturalization and revegetation of the Indian Creek subwatershed (improved water quality and flow regime, which can result in reduced erosion, more baseflow, lower peak flows)
- Improved habitat conditions that could facilitate the possible future re-establishment of Silver Shiner (SAR)

Potential operational effects will be mitigated through successful implementation of the SWM plan.

The SWM infrastructure within the PDA will mitigate terminal sediment loads that would otherwise move to the watercourses. Oil/grit separators will receive all drainage area inflows into each SWM pond and will be designed to reduce sediment loads from the PDA to Tributary A and Indian Creek. The SWM ponds will be designed to attenuate active storage discharges to account for locally-derived erosion and sediment control criteria (AMEC 2013c). The SWM ponds will be designed to meet MOE Stormwater Management Planning and Design Manual (2003) guidelines which provide target removal rates for total suspended solids (TSS) and total phosphorus of 80% and 70%, respectively. TSS concentrations are commonly used to represent sediment concentrations in the water column. The removal of sediment by the SWM ponds will also mitigate potential metal compound loadings.

The empirical Revised Universal Soil Loss Equation (RUSLE) for application in Canada and an empirical phosphorus loading model were used to estimate sediment and phosphorus surface run-off loads, respectively, for the pre- and post-development land use conditions within the PDA. The changes in contaminant loads to local receiving watercourses will result in positive,

localized residual effects with estimated PDA reductions in TSS and total phosphorus loads of 44% and 40.5%, respectively (Surface Water TDR, EIS Appendix E.15). This will contribute to improvement on a subwatershed level, as the Indian Creek subwatershed is currently known to be impacted by high nutrient and sediment loads.

4.1.3 Residual Project Effects: Change in Fish Habitat

Indian Creek

During the development of site plan layout, the Project considered two alternatives for how the construction and development of the Terminal would have regard for the integrity of Indian Creek given the required design requirements for the Terminal. Based on the design and layout of the proposed Terminal, encroachment into a portion of Indian Creek that currently flows along the CN mainline was identified. To address this and considering the long-term impacts on the Terminal and Indian Creek, the following two options were explored:

(a) construction of a retaining wall immediately adjacent to Indian Creek to allow for the construction of the terminal while maintaining the current location of the creek; and

(b) realignment of Indian Creek to relocate it away from the terminal and its operation.

The first option would involve the construction of a 4 m high (maximum height) by approximately 285 m long concrete retaining wall along the northeast bank of Indian Creek. To avoid in-water works a smaller work pad used for the temporary storage and movement of containers would also have to be built.

A retaining wall at this location was not considered a long-term solution to stabilizing the banks near the mainline for two main reasons. First, a retaining wall potentially compromised the allowance for natural stream functions such as meander migration (planform adjustment) and channel widening. Second, a retaining wall minimized the implementation of riparian habitat along Indian Creek in comparison to the level of habitat enhancement opportunities that could be afforded with a relocation option. This structural solution to the protection of the Terminal and CN's existing mainline would also result in the hardening of the outer bank of Indian Creek. In comparison, the realignment and infilling alternative allows for a larger separation between Indian Creek and Terminal operations. This option also provides the opportunity to incorporate naturalization, restoration and enhancements to improve aquatic and terrestrial corridor functions. This approach also addresses worker safety concerns by removing a potential falling hazard that would be associated with the retaining wall option. Further discussion is presented in Section 2.2.3.8 of the EIS (pages 35-36).

The relocation option directly addresses existing erosion concerns along Indian Creek, where flows near the existing CN mainline have created or aggravated slope instability causing erosion and slumping in this area. Given its ability to provide a long-term solution to erosion hazards, to accommodate the Terminal design requirements and to create a naturalized channel and corridor with enhanced aquatic and terrestrial habitat, the realignment/relocation alternative was preferred. The channel design also incorporates maintenance of flood conveyance and the connection of Indian Creek to its floodplain, which benefits flood management and corridor functions of Indian Creek.

The proposed footprint of the Project will require 1,075 linear m of Indian Creek to be removed, representing a bankfull area of 11,503 m^2. The permanent alteration of 1,075 linear m of Indian Creek will result in serious harm to fish. To offset the removal, 12,660 m^2 of new/altered and enhanced channel will be constructed, which reconnects with the existing Indian Creek channel approximately 150 m upstream of the Tremaine Road bridge crossing (**Figure 4.1 Appendix A**). The new/altered channel area has increased relative to the 2016 LOI due to a slightly greater channel length and the addition of several more connected wetlands. Habitat created as offsetting for the Project is anticipated to be of a higher quality than existing habitat as a result of increased channel bed and bank stability, improved in-water habitat features such as pools and riffles, enhanced riparian vegetation and the addition of connected wetland rearing areas. Additional habitat enhancements (wood toe protection and boulder clusters) were designed for a reach of Indian Creek located upstream of the realigned section. The areal extent of these activities is presented in **Table 4.2** and illustrated in **Figure 4.1**, **Appendix A.**

Table 4.2: Changes to Fish Habitat – Indian Creek

Feature	Area (m^2)	Comments
FEATURES TO BE REMOVED OR OVERPRINTED (LOSSES)		
Existing Channel	11,503 m^2	Permanently flowing, existing channel (fish habitat supporting several different species); value calculated based on bankfull channel dimensions).
FEATURES TO BE CONSTRUCTED (GAINS)		
New/altered channel (realignment) and seasonally connected wetlands	12,660 m^2*	Consists of 5,990 m^2 of channel and 6,670 m^2 of connected wetlands (wetland area includes the retained oxbow). Permanently flowing, newly created natural channel (realigned from existing; enhanced fish habitat supporting several different species) and seasonally connected wetlands that serve as potential spawning and rearing habitat (channel area calculated using channel length and proposed Bankfull width).
Habitat enhancements upstream of realignment	450 m^2**	Three instream boulder clusters and five areas of wood toe protection to reduce bank erosion.
NET EFFECTS		
Change in area (based on bankfull channel dimension)	1,157 m^2*	Although the channel length will be shorter, the bankfull stage of the realigned channel includes the connected wetlands, which will provide direct habitat for fish. The inherent benefits of the riparian and floodplain enhancements (below) will further contribute to overall habitat quality but are not factored into the calculation of habitat net change.
PROPOSED ENHANCEMENTS		
Riparian and floodplain enhancements	59,390 m^2*	Reduces erosion potential, provides nutrient inputs (thereby improving water quality).
NOTES * areas have changed relative to the December 1, 2016 LOI due to refinements of the channel design and enhancement areas ** enhancement of existing habitat; therefore, not included in the calculation of net effects		

Tributary A

Tributary A will be realigned from the downstream edge of the existing track infrastructure to its confluence with Indian Creek. Currently, the channel in this section is characterized as low quality fish habitat that consists of an intermittent channel and on-line agricultural pond. Based on fish capture records, the tributary and pond are used by YOY Largemouth Bass and White Sucker, Brook Stickleback, Bluegill, and Pumpkinseed.

The proposed changes will reduce the amount of rearing and foraging habitat available to the species listed above and will reduce spawning habitat for these species, with the exception of White Sucker, which spawn in relatively fast flowing water, over gravel substrates (Twomy et al. 1984; Scott and Crossman 1998). White Sucker spawning habitat conditions are absent from Tributary A and the on-line agricultural pond.

The loss of habitat associated with the on-line pond is difficult to enumerate due to the constantly fluctuating extent of wetted perimeter. When the pond berm was intact, impounded water levels were likely more consistent, resulting in relatively stable pond habitat conditions. The pond berm is now partially breached resulting in accelerated outflow, but enough of the berm is present to create temporary backwater conditions that fluctuate depending on the frequency of precipitation events and associated runoff volumes and therefore create unstable habitat conditions. At times, the pond may dry up completely. For the purpose of calculation of habitat removal, the low flow channel area through the existing, previously inundated area was used.

Habitat created as offsetting for the Project is anticipated to be of a higher quality than existing as a result of increased channel definition, increased morphological diversity, enhanced riparian vegetation and connected wetland rearing areas. Following completion of the proposed works, there will be a net gain of approximately 1,116 m^2 (includes culvert removal at the pond outlet) (**Table 4.3**).

Table 4.3 outlines the changes in available fish habitat based on Project activities, including the following measures to offset serious harm:

- Creation of 3,580 m^2 of new channel and seasonally connected wetlands, using natural channel design principles
- Removal of the existing culvert and installation of a channel through the berm at the downstream end of online pond, which daylights 13 m^2 of channel
- Construction of 21,123 m^2 of riparian and floodplain enhancements (including plantings and grading to reduce erosion potential)

Figures 4.2, Appendix A illustrates the offsetting measures that have been factored into the quantification of change calculations in **Table 4.3**. Detailed design drawings for the Tributary A realignments are provided in **Appendix B.**

Due to the lack of direct fish habitat in Tributary A upstream of the mainline, the footprint areas of Culvert 1, 2A and 2B are not included in the calculation of habitat enclosures or losses. The locations of Culvert 1, 2A and 2B are illustrated in **Figure 4.3**.

Table 4.3: Changes to Fish Habitat – Tributary A

Changes to Fish Habitat	Area (m^2)	Comments
FEATURES TO BE REMOVED, OVERPRINTED, OR ENCLOSED (LOSSES)		
Channel	2,594 m^2	Intermittent flow (seasonal fish habitat). Area based on bankfull width of 3.53 m and 735 m length as presented in the EIS (Stantec, 2015a).
FEATURES TO BE CONSTRUCTED		
New/altered channel and seasonally connected wetlands (from proposed location of culvert outlet of piped, realigned watercourse)	3,710 m^{2*}	Consists of 1,760 m^2 of channel and 1,950 m^2 of connected wetlands. Channel area is based on the designed channel length and bankfull width. Retains the same flow periodicity as the existing channel (i.e., intermittent), but construction is intended to result in a substantial increase in habitat quality.
Daylighting of channel through berm	13 m^{2**}	Improves upstream access.
NET EFFECTS		
Change in area (based on bankfull channel dimension)	1,116m^{2*}	Numerically, the net change in habitat area is expressed as a gain, with further benefits associated with improved habitat quality that the new channel will provide. Additionally, further benefits are associated with the riparian and floodplain enhancements (below), which will contribute to overall habitat quality
PROPOSED ENHANCEMENTS		
Riparian and floodplain enhancements	13,420 m^{2*}	Reduces erosion potential, nutrient inputs (thereby improving water quality). Area not included in calculation of channel habitat offset, however the inherent benefits add to the value of the offsetting.
NOTES * areas have changed relative to the December 1, 2016 LOI due to refinements of the channel design and enhancement areas ** not included in the calculation of net effects		

The values in Tables 4.2 and 4.3 differ from those presented in Table 6.12 and 6.13 in Section 6.5.1.9 of the EIS (Stantec 2015). This is based on refinements made to the Project design and further analysis of the proposed habitat functions of restoration, naturalization and

rehabilitation areas. Values were calculated using GIS to measure relevant polygons contained within the CAD files to produce the design drawings (**Appendix B**).

Tributary C

During field investigations, it was observed that Tributary C consists of a dry, narrow, and poorly defined channel within the PDA and LAA, transitioning to a dry, well defined channel with occasional reaches of cobble and gravel downstream of the PDA. To accommodate the Lower Base Line grade separation, the existing culvert and watercourse (which acts as a roadside ditch at this location) will be realigned (See **Figure 4.3**, **Appendix A**). The existing 23 m long corrugated steel pipe culvert will be replaced with a 75 m long by 2.4 m wide concrete culvert, fitted with baffles as per the design drawings (**Appendix B**). The channel realignment will result in the alteration of approximately 250 linear m and the enclosure of approximately 52 linear m (the difference between the existing culvert and the proposed culvert) of poorly defined channel that supports seasonal fish habitat. The installation of an approximately 30 m long culvert (Culvert 6) on this feature at the noise barrier will result in the alteration of approximately 30 m^2 of seasonal habitat. As a result of the low quality, seasonal habitat present in Tributary C, the proposed works will not result in serious harm to fish.

4.2 ASSESSMENT OF CHANGE IN FISH MOVEMENT, MIGRATION, AND FISH PASSAGE

4.2.1 Project Pathways

Fish movement and migration are important to local fish populations and assemblages to access habitat for lifecycle requirements. Isolated construction methods associated with infrastructure construction, channel realignment and in-channel enhancement work, as well as temporary vehicle crossings might result in a temporary blockage or diversion of flow resulting in the blockage of fish passage for a short duration. The degree of alteration or restriction will depend on the timing of construction and the mitigation measures applied. Acoustic emissions associated with construction and operations may alter fish behaviour, affecting movement patterns by causing fish to temporarily avoid or move away from the source of the noise.

Fish movement and migration are important to local fish populations and assemblages to access habitat for lifecycle requirements. Several recreational and commercial fish species in the RAA, as well as several fish species that might be prey for these fish, spawn in spring or early summer in smaller watercourses or waterbodies and require open migratory pathways to reach their spawning grounds (Scott and Crossman 1998; Holm et al. 2009).

On-line agricultural pond outlet structures can present barriers to fish passage (Baxter 1977; TRCA 2010; Conservation Halton and Hamilton Conservation Authority n.d.), cause increases in downstream water temperature during the summer months, corresponding to reductions in coldwater fish species (Lessard and Hayes 2003), as well as decreases in downstream in-water DO concentrations (Maxted et al. 2005).

Several studies (Smith et al. 2004; Hastings and Popper 2005; Popper and Hastings 2009; Voellmy et al. 2014) indicate that an increase in certain anthropogenically created noise (and associated vibrations) can cause effects on fish, such as:

- Avoidance of areas with elevated sound levels
- Changes in anti-predator behaviours of prey species
- Behavioural changes that can result in decreased fitness
- Temporary or permanent damage to sound receptors
- Communication and detection of other environmental noise

As discussed in the studies cited above, potential effects of noise on fish typically vary by intensity and duration, rather than by the specific source of the sound. Irregular and regular, repetitive increases in sound levels and increases in baseline, or ambient sound levels can affect each species differently. However, the literature cited above generally indicates that these types of noise have the potential to affect fish. Since the construction and operation of the Project will result in an increase in irregular, repetitive noise and an increase in ambient noise levels, Project-related noise and vibration has the potential to affect fish. As presented in Milton Logistics Hub TDR - Vibration Effects Assessment (Appendix E.18 of the EIS), operation of the Project is not anticipated to result in an increase in anthropogenically created noise (and associated vibrations) after the implementation of the proposed mitigation measures and increased distance between the tracks and facility from the Indian Creek (following channel realignment).

4.2.2 Mitigation Measures

- The new channel will be constructed in the dry, while leaving earthen plugs at the connection points. This will reduce the period when installation of coffer dams is potentially required, thus reducing potential to disrupt fish movement, migration and passage.
- Downstream flow will be maintained at all times when conducting in-water construction activities.
- Ensure water and pump intakes reduce or avoid disturbance of the watercourse bed and are screened with a maximum mesh size of 2.54 mm and an approach velocity of 0.038 m/s, consistent with DFO's Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO 1995). To accomplish this, where pumps larger than 15 cm diameter are used, place the intakes in a

mesh cage (2.54 mm) to reduce the approach velocity that fish are exposed to and prevent them from being impinged on the intakes. Maintain the screens free of debris.

- Do not withdraw more than 10% of the instantaneous water flow at any given time.
- Only conduct work during appropriate in-water work timing windows as set out in agency approvals. A typical timing window for warmwater watercourses in southern Ontario allows in-water work between July 1 and March 14.
- Follow DFO Measures to Protect Fish and Fish Habitat (DFO 2019), to reduce effects on fish and fish habitat (e.g., timing windows for in-water construction activities, fish relocations, sediment and erosion controls, operation of machinery, etc.).

4.2.3 Residual Project Effects: Change in Fish Movement, Migration, and Fish Passage

With the implementation of the proposed mitigation measures, it is expected that there will be no permanent changes in fish movement, migration or fish passage as a result of Project-related activities.

4.3 ASSESSMENT OF CHANGE IN FISH MORTALITY

4.3.1 Project Pathways

Fish are subject to two sources of increased mortality during construction, channel realignment, restoration, and naturalization: (a) through the direct risk of mortality during in-water construction activities (e.g., contact with machinery, impingement on pump intakes, accidental removal from a watercourse or waterbody via construction equipment or asphyxiation as a result of dewatering activities), or (b) through the accidental introduction of a deleterious substance during construction (described in the Section 4.4).

4.3.2 Mitigation Measures

- Stream diversions and culvert installation will be conducted in isolation of stream flows (e.g., dam and pump, flume, diversion).
- Project personnel are not permitted to fish on the work site.
- The Contractor will notify CN 72 hours before construction of any watercourse or waterbody crossing or diversions to ensure fish salvage operations are conducted, where required.
- Conduct fish salvages by a qualified aquatic biologist, where required, in accordance with permit conditions.
- Release captured fish to areas within the same watercourse, outside of the work area, where suitable habitat exists.

- Install erosion and sediment control at appropriate locations adjacent to all watercourses and/or water bodies, or as directed by the Environmental Monitor(s). Appropriate temporary erosion and sediment control structures shall be installed, maintained and monitored through all phases of construction.

In addition to the recommended measures listed above, activities near water will be carried out following standard guidance for items such as timing windows, sediment and erosion controls, and instream work approaches as outlined in the DFO Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013b), to reduce effects on fish and fish habitat.

4.3.3 Residual Project Effects: Change in Fish Mortality

It is expected that there will be a short-term increase in fish mortality risk as a result of Project-related activities, for the reasons described in Section 4.3.1. However, implementation of appropriate mitigation measures is expected to reduce the risk.

4.4 ASSESSMENT OF CHANGE IN WATER QUALITY

4.4.1 Project Pathways

The presence of suspended sediment in a watercourse or waterbody can result in biological effects. At lower suspended sediment concentrations, the effects include subtle behavioural changes in fish, such as avoidance reactions that might lead to higher energy expenditures by individual fish and changes in territorial responses in some species (Newcombe and Jensen 1996; DFO 2013b). At higher concentrations, fine suspended sediment, such as silts and clays, might induce sub-lethal effects, such as reduced feeding efficiency, decreased predator avoidance and lower growth rates (Newcombe and Jensen 1996). Fish mortality might also occur as a result of heavy gill abrasion at high sediment concentrations (Newcombe and Jensen 1996; DFO 2013b). Continuous, elevated sediment levels might reduce overall fish production in a watercourse or waterbody because of turbidity-related reductions in algae and in benthic and aquatic invertebrate production.

When water velocities are reduced, suspended sediment can settle out and smother benthic invertebrate communities or fish eggs and larvae if they are present in a watercourse and degrade water quality (Alberta Transportation 2009; DFO 2013b). If high volumes of fines (silt, clay and sand) are deposited, pool and run habitat can be in-filled or the voids in gravel and cobble bed materials might become embedded. This alteration of downstream substrate conditions affects the abundance and diversity of benthic invertebrate communities and availability of spawning areas (Reid and Anderson 2002; DFO 2013b).

Several recreational species present in the PDA, LAA, and RAA require clear water with gravel, pebble or rock substrate in which to spawn (Scott and Crossman 1998; Holm et al. 2009).

Therefore, suspended sediment concentrations and mobilization or deposition of sediment might affect spawning activities of the species.

4.4.2 Mitigation Measures

- Establish and clearly identify a riparian buffer before the start of clearing activities. Restrict disturbance in this area to activities associated with realignment, restoration and naturalization. Install erosion and sediment control at appropriate locations adjacent to all watercourses and/or waterbodies, or as directed by the Environmental Monitor(s).
- Install and maintain appropriate temporary erosion and sediment control structures through all phases of construction.
- Ensure water from flumes, dams and pumps, diversions or other methods do not cause erosion or introduce sediment into the channel.
- Restrict grubbing, stripping and grading on approach slopes to watercourses and waterbodies to the amount required to allow safe passage of equipment and completion of the relevant work.
- Delay grading of the primary banks of watercourses and waterbodies until immediately before construction of temporary crossings and watercourse realignment, where practicable.
- Complete dewatering in a manner that does not cause erosion or allow sediment to re-enter a watercourse or waterbody through the use of appropriate sediment control devices.
- Collect and treat stormwater run-off from the Terminal prior to release to Indian Creek or Tributary A.
- Follow DFO Measures to Protec Fish and Fish Habitat (DFO 2019), to reduce effects on fish and fish habitat (e.g., timing windows for in-water construction activities, fish relocations, sediment and erosion controls, operation of machinery, etc.).

4.4.3 Residual Project Effects: Change in Water Quality

Construction of SWM facilities associated with the Project is anticipated to reduce concentrations of TSS and other deleterious substances, resulting in a positive effect (low magnitude) to LAA and PDA water quality. The positive effect is considered low magnitude because the watercourse reaches in the PDA and LAA are already receiving inputs from outside those areas.

With the implementation of appropriate mitigation measures, operation and maintenance of the facility is not anticipated to result in changes to water quality.

4.5 SUMMARY OF PROJECT RESIDUAL ENVIRONMENTAL EFFECTS ON FISH AND FISH HABITAT

The Project includes changes to three watercourses that support fish or fish habitat – Indian Creek, Tributary A and Tributary C. Work associated with Indian Creek and Tributary A includes channel realignment or infilling, which will cause serious harm to the existing habitat that will require offsetting.

Where realignment is proposed for reaches of Tributary A and Indian Creek, implementation of offsetting measures will result in an increase of 2,273 m^2 of fish habitat (the combined increase in both watercourses), as presented in Section 4.1.3. Additionally, it is expected that the habitat created by the offsetting plan and the riparian and floodplain enhancements will result in an increase in habitat quality within the LAA and PDA. Therefore, it is anticipated that residual harm caused by Project activities will be offset effectively and no residual serious harm to fish will occur.

Works associated with Tributary C include installation of a 30 m long culvert beneath the proposed acoustic barrier, the realignment of 250 m of the tributary and addition of a longer culvert to facilitate watercourse flow beneath the mainline and around the proposed grade separation. As presented in Section 4.1.3, the proposed works in Tributary C are not anticipated to result in serious harm to fish as a result of the low quality, seasonal habitat provided by the watercourse.

A summary of the changes and impacts to fish habitat and how the offsetting plan will address the changes to fish habitat is provided in **Table 4.4.**

Table 4.4 Summary of Changes to Fish Habitat and Habitat Resulting from the Offsetting Plan

Watercourse	Changes and Impacts to Fish/Fish Habitat	How the Offsetting Plan Will Address the Changes
Indian Creek	Loss of 11,503 m^2 of moderate quality, warmwater habitat with a permanent flow regime. The creek provides habitat (spawning, rearing, foraging, overwintering) for a range of species (see Table 3.1) and life stages. Existing conditions include bank erosion and slumping near the existing CN mainline.	Creation of 12,660 m^2 of habitat using natural channel design principles and enhancement of 450 m^2. The new channel (including connected wetlands) will provide higher quality habitat as a result of increased stability of the channel bed and banks, improved habitat features (pools, riffles), enhanced riparian vegetation and addition of connected wetlands that will provide spawning and rearing habitat for resident species.

Table 4.4 Summary of Changes to Fish Habitat and Habitat Resulting from the Offsetting Plan

Watercourse	Changes and Impacts to Fish/Fish Habitat	How the Offsetting Plan Will Address the Changes
		Benefits of the 59,390 m^2 of enhancements in the riparian area and floodplain are discussed throughout this document.
Tributary A	Loss of 2,594 m^2 of poor quality habitat with an intermittent flow regime. The tributary provides poor quality spawning, rearing and foraging habitat (see species list in Table 3.1). Rearing habitat for Largemouth Bass and White Sucker is available in the lower portion of the tributary. The agricultural pond provides low quality habitat in summer that is unstable due to water level fluctuations and will be removed.	Creation of 3,710 m^2 of higher quality habitat and daylighting of 13 m^2 of channel. The area of potential rearing and foraging habitat for Largemouth Bass, Brook Stickleback, Bluegill and Pumpkinseed is reduced; however, the new channel creates White Sucker spawning habitat that currently is not available in Tributary A or the pond. The new channel replaces the pond with a natural channel. Benefits of the 13,420 m^2 of enhancements in the riparian area and floodplain are discussed throughout this document.
Tributary C	Alteration of 250 m, enclosure of 52 m (Culvert 7) and enclosure of 30 m (Culvert 6) of poor quality seasonal habitat.	Not applicable (no serious harm)

In addition to the offsetting plan, work in or near water will be carried out following the conditions and mitigation measures presented in Sections 4.1.2, 4.2.2, 4.3.2, and 4.4.2, which are consistent with the *Updated Consolidated Table of Mitigation Measures and Proponent Commitments* provided to Joint Review Panel on July 17, 2019. A summary of the project residual environmental effects on fish and fish habitat from the EA for the project is presented in **Table 4.5**.

Table 4.5: Summary of Project Residual Environmental Effects on Fish and Fish Habitat

Residual Effect	Residual Environmental Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic
Change in Fish Habitat	C	N	N	RAA	LT	C	I	D
Change in Fish Movement, Migration, and Fish Passage	C,O	N	L	PDA	ST	IR	R	D
Change in Fish Mortality	C	A	L	LAA	ST	IR	R	D
Change in Water Quality	C,O	P	L	LAA	LT	C	I	D

KEY

See Table 6.10 in the EIS for detailed definitions

Project Phase
C: Construction
O: Operation

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local assessment area
RAA: Regional assessment area

Duration:
ST: Short-term;
MT: Medium-term
LT: Long-term
P: Permanent

NA: Not applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological Context:
D: Disturbed
U: Undisturbed

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5.0 MONITORING

The following monitoring items are also discussed in further detail in the report entitled CN Milton Logistics Hub: Follow-up Program for Fish and Fish Habitat (Stantec, May 18 2021).

5.1 CONSTRUCTION MONITORING

Construction monitoring will be completed by a qualified fluvial geomorphologist or stream design engineer and a qualified fisheries biologist. The fluvial geomorphologist/design engineer and fisheries biologist will conduct monitoring to document consistency of construction activities related to channel design drawings and conditions of regulatory approval. Additionally, the fluvial geomorphologist/design engineer and fisheries biologist will recommend corrective actions in the event that deviations from the design drawings or unforeseen conditions are observed or are otherwise deemed necessary. An environmental monitor who is a Certified Inspector of Sediment and Erosion Control (CISEC) will monitor and document erosion and sediment control (ESC) success and will recommend corrective measures to the contractor when necessary. Proposed ESC measures are detailed in Drawing C-600 to C-602, under separate cover.

Regular inspections of ESC measures will be undertaken throughout all stages of construction until all disturbed areas have naturally stabilized. Monitoring will occur at the following frequencies:

- on a daily basis during in-water work
- after significant (>25 mm) rainfall events
- daily or as deemed appropriate by the environmental monitor during extended rain periods
- regular monitoring (e.g., weekly or as deemed appropriate by the environmental monitor) following in-water work
- all damaged or ineffectively functioning ESC measures will be repaired and/or replaced within 24 hours of the contractor being notified of a deficiency

Should dewatering of the excavated area be required (due to rain or minor amounts of groundwater), any water pumped from the excavated area will be pumped through a filter bag or into an area of undisturbed vegetation at least 30 m from the watercourse or an alternate area approved by the engineer/fisheries biologist.

The proposed ESC plan is detailed in Drawings C-600 to C-602, under separate cover. It is intended to minimize the effects of the channel works on nearby areas and the receiving water bodies (Indian Creek, Tributary A and Tributary C).

Erosion control fencing or other similarly functioning structure will be installed and maintained between flowing water and construction traffic or un-stabilized areas. Mud mats are proposed at construction entrances to minimize the transfer of sediments off-site.

Construction is proposed to be in short stages such that watercourse flows are diverted around a work area using pump-around operations. The work areas will be sized such that planned activities can be completed as quickly as possible to reduce the duration of pumping. A pump around detail is presented on Drawing C-503, under separate cover. Work will progress from upstream to downstream, with completed areas to be stabilized with seed and matting at the end of each work day. Additional construction notes are provided on Drawing C-500, under separate cover.

5.2 POST-CONSTRUCTION MONITORING

The requirements and frequency of the post-construction monitoring program will ultimately be set out as conditions of approval by CEAA and DFO. However, the following post-construction monitoring is proposed for five years following completion of the channel construction:

- Geomorphic monitoring to confirm that installed channel features are stable and that no excessive erosion is occurring throughout the Project reach
- Geomorphic monitoring to document the success of the installed channel features as measures to offset serious harm to fish
- Fisheries monitoring to document habitat use
- Vegetation monitoring to document establishment and propagation

Monitoring is proposed to begin the year of construction (year zero) and conclude in year five.

Annual reports will be prepared, outlining the results of the monitoring program and providing recommendations for maintenance, if necessary. A final monitoring report will be prepared and submitted at the end of year-5 summarizing monitoring results and presenting conclusions regarding the success of the offsetting measures as listed in Table 5.1.

Long-term maintenance, as necessary (i.e., beyond the five-year monitoring period), will include the removal of excess tree and shrub growth from the floodplain so that flow conveyance capacities are maintained.

A summary of the proposed post-construction monitoring program is outlined in **Table 5.1** with success criteria provided in **Table 5.2**. Further detail regarding each monitoring component is provided in Sections 5.3, 5.4, and 5.5 below.

Table 5.1: Proposed 5-Year Post-Construction Monitoring Program

Monitoring Year	Component	Details
Year 0	Geomorphic Monitoring	• Establish monitoring locations and photo points • Establish monitoring baseline through 'as-constructed' geomorphic assessment
	Fisheries Monitoring	• Visually assess the quality of fish and overall aquatic habitat and establish monitoring stations for year 1 • Verify the installation of fish and aquatic habitat structures
	Vegetation Monitoring	• Verify installation of plant materials as per planting plan
Years 1, 2, 3, 4 and 5	Geomorphic Monitoring	Spring • Visual assessment of Project conditions • Photos at photo points (including in-water structures) Fall • Geomorphic assessment as per Section 5.2.1
	Fisheries Monitoring	Late Spring/Early Summer • Supplement photographs taken during the geomorphic assessment • Annual assessment of fish species diversity and relative abundance of species as per Section 5.2.2 (late spring/early summer monitoring) • Annual visual assessment of fish habitat Fall • Annual assessment of fish species diversity, productivity and habitat use as per Section 5.2.2 fall monitoring
	Vegetation Monitoring	Fall • See Section 5.2.3 • Vegetation Assessment per contract warranty maintenance clause (year 1 and 2) • Visual assessment of vegetation as it relates to stability of the Project (year 3, 4 and 5)

Table 5.2: Criteria and Schedule to Assess the Implementation and Success of Offsetting Measures

Attribute	Success Criteria	Monitoring Schedule
Construction and Physical Form of Offset Measures (Geomorphic Assessments and Vegetation Monitoring)		
Profile	• Channel features remain generally within design ranges, without demonstrating excessive aggradation, degradation or profile adjustment	Year 0, 1, 2, 3, 4 and 5
Pattern	• The pattern features remain generally within design ranges, without demonstrating excessive adjustment from the design parameters	Year 0, 1, 2, 3, 4 and 5
Dimension	• Channel features generally remain within design ranges	Year 0, 1, 2, 3, 4 and 5
Pebble Counts	• Bed particle size remains consistent with riffle material design goals and objectives over the monitoring period	Year 0, 1, 2, 3, 4 and 5
Stability of Structures and Channel Banks	• Constructed habitat features remain in place as constructed or with only minor changes (e.g., wood toe protection, riffles). • The constructed channel is stable and not eroding (less than 5% of bank length shows signs of erosion requiring repair or no severe erosion areas exceed 5 m in length)	Year 0, 1, 2, 3, 4 and 5 Year 0, 1, 2, 3, 4 and 5
Vegetation Establishment	• Stem count of enhancement area achieves 70% of planting density*: o Tributary A Planting Density: 6,400 stems/ha o Indian Creek Planting Density: 2,940 stems/ha	Year 0, 1, 2, 3, 4 and 5
Habitat Use (Fisheries Monitoring)		
Species Presence	• Fish community (species diversity) is similar to baseline and/or reference data	Year 1**, 2, 3, 4 and 5
Life Cycle Usage	• Multiple year classes are present in the realigned channel segments (as demonstrated by length frequency distribution of fish captured) • Habitat is available for a range of fish life stages	Year 1**, 2, 3, 4 and 5
Abundance/ Productivity	• Catch per unit effort (CPUE) is similar to baseline data and/or reference data	Year 1**, 2, 3, 4 and 5

* Based on plantings of livestakes, trees and shrubs as per the landscape plans
** Low diversity, habitat usage and productivity in new channel segments is likely to occur in Year 1 prior to the establishment of the fish community in the newly created habitat areas (channel realignments)

5.2.1 Geomorphic Monitoring

Channel alignment stabilization and restoration programs are intended to meet regulatory requirements. Post-construction monitoring of the new channel bed and streambanks includes an evaluation of stability which provides an indicator of long-term function.

The purpose of the geomorphic assessment is to confirm that installed channel features are stable, and that no excessive erosion is occurring throughout the Project reach. Evaluation of stream characteristics within the realigned channels will include profile, pattern, dimensions and pebble count at established monitoring locations and photo points.

Monitoring is proposed to take place in years 0, 1, 2, 3, 4 and 5 after construction of the realigned channels. Year 0 monitoring takes place immediately after construction and sets the baseline for future years of monitoring.

Year 0 will include the establishment of monitoring locations and photo points and will establish monitoring baseline through 'as-constructed' geomorphic assessment. Years 1, 2, 3, 4 and 5 will include bi-annual monitoring in the spring and fall, as follows.

- Spring Assessment – visual assessment, including photo documentation of instream structures for geomorphic conditions
- Fall Assessment – geomorphic assessment of stream characteristics (profile, pattern, dimensions, pebble counts)

Geomorphic monitoring will be completed by a qualified geomorphologist or stream restoration engineer.

Using appropriate survey techniques, Indian Creek and Tributary A will be surveyed to document and assess the characteristics outlined below:

- **Profile:** The as-constructed (Year 0) longitudinal thalweg survey for a representative section of each reach (minimum length of section is 10 bankfull widths) will be conducted after construction is completed. Success will be determined based on whether the channel features remain generally within design ranges, without demonstrating excessive aggradation, degradation or profile adjustment.
- **Pattern:** The stability of the realignment stream pattern will be surveyed along the realigned channels. Parameters will include, at a minimum, radius of curvature, meander wavelength, and meander width ratio. Survey stationing will be based on design stationing. Success will be determined based on whether the pattern features remain generally within design ranges, without demonstrating excessive adjustment from the design parameters.

- **Dimension:** After construction, permanent cross-sections will be established in two riffles and two pools in each reach. Data collected will include, at a minimum, cross-sectional area, bankfull width, bankfull mean depth, bankfull max depth, flood-prone width, width-to-depth ratio, and entrenchment ratio. Success will be measured based on whether the channel features generally remain within design ranges. The 'as-constructed' cross-sections will be selected and established on the reach using permanent benchmarks once construction is completed.

Riffle pebble counts in the riffle cross-sections will be completed in each reach for each monitoring year using the modified Wolman Pebble Count procedure (Rosgen 1996). Data reported will include the D50 and D84 particle sizes. The first pebble count will be conducted after construction is complete, during the as-constructed (year 0) survey. As the restoration works stabilize with vegetation growth, material settlement and sediment transport through the system the pebble count particle size will adjust especially as interstitial spacing is infilled and imbrication occurs in riffle forms. Pebble counts will be used to document that bed particle size remains consistent with riffle material design goals and objectives over the monitoring period.

5.2.2 Fisheries Monitoring

Fisheries monitoring will be completed as an anticipated condition of *Fisheries Act* Authorization for the channel realignments. The monitoring will be performed by qualified fisheries biologists with experience in fish collection and identification and in post-construction monitoring of aquatic ecosystems to determine the effectiveness of proposed offsetting measures.

Monitoring is proposed to be consistent with methods used during baseline data collection, as described in Section 4.2.1(p. 14) of the TDR. Specifically, sampling will be conducted for five (5) years following construction of the realigned channels and culverts.

Habitat conditions and habitat use will be documented in representative stations in the newly constructed reaches of Tributary A and Indian Creek. Field methods for fish sampling will follow the Ontario Stream Assessment Protocol (OSAP), version 3 (Stanfield et al. 2013) as described below.

Two stations will be established in the realigned portion of each watercourse and one station will be established in a reference reach of each watercourse. Each station will be at least 40 m long and selected to sample a riffle-pool sequence as per the sampling protocol. Fish will be sampled using a backpack electrofisher and may be supplemented using seine nets and minnow traps. Monitoring is proposed in late spring/early summer and in the early fall as follows:

- Late spring/early summer – single pass sampling with block nets

  Captured fish will be enumerated by species. Observations will be recorded regarding the life stages observed for each species (e.g., young-of-the-year, juvenile, adult) and the

habitat type associated with the various life stages. Captured fish will be released outside of the sampling station (beyond the block nets). Habitat characteristics, level of effort, and GPS coordinates of each station will be documented.

The data collected during the spring monitoring events will be used to document habitat use at this time of year (e.g., spawning/rearing) as an indicator of the types of habitat provided by the offsetting measures. Species diversity and relative abundance of species will be compared between the reference stations and the stations located within the realigned reaches.

- Fall - multiple-pass sampling with block nets

  Captured fish will be enumerated by species, and a subsample of each species will be weighed and measured; the remaining fish will be bulk weighed. Captured fish will be released outside of the sampling station (beyond the block nets). Habitat characteristics, level of effort, and GPS coordinates of each stations will be documented.

  The data collected during the fall monitoring events will be used to calculate metrics, such as catch per unit effort (CPUE), biomass, and density. Fish size classes (length) will be used as an indicator of life stage, which can provide information with respect to habitat use. The data (abundance, length distributions, species diversity) will be compared to data collected in October 2015, to demonstrate that offsetting measures are functioning (i.e., the habitat is being used by a range of life stages and species) and that productivity (based on density and/or CPUE) has been maintained or enhanced. Data from within the realigned reaches will also be compared to the reference stations established for the monitoring program.

The final sampling designs, frequencies and types of data analysis will be determined through consultation with DFO.

5.2.3 Vegetation Monitoring

Channel stability is greatly enhanced by a healthy riparian vegetation community. A monitoring program will be implemented to verify the installation of plant materials as per planting plan and evaluate the successful propagation of native plant species (planted or naturally regenerated) (**Table 5.2**).

Riparian vegetation establishment will be assessed by a terrestrial biologist or landscape architect with experience in post-construction monitoring. Monitoring will occur in the first spring and fall following completion of construction (year 1), followed by a single fall visit in the following monitoring years (years 2 to 5).

Monitoring will be conducted to document the success of the revegetation efforts including the planting plan (Drawings L-300, L-310, L-500, and L-501, under separate cover) and natural

regeneration. Deficient, dead, or dying plant material will be identified and replaced by the contractor as necessary such that revegetation of the enhancement areas is achieved.

The landscape architect will provide input to the yearly post-construction monitoring report. Input will include details regarding monitoring methods, successes and deficiencies of the planting plan (Drawings L-300, L-310, L-500, and L-501, under separate cover), recommendations for remedial action, and a photographic record of conditions observed during monitoring.

5.3 CONTINGENCY PLAN

As requested by DFO during the Review Panel Hearing, the following contingency measures/adaptive management measures were developed to address unexpected situations or occurrences that could potentially affect fish habitat (within the PDA and downstream watercourses outside of the LAA). The following information is provided with respect to contingency planning (adaptive management) during construction and operation of the Project, with post-construction measures summarized in **Table 5.3**.

5.3.1 Construction

As identified in the Project mitigation measures presented in the EIS, contingency equipment and materials related to erosion and sediment control will be available on site prior to the commencement of in-water work. If construction monitoring concludes that mitigation measures are insufficient to prevent sediment from entering the watercourse or measures are in need of repair, additional measures will be implemented under the direction of the environmental monitor. Measures may include adding silt fencing, erosion control blankets or other measures in additional locations, or repairing existing measures where necessary.

Where de-watering of in-water work areas is required, back-up pumps, intake screens, hoses, and equipment will be available on site in order to maintain downstream flow in the event of equipment failure or additional materials are needed for work area isolation.

Where fish relocations are conducted prior to work in areas that are isolated from creek flows, fish removals will be repeated if high stream flows result in a breach of the isolation measures and water re-enters the work area. If necessary, the MNRF and DFO will be consulted if extensions to the in-water timing window are anticipated.

Contingency measures implemented during construction will be included in the construction monitoring reports.

5.3.2 Post-Construction

While the channels were designed to reduce the risk of failures, the channels are located in flashy hydrology areas with steepened channel slopes. Therefore, some repairs may be

expected to be necessary while vegetation is establishing during the proposed five-year monitoring program. Since the watercourse banks and floodplain vegetation will take time to stabilize following installation, natural adjustments and significant storms could produce minor erosion in the realigned channels. For this reason, it is important that the watercourses are inspected as per the monitoring plan. In many cases, minor areas of erosion will stabilize, while other areas may require restorative maintenance. Triggers for maintenance and repair activities are summarized in **Table 5.3**.

Maintenance activities could include minor grading and replacing soil, and reseeding areas and replanting vegetation that did not survive or washed away, removing logs or debris that have collected on the in-water structures and are altering the flow patterns sufficiently to threaten the integrity of the site. In rare instances it may be necessary to reconstruct some of the in-water structures after a large storm event if the fluvial geomorphologist/design engineer identifies conditions of instability. Materials installed during construction (e.g., boulders, sod mats) are usually still on site, and would be recovered, repositioned and reused. After the first two years, the requirement for maintenance activities is anticipated to decline as the vegetation establishes and increases the stability of the site. The results of the monitoring program will determine if ongoing inspection is recommended beyond the five-year monitoring period.

With respect to vegetation monitoring, deficient, dead, or dying plant material identified up to and including year 5 post-construction will be replaced if the success criteria identified in **Table 5.3** are not achieved.

Fisheries biologists will collaborate with the fluvial geomorphologists. If the fisheries monitoring data are indicative that the offsetting measures are not functioning as expected (e.g., decreasing biomass or diversity) biologists will consult with the geomorphologists to determine if the design is functioning as intended. As discussed above, areas requiring repair or maintenance will be addressed and modified as required, to maintain bank stability and provide diverse fish habitat.

If the stream characteristics are within the expected range (as per the geomorphic assessment) other factors that may influence fish communities and/or fish habitat in the PDA will be considered, such as weather conditions during and prior to the data collection, downstream barriers to fish passage and upstream influences on water quality or quantity. The results of other follow-up programs to be completed for this Project as conditions of approval (i.e., surface water quality monitoring) will be considered as input to this determination.

If monitoring results demonstrate that offsetting measures are not having the intended effect, CN would work with DFO to identify opportunities to implement additional offsetting measures to improve habitat within the Indian Creek watershed.

Table 5.3: Identification of Offset Plan Failures and Contingency Measures

Attribute	Identified Failure	Contingency
Construction and Physical Form of Offset Measures (Geomorphic Assessments and Vegetation Monitoring)		
Construction	• Channel not constructed as per drawings • Habitat features not constructed as per drawings	Fluvial geomorphologist to review construction and recommend corrective actions
Profile	• Channel features are not within design ranges (there is excessive aggradation, degradation or profile adjustment)	Fluvial geomorphologist to assess failure and recommend corrective actions (See Section 5.3.2)
Pattern	• The pattern features remain are not within design ranges (there is excessive adjustment from the design parameters)	
Dimension	• Channel features are not within design ranges	
Pebble Counts	• Bed particle size is not consistent with riffle material design goals and objectives	
Stability of Structures and Channel Banks	• Constructed habitat features (e.g., wood toe protection, riffles) are missing or not functional • Channel not stable (more than 5% of bank length shows signs of erosion requiring repair) or severe erosion areas exceed 5 m in length)	Repair or replace structures Implement restorative measures (e.g., minor grading, replacing soil, adding matting) (See Section 5.3.2)
Vegetation Establishment	• Stem count of enhancement area is less 70% of planting density*: Tributary A Planting Density: 6,400 stems/ha Indian Creek Planting Density: 2,940 stems/ha	Use warrantee inspections as opportunity for contractor to replace dead or dying plant material to bring # of stems/ha back to >70% of planting density. If certain species are experiencing high rates of mortality, replace these species with other approved species with demonstrated hardiness for site.
Habitat Use (Fisheries Monitoring)		
Species Presence	• Fish community (species diversity) is less than baseline studies and reference area in Year 2- to 5**	Collaborate with the fluvial geomorphologist to determine potential cause. Assess potential influence of external factors. Recommend corrective actions as required and based on available information.
Life Cycle Usage	• Multiple year classes that are present in baseline studies / reference area are not present in the realigned channel segments in Years 2 to 5 **	
Abundance/ Productivity	• Catch per unit effort (CPUE) is less than baseline data and reference area in Years 2 to5**	

* Based on plantings of livestakes, trees and shrubs as per the landscape plans
** Year 1 excluded as channel stabilizes and food sources become established

6.0 CONCLUSION

Based on the information contained in this LOI and the EIS, the works associated with the construction of the Project will require realignment of a reach in each of Tributary A, Indian Creek and Tributary C. The proposed realignments of Tributary A and Indian Creek resulted in serious harm to fish habitat that are part of, or support a CRA fishery.

To offset the serious harm, watercourse realignments and habitat creation will be completed using natural channel design principles and substantial areas of riparian enhancement are proposed.

The net change in fish habitat following implementation of mitigation and offsetting measures was determined by calculating the area of habitat loss for Tributary A and Indian Creek, and the proposed offsets that will be incorporated as part of the Project design. Within the PDA, there will be an overall net gain of 2,273 m^2 of fish habitat to the system when activities within the bankfull width of the watercourses are taken into consideration. In addition, there will be approximately 72,810 m^2 of riparian and floodplain enhancements that will contribute to improved habitat quality from both aquatic and terrestrial perspectives. By implementing the offsetting measures, the Project will achieve several goals and objectives of the Bronte Creek Watershed Study (CH 2002a).

Monitoring will be conducted during- and post-construction to document the success of the implementation of mitigation and offsetting measures. Contingency measures are recommended in the event that mitigation or offsetting measures are not functioning as intended.

As a result, Stantec is of the opinion that the proposed offsetting measures will result in a net gain of fish habitat in the Indian Creek subwatershed, and diversification of habitat types which will benefit various life stages of the fish community inhabiting this portion of the system. The proposed offsetting measures are therefore considered appropriate to support the issuance of a *Fisheries Act* Authorization for the Project.

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7.0 REFERENCES

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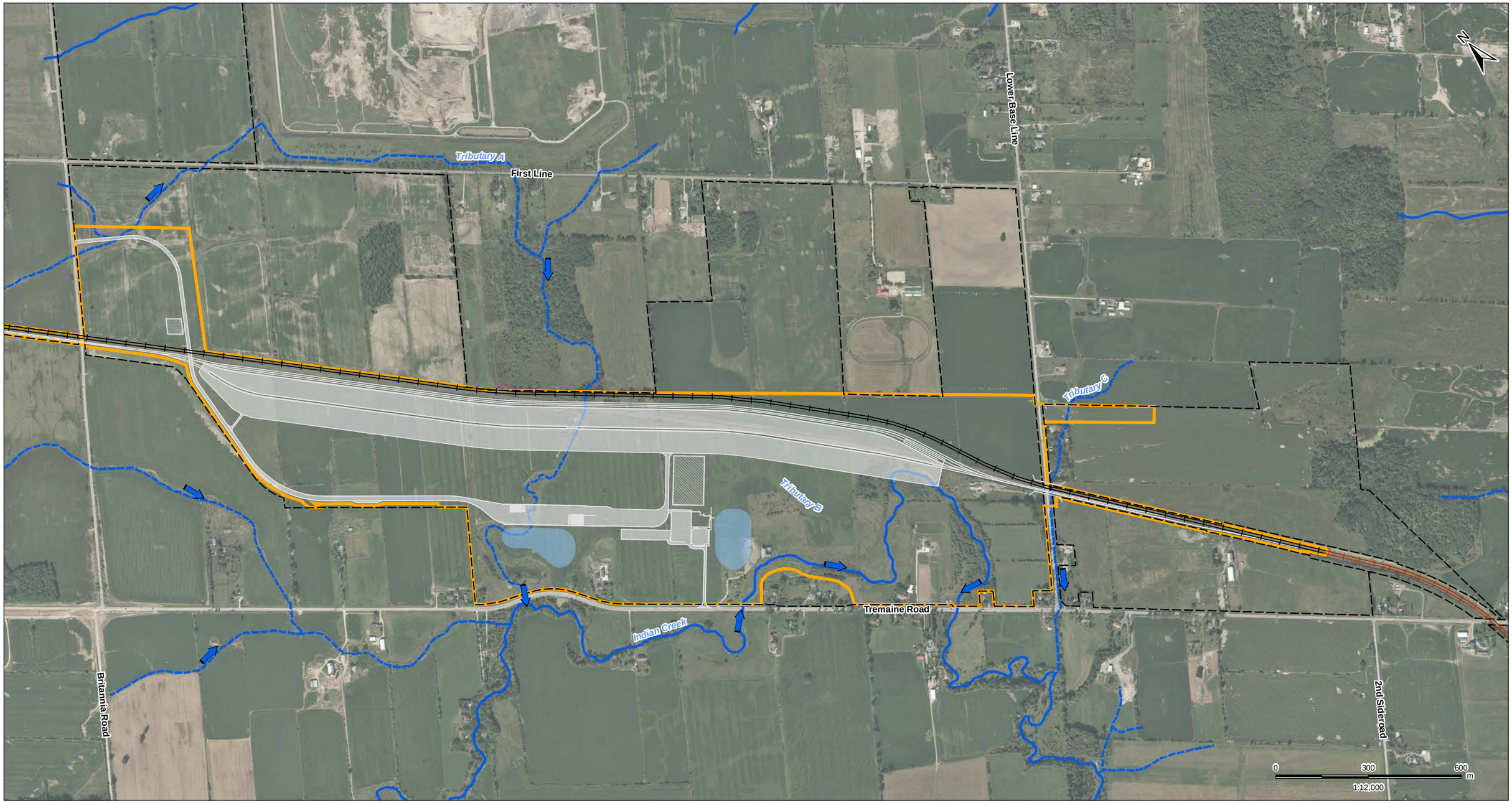
APPENDIX A: FIGURES



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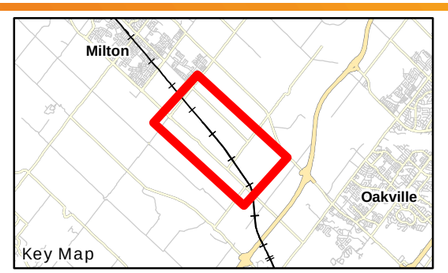
Legend

Project Components
- Project Development Area
- Existing Single Track Mainline
- Existing Double Track Mainline
- Double Track - Mainline
- Project Component
- CN-Owned Property

- SWM Pond

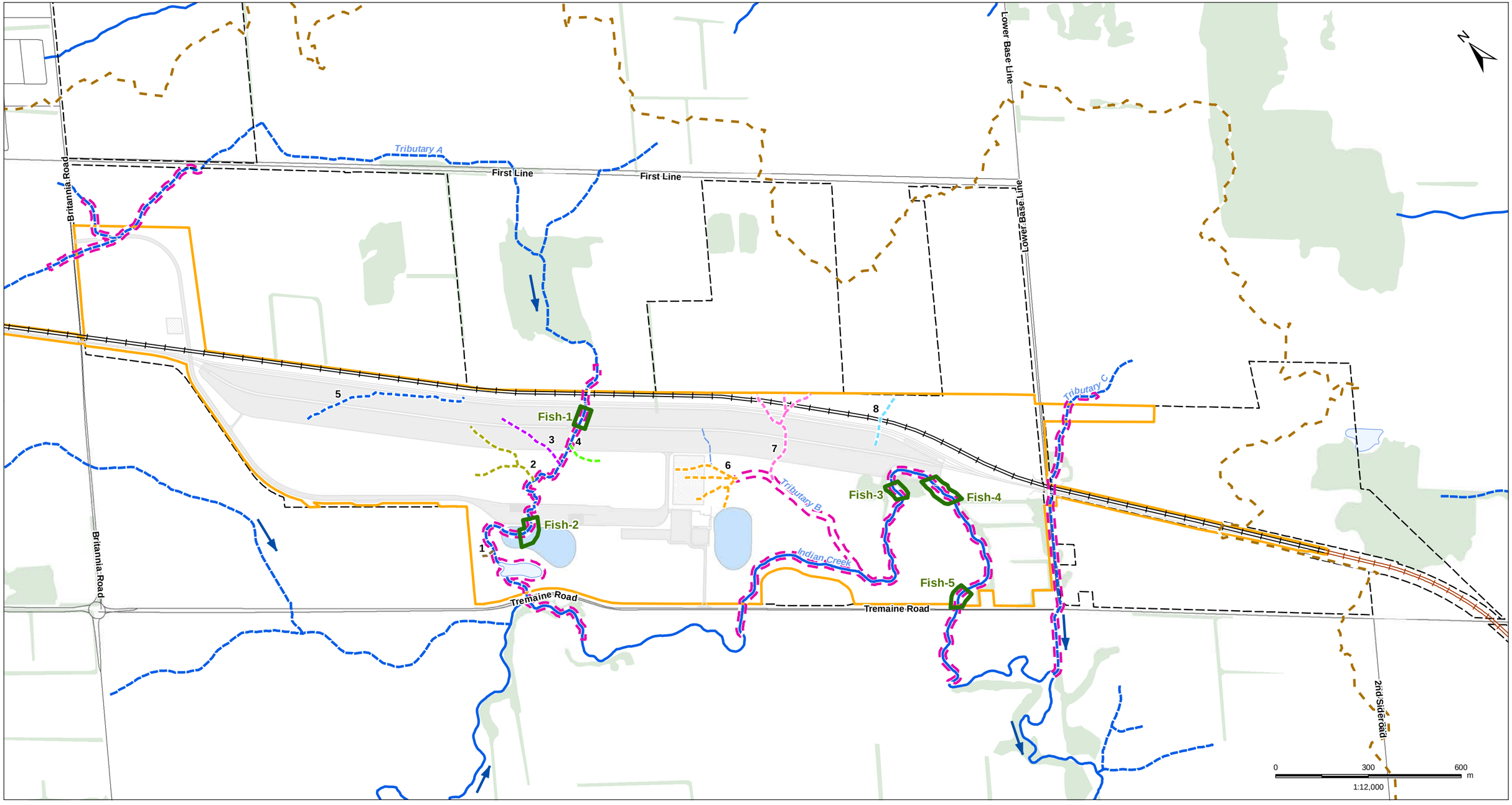
Existing Features
- Permanent Watercourse
- Intermittent Watercourse
- Waterbody
- Flow Direction



Client/Project
Canadian National Railway
Milton Logistics Hub

Figure No.
1

Title
Project Location



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Legend

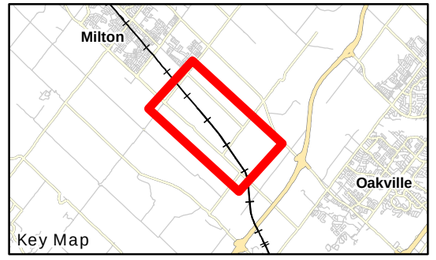
Project Components
- Project Development Area
- Regional Assessment Area (Indian Creek Subwatershed)
- Local Assessment Area (Stantec assessed 2015)
- Existing Single Track Mainline
- Existing Double Track Mainline
- Double Track - Mainline

- Project Component
- CN-Owned Property
- SWM Pond

Existing Features
- Permanent Watercourse
- Intermittent Watercourse
- Headwater Feature
- Waterbody

- Flow Direction
- Road
- Wooded Area
- Fish Collection Location (AECOM, 2013)

Headwater Features (AECOM, 2013)
- Headwater Feature #1
- Headwater Feature #2
- Headwater Feature #3
- Headwater Feature #4
- Headwater Feature #5
- Headwater Feature #6
- Headwater Feature #7
- Headwater Feature #8



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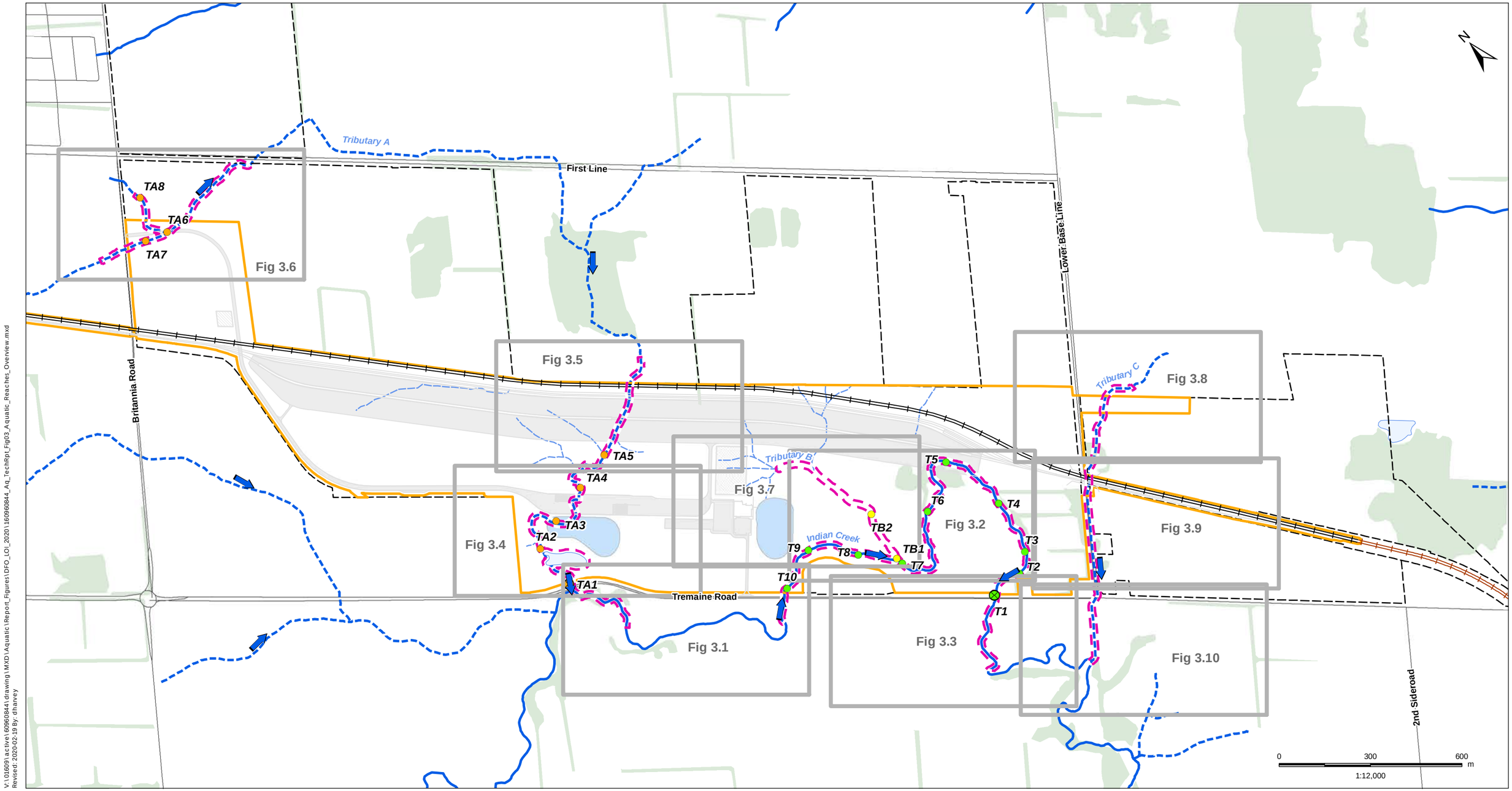
Canadian National Railway
Milton Logistics Hub

Figure No.
2

Title
Fish Sampling Locations and Indian Creek Headwater Drainage Areas



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Legend

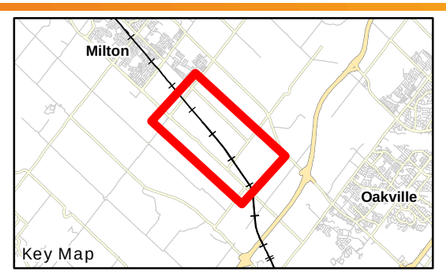
Project Components
- Project Development Area
- Local Assessment Area
- Existing Double Track Mainline
- Double Track - Mainline
- Project Component
- CN-Owned Property
- SWM Pond

Existing Features
- Permanent Watercourse
- Intermittent Watercourse
- Headwater Tributary
- Waterbody
- Road
- Flow Direction

- Wooded Area

Transect Locations (Stantec, 2015)
- Indian Creek (T#)
- Indian Creek - Tributary A (TA#)
- Indian Creek - Tributary B (TB#)

Water Quality Stations
- Indian Creek
- Indian Creek - Tributary A



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Canadian National Railway
Milton Logistics Hub
Technical Data Report - Fish and Fish Habitat (Appendix E.4)

Figure No.
3.0

Title
Aquatic Habitat Assessment Locations

Stantec

Notes

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Legend

Project
- Project Development Area
- Local Assessment Area
- Existing Single Track Mainline
- Existing Double Track Mainline
- Double Track - Mainline
- Project Component

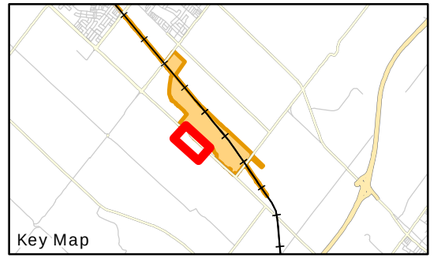
- CN-Owned Property
- SWM Pond

Existing Features
- Permanent Watercourse
- Intermittent Watercourse
- Headwater Feature
- Waterbody
- Flow Direction

Aquatic Assessment Transect Location and Photo Direction (June 2015)

Aquatic Habitat Assessment
- 1 Pool
- 2 Riffle
- 3 Run

Upstream / Left Bank / Right Bank / Downstream



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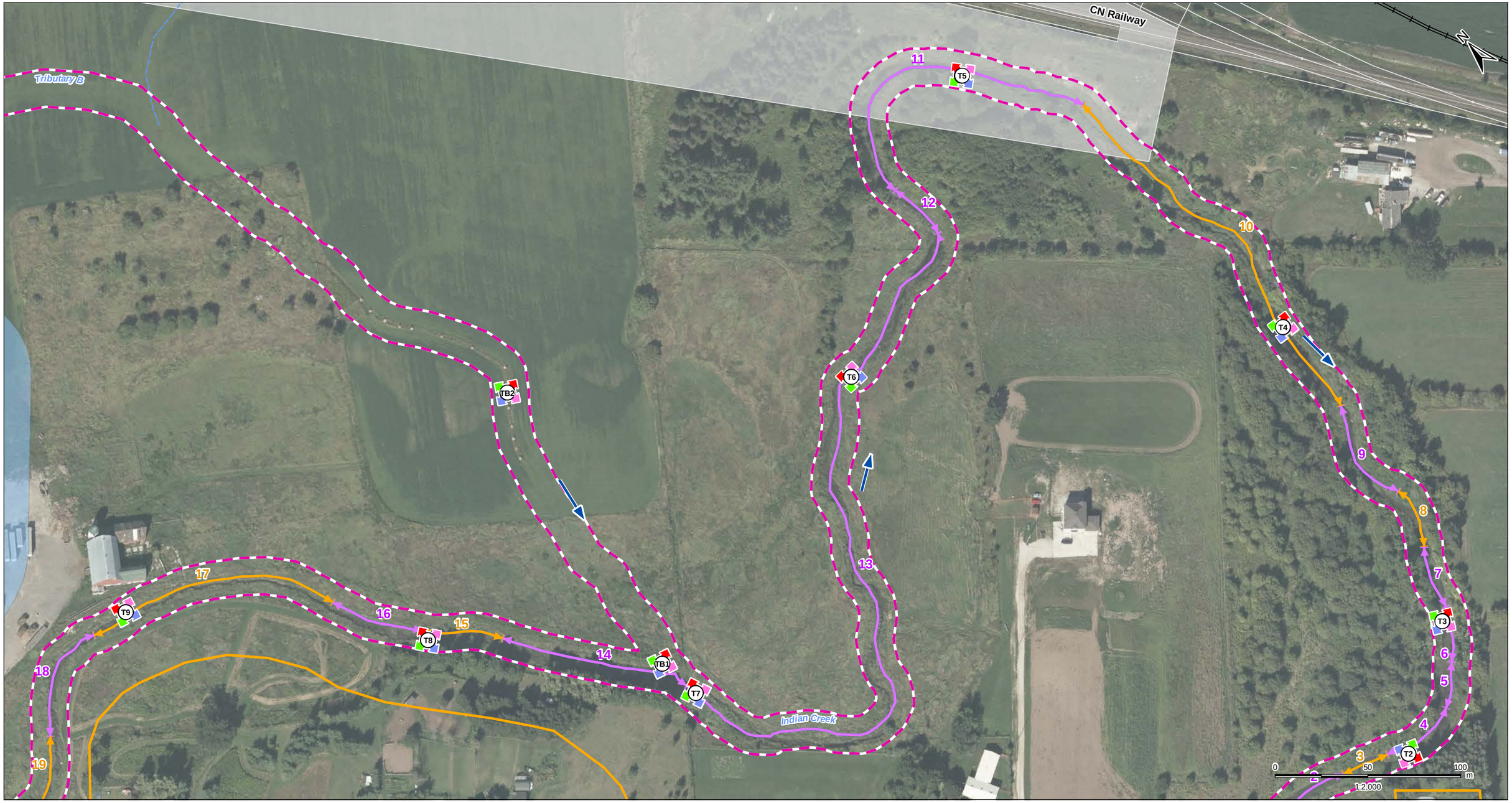
Client/Project
Canadian National Railway
Milton Logistics Hub
Technical Data Report - Fish and Fish Habitat (Appendix E.4)

Figure No.
3.1

Title
Aquatic Habitat Assessment Locations - Indian Creek (1 of 3)



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Legend

Project
- Project Development Area
- Local Assessment Area
- Existing Single Track Mainline
- Existing Double Track Mainline
- Double Track - Mainline
- Project Component

- CN-Owned Property
- SWM Pond

Existing Features
- Permanent Watercourse
- Intermittent Watercourse
- Headwater Feature
- Waterbody
- Flow Direction

Aquatic Assessment Transect Location and Photo Direction (June 2015)

Aquatic Habitat Assessment
- 1 Pool
- 2 Riffle
- 3 Run

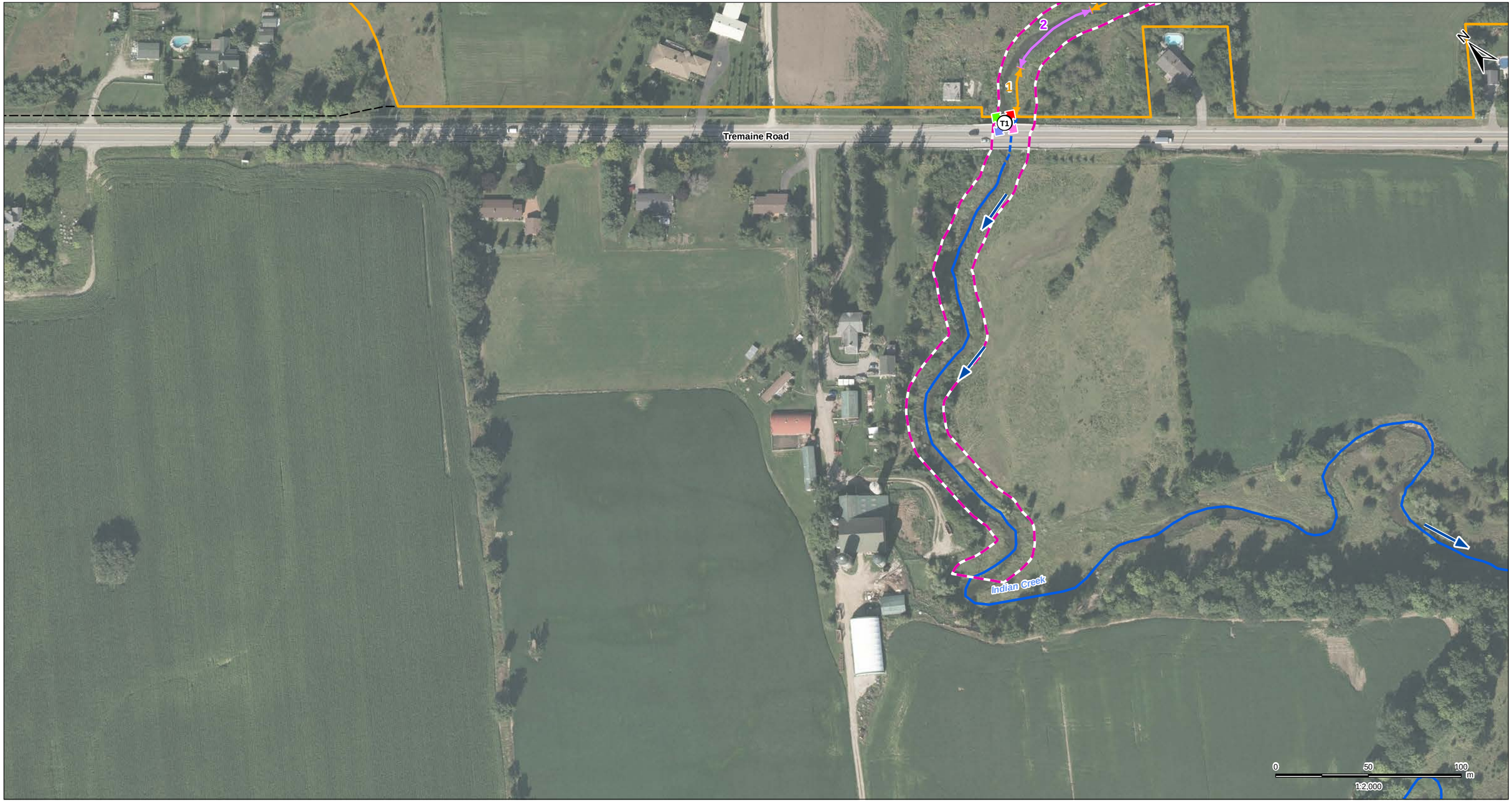
Upstream
Left Bank
Right Bank
Downstream

Key Map

Client/Project
Canadian National Railway
Milton Logistics Hub
Technical Data Report - Fish and Fish Habitat (Appendix E.4)

Figure No.
3.2

Title
Aquatic Habitat Assessment Locations - Indian Creek (2 of 3)



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Legend

Project
- Project Development Area
- Local Assessment Area
- Existing Single Track Mainline
- Existing Double Track Mainline
- Double Track - Mainline
- Project Component

- CN-Owned Property
- SWM Pond

Existing Features
- Permanent Watercourse
- Intermittent Watercourse
- Headwater Feature
- Waterbody
- Flow Direction

Aquatic Assessment Transect Location and Photo Direction (June 2015)

Aquatic Habitat Assessment
- 1 Pool
- 2 Riffle
- 3 Run

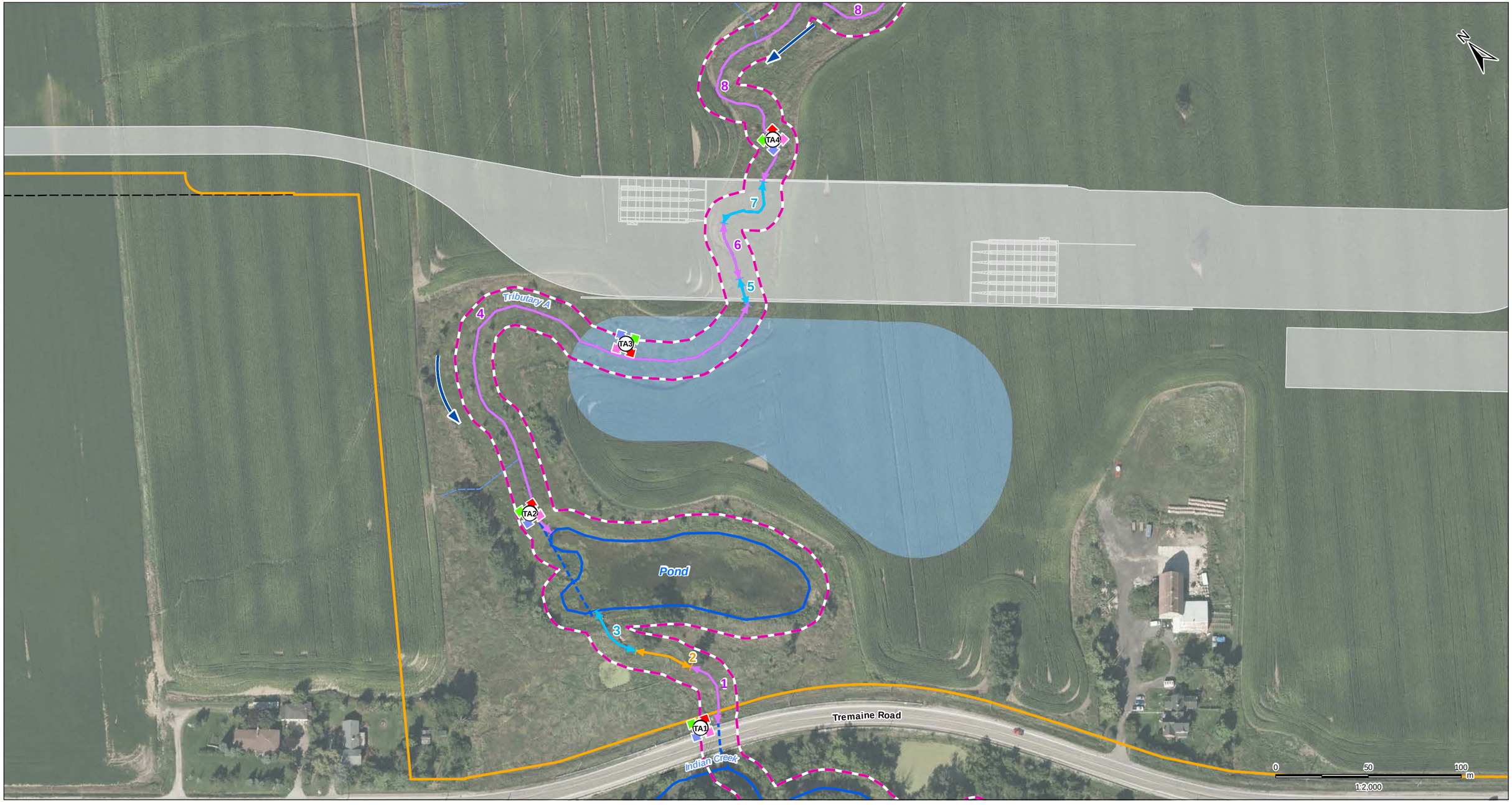
Upstream
Left Bank
Right Bank
Downstream

Key Map

Client/Project
Canadian National Railway
Milton Logistics Hub
Technical Data Report - Fish and Fish Habitat (Appendix E.4)

Figure No.
3.3

Title
Aquatic Habitat Assessment Locations - Indian Creek (3 of 3)



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Legend

Project
- Project Development Area
- Local Assessment Area
- Existing Single Track Mainline
- Existing Double Track Mainline
- Double Track - Mainline
- Project Component

- CN-Owned Property
- SWM Pond

Existing Features
- Permanent Watercourse
- Intermittent Watercourse
- Headwater Feature
- Waterbody
- Flow Direction

Aquatic Assessment Transect Location and Photo Direction (June 2015)

Aquatic Habitat Assessment
- 1 Pool
- 2 Riffle
- 3 Run

Upstream / Left Bank / Right Bank / Downstream

Key Map

Client/Project
Canadian National Railway
Milton Logistics Hub
Technical Data Report - Fish and Fish Habitat (Appendix E.4)

Figure No.
3.4

Title
Aquatic Habitat Assessment Locations - Indian Creek - Tributary A (1 of 3)

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Legend

Project
- Project Development Area
- Local Assessment Area
- Existing Single Track Mainline
- Existing Double Track Mainline
- Double Track - Mainline
- Project Component

- CN-Owned Property
- SWM Pond

Existing Features
- Permanent Watercourse
- Intermittent Watercourse
- Headwater Feature
- Waterbody
- Flow Direction

Aquatic Assessment Transect Location and Photo Direction (June 2015)

Aquatic Habitat Assessment
- 1 Pool
- 2 Riffle
- 3 Run

Upstream
Left Bank
Right Bank
Downstream

Key Map

Client/Project
Canadian National Railway
Milton Logistics Hub
Technical Data Report - Fish and Fish Habitat (Appendix E.4)

Figure No.
3.5

Title
Aquatic Habitat Assessment Locations - Indian Creek - Tributary A (2 of 3)

V:\01609\active\160960844\drawing\MXD\Aquatic\Report_Figures\DFO_LOI_20201160960844_Aq_TechRpt_Fig03_1of7_Aquatic_Reaches_Mapbook.mxd
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Legend

Project
- Project Development Area
- Local Assessment Area
- Existing Single Track Mainline
- Existing Double Track Mainline
- Double Track - Mainline
- Project Component

- CN-Owned Property
- SWM Pond

Existing Features
- Permanent Watercourse
- Intermittent Watercourse
- Headwater Feature
- Waterbody
- Flow Direction

Aquatic Assessment Transect Location and Photo Direction (June 2015)

Aquatic Habitat Assessment
- 1 Pool
- 2 Riffle
- 3 Run

Upstream
Left Bank
Right Bank
Downstream

Key Map

Client/Project
Canadian National Railway
Milton Logistics Hub
Technical Data Report - Fish and Fish Habitat (Appendix E.4)

Figure No.
3.6

Title
Aquatic Habitat Assessment Locations - Indian Creek - Tributary A (3 of 3)

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Legend

Project
- Project Development Area
- Local Assessment Area
- Existing Single Track Mainline
- Existing Double Track Mainline
- Double Track - Mainline
- Project Component

- CN-Owned Property
- SWM Pond

Existing Features
- Permanent Watercourse
- Intermittent Watercourse
- Headwater Feature
- Waterbody
- Flow Direction

Aquatic Assessment Transect Location and Photo Direction (June 2015)

Aquatic Habitat Assessment
- 1 Pool
- 2 Riffle
- 3 Run

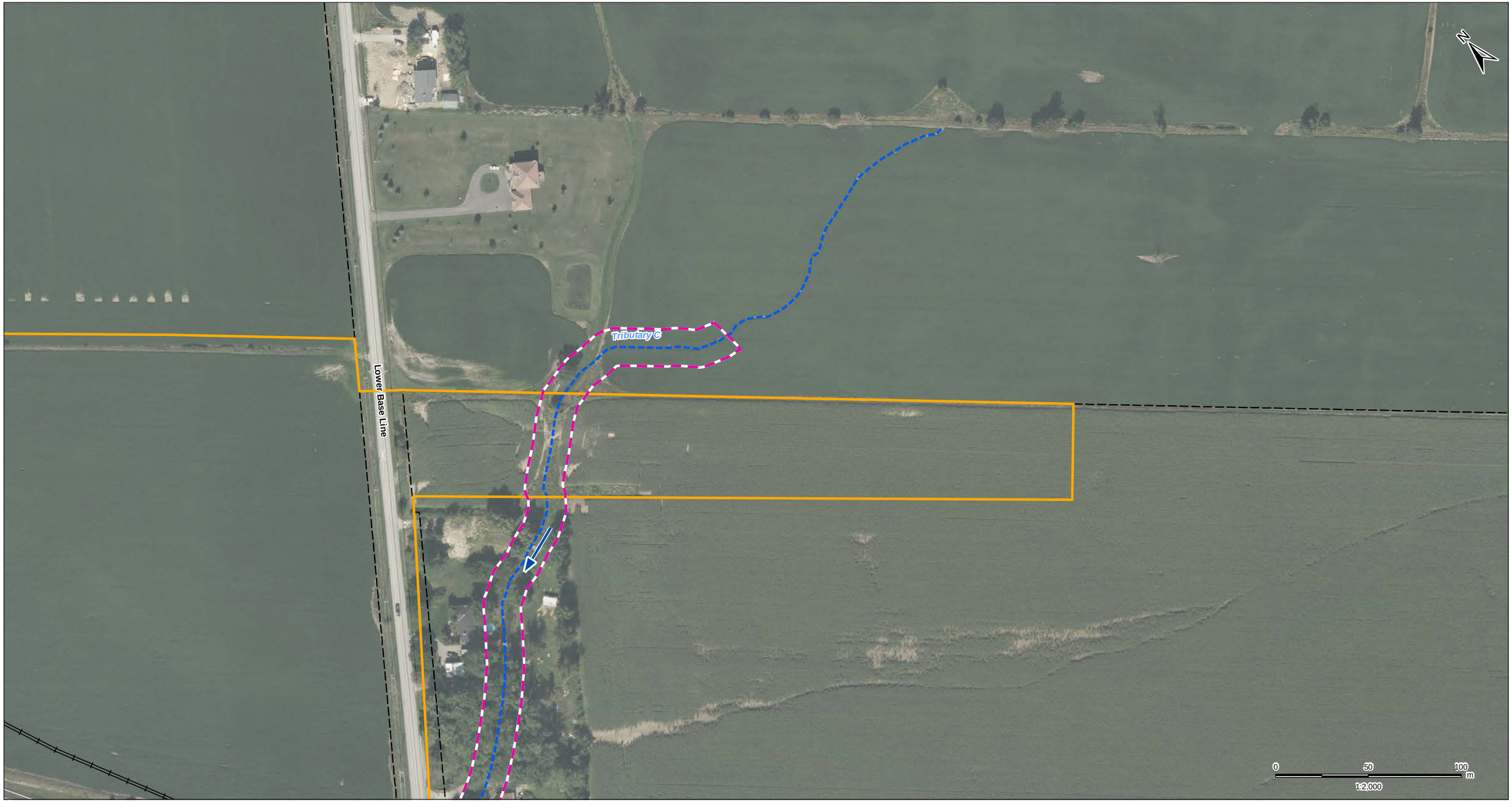
Upstream
Left Bank
Right Bank
Downstream

Key Map

Client/Project
Canadian National Railway
Milton Logistics Hub
Technical Data Report - Fish and Fish Habitat (Appendix E.4)

Figure No.
3.7

Title
Aquatic Habitat Assessment Locations - Indian Creek - Tributary B (1 of 1)



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Legend

Project
- Project Development Area
- Local Assessment Area
- Existing Single Track Mainline
- Existing Double Track Mainline
- Double Track - Mainline
- Project Component

- CN-Owned Property
- SWM Pond

Existing Features
- Permanent Watercourse
- Intermittent Watercourse
- Headwater Feature
- Waterbody
- Flow Direction

Aquatic Assessment Transect Location and Photo Direction (June 2015)

Aquatic Habitat Assessment
- 1 Pool
- 2 Riffle
- 3 Run

Upstream
Left Bank
Right Bank
Downstream

Key Map

Client/Project
Canadian National Railway
Milton Logistics Hub
Technical Data Report - Fish and Fish Habitat (Appendix E.4)

Figure No.
3.8

Title
Aquatic Habitat Assessment Locations - Indian Creek - Tributary C (1 of 3)

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Revised: 2020-02-19 By: dharvey

February 2020
160960844

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Notes

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Legend

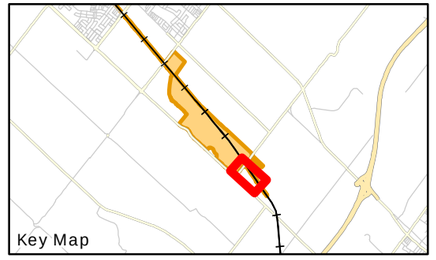
Project
- Project Development Area
- Local Assessment Area
- Existing Single Track Mainline
- Existing Double Track Mainline
- Double Track - Mainline
- Project Component
- CN-Owned Property
- SWM Pond

Existing Features
- Permanent Watercourse
- Intermittent Watercourse
- Headwater Feature
- Waterbody
- Flow Direction

Aquatic Assessment Transect Location and Photo Direction (June 2015)

Aquatic Habitat Assessment
- 1 Pool
- 2 Riffle
- 3 Run

Upstream
Left Bank
Right Bank
Downstream



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Canadian National Railway
Milton Logistics Hub
Technical Data Report - Fish and Fish Habitat (Appendix E.4)

Figure No.
3.9

Title
Aquatic Habitat Assessment Locations - Indian Creek - Tributary C (2 of 3)

V:\01609\active\160960844\drawing\MXD\Aquatic\Report_Figures\DFO_LOI_2020\160960844_Aq_TechRpt_Fig03_1of7_Aquatic_Reaches_Mapbook.mxd
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Legend

Project
- Project Development Area
- Local Assessment Area
- Existing Single Track Mainline
- Existing Double Track Mainline
- Double Track - Mainline
- Project Component

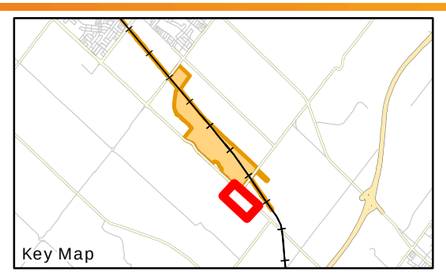
- CN-Owned Property
- SWM Pond

Existing Features
- Permanent Watercourse
- Intermittent Watercourse
- Headwater Feature
- Waterbody
- Flow Direction

Aquatic Assessment Transect Location and Photo Direction (June 2015)

Aquatic Habitat Assessment
- 1 Pool
- 2 Riffle
- 3 Run

Upstream
Left Bank
Right Bank
Downstream



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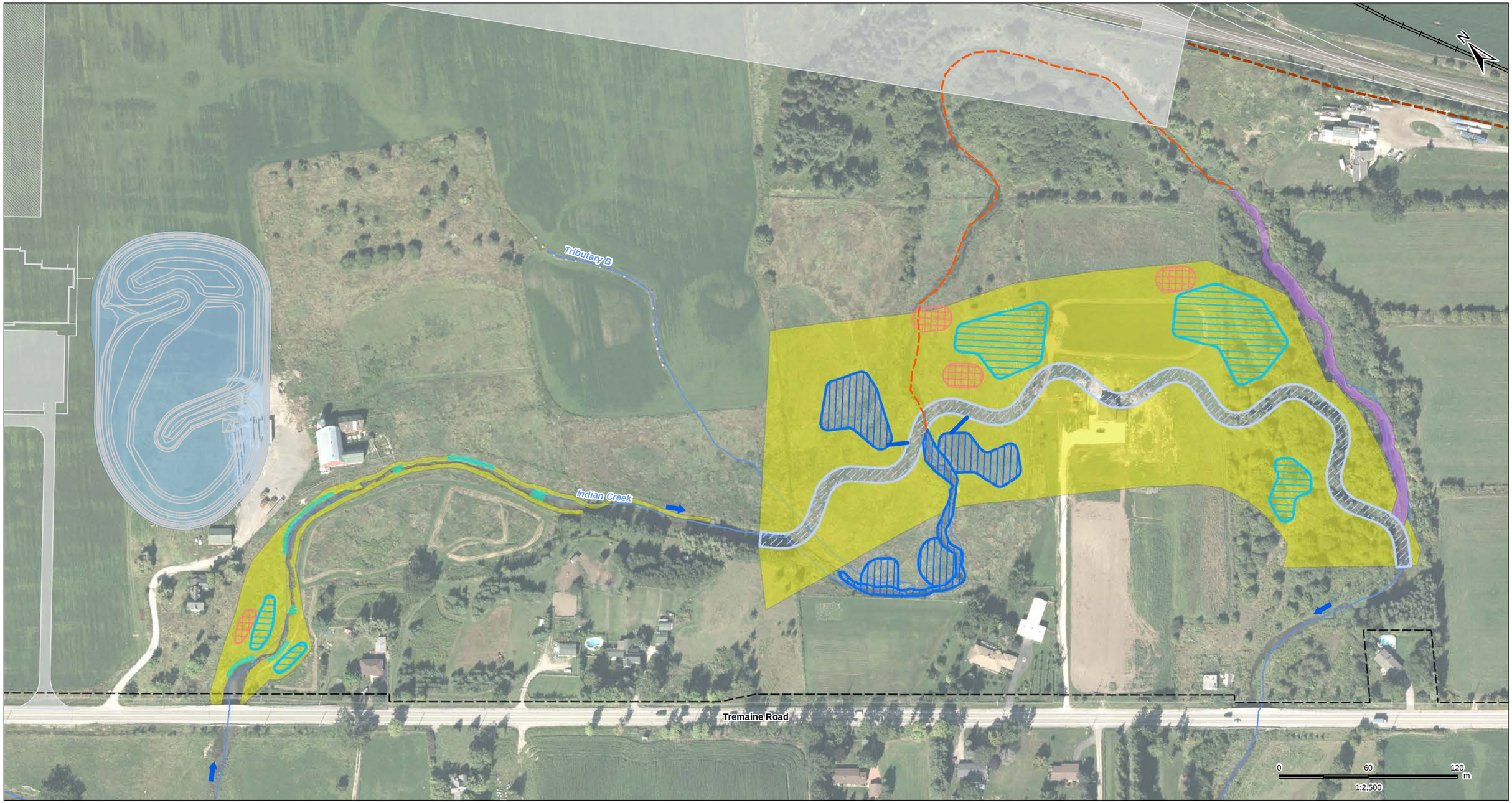
Milton Logistics Hub
Technical Data Report - Fish and Fish Habitat (Appendix E.4)

Figure No.
3.10

Title
Aquatic Habitat Assessment Locations - Indian Creek - Tributary C (3 of 3)



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160960844

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Legend

- Flow Direction
- Existing Watercourse (MNRF/ LIO)
- Existing Channel to be Removed (Loss)
- New Channel
- Connected Riparian Wetland
- Disconnected Riparian Wetland
- Turtle Nesting Mound
- Fish Habitat Enhancement
- Retained Channel
- Riparian Enhancement

Project Components

- Double Track - Mainline
- Project Component
- CN-Owned Property
- Proposed Noise Berm
- SWM Pond

Notes

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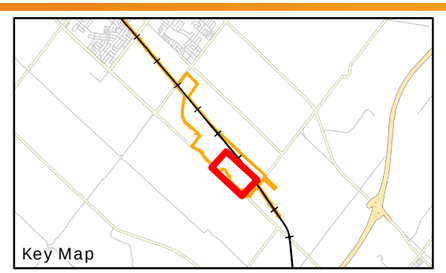

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Canadian National Railway
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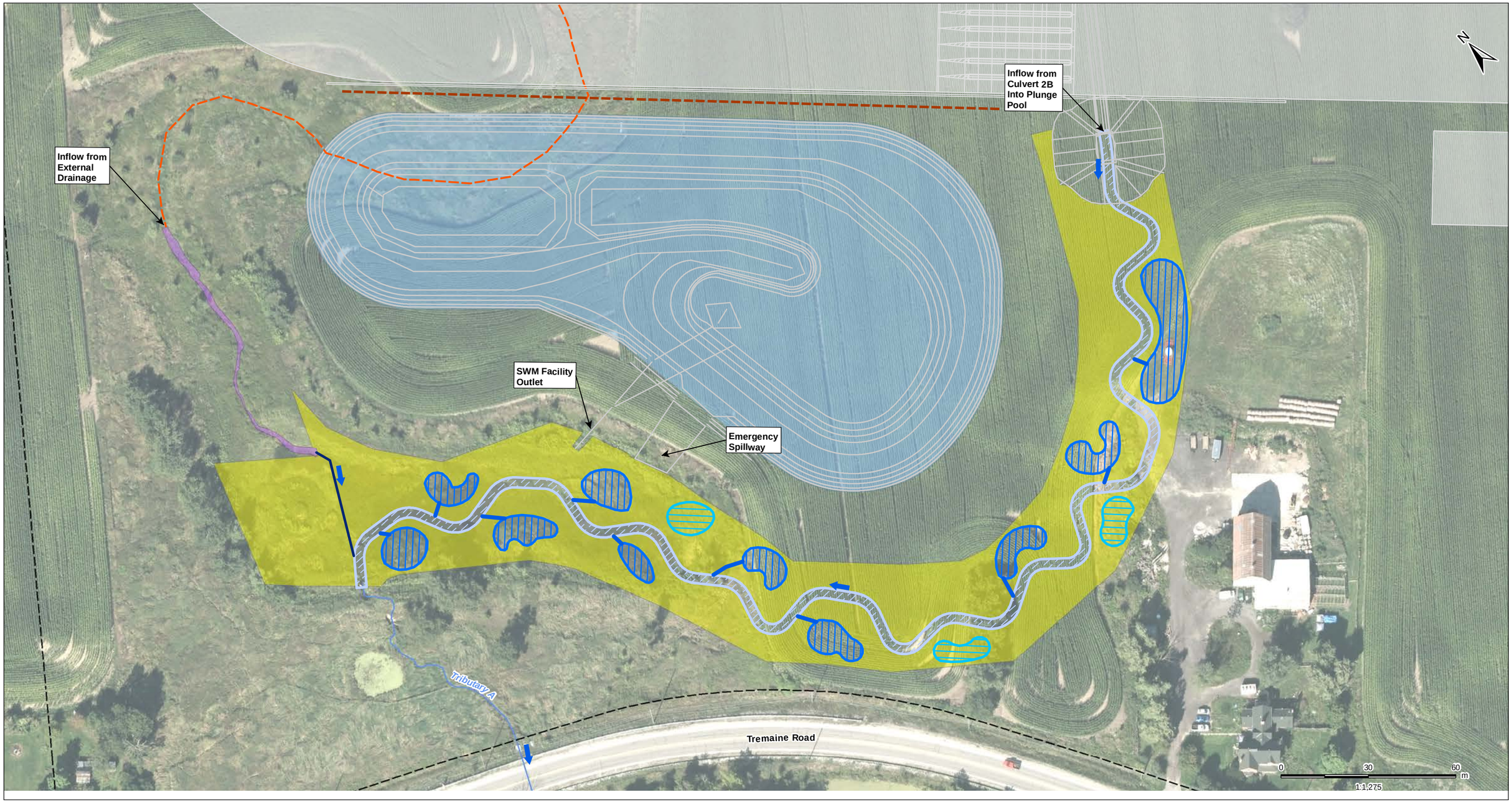
Figure No.

4.1

Title

Watercourse Realignment and Enhancements- Indian Creek



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Legend

- Flow Direction
- Outlet Channel
- Existing Watercourse (MNRF/ LIO)
- Existing Channel to be Removed (Loss)
- New Channel
- Connected Riparian Wetland
- Disconnected Riparian Wetland
- Retained Channel
- Riparian Enhancement

Project Components

- Project Component
- CN-Owned Property
- Proposed Noise Berm
- Concrete Pad
- SWM Pond

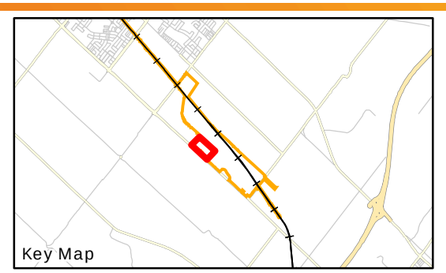

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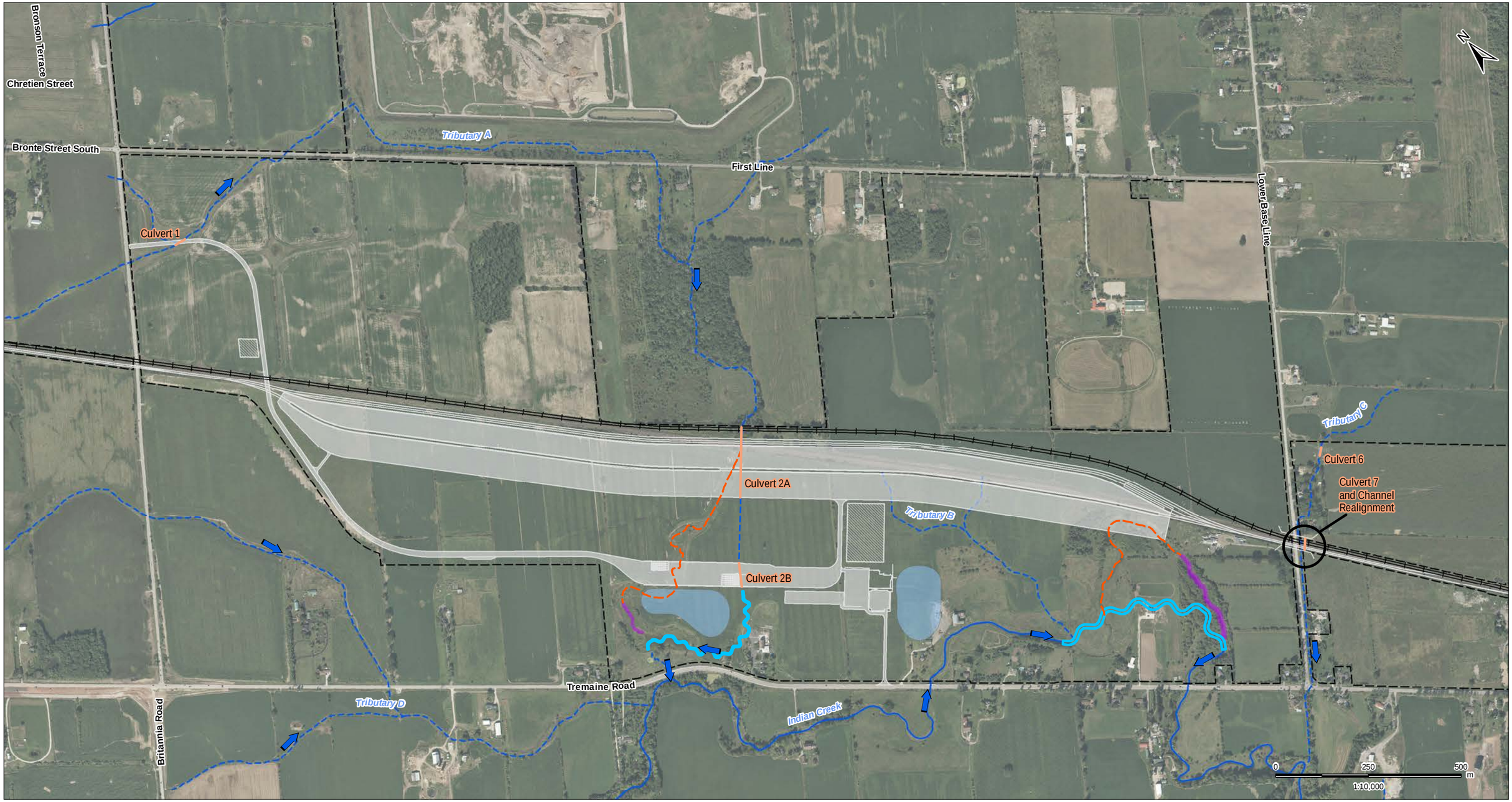
Figure No.

4.2

Title

Watercourse Realignment and Enhancements- Tributary A



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Legend

Existing Features
- Existing Single Track Mainline
- Existing Double Track Mainline
- CN-Owned Property

Project Components
- Single Track - Mainline
- Double Track - Mainline
- Project Component

- Proposed Culvert
- Permanent Watercourse
- Intermittent Watercourse
- Existing Channel to be Removed (Loss)
- Flow Direction
- Creek Realignment
- Retained Channel
- SWM Pond

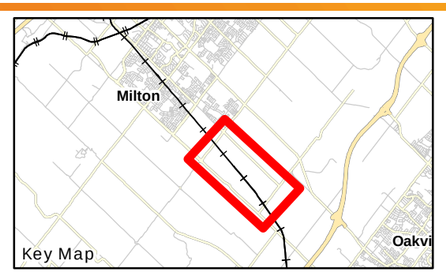

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Figure No.
4.3

Title
Culvert Locations- Tributary A and Tributary C

APPENDIX B:
PROJECT DESIGN DRAWINGS

(UNDER SEPARATE COVER)

APPENDIX C:
PHOTOGRAPHIC RECORD

Photo 1: Transect 1(Indian Creek)- Facing upstream.

Photo 2: Transect 1 (Indian Creek)- Facing downstream towards Tremaine Road.

Photo 3: Transect 1bank - Facing upstream.

Photo 4: Transect 1 bank.

Photo 5: Transect 1- Turbid water.

Photo 6: Transect 2- Facing upstream (northeast).

Photo 7: Transect 2- Facing downstream (southwest).

Photo 8: Transect 2- Facing upstream.

Photo 9: Transect 2 – Channel bank.

Photo 10: Transect 2- Turbid water.

Photo 11: Transect 3 - Facing upstream (north).

Photo 12: Transect 3- Facing downstream (south).

Photo 13: Transect 3- Channel bank.

Photo 14: Transect 3- Channel bank.

Photo 15: Transect 3 – Substrate and vegetation at bank.

Photo 16: Transect 4 - Facing upstream.

Photo 17: Transect 4- Facing downstream (south).

Photo 18: Transect 4 – Channel bank.

Photo 19: Transect 4 – Typical channel.

Photo 20: Transect 4- Channel substrate.

Photo 21: Transect 5-Facing upstream (north).

Photo 22: Transect 5- Facing downstream (south).

Photo 23: Transect 5 – Channel bank.

Photo 24: Transect 5 – Channel bank.

Photo 25: Facing upstream between Transect 5 and 6.

Photo 26: Facing upstream between Transect 5 and 6.

Photo 27: Facing upstream (northwest), at pool area in Indian Creek (between Transect 5 and 6).

Photo 28: Pool area in Indian Creek (between Transect 5 and 6).

Photo 29: Transect 6 - Facing upstream.

Photo 30: Transect 6 - Facing downstream.

Photo 31: Transect 6 – Channel bank.

Photo 32: Transect 6 - Channel bank.

Photo 33: Transect 6 - Facing upstream.

Photo 34: Upstream of Transect 6 facing downstream.

Photo 35: Downstream of Transect 7, facing upstream.

Photo 36: Transect 7- Facing upstream (north).

Photo 37: Transect 7- Facing downstream.

Photo 38: Transect 7- Channel bank.

Photo 39: Transect 7- Channel bank.

Photo 40: Transect 7- Facing upstream.

Photo 41: Facing downstream between Transect 7 and 8.

Photo 42: Facing upstream between Transect 7 and 8.

Photo 43: Transect 8- Facing upstream.

Photo 44: Transect 8- Facing downstream.

Photo 45: Transect 8- Facing northeast, showing left bank of channel.

Photo 46: Transect 8- Facing southwest, showing right bank of channel.

Photo 47: Transect 8 - Facing upstream.

Photo 48: Facing upstream between Transect 8 and 9.

Photo 49: Transect 9 - Facing upstream.

Photo 50: Transect 9- Facing downstream.

Photo 51: Transect 9 – Channel bank.

Photo 52: Transect 9 – Channel bank.

Photo 53: Transect 9 - Bottom substrate.

Photo 54: Upstream of Transect 9; slumping on creek bank.

Photo 55: Transect 10 - Facing upstream towards Tremaine Road.

Photo 56: Transect 10 - Facing downstream (northeast).

Photo 57: Transect 10 – Channel bank.

Photo 58: Transect 10 – Channel bank.

Photo 59: Transect 10 - Facing downstream.

Photo 60: Facing downstream from Tremaine Road.

Photo 61: Facing upstream from Tremaine Road.

Photo 62: Facing upstream from Tremaine Road.

Photo 63: Indian Creek at Britannia Road near Bell School Lane.

Photo 64: Indian Creek facing upstream from Britannia Road (near Bell School Lane).

Photo 65: Indian Creek facing downstream from Britannia Road near Bell School Lane.

Photo 66: Indian Creek facing downstream from Britannia Road near Bell School Lane.

Photo 67: Facing downstream from Bell School Lane.

Photo 68: Facing downstream from Bell School Lane.

Photo 69: Indian Creek upstream of Bell School Lane.

Photo 70: Indian Creek upstream of Bell School Lane.

Photo 71: Facing upstream from Appleby Line.

Photo 72: Facing upstream from Appleby Line.

Photo 73: Facing downstream from Appleby Line.

Photo 74: Facing downstream from Appleby Line.

Photo 1: Facing upstream (east) from Tremaine Road.

Photo 2: Facing downstream (south), at the confluence of Tributary A with the main channel of Indian Creek.

Photo 3: Transect 1- Facing upstream (northeast).

Photo 4: Transect 1- Facing downstream (southwest) towards the Tremaine Road culverts.

Photo 5: Transect 1- Facing downstream (south), through a culvert under Tremaine Road.

Photo 6: Transect 1- Facing east towards right bank of channel.

Photo 7: Transect 1- Facing upstream (northeast).

Photo 8: Upstream of Transect 1 facing upstream (northeast) towards concrete drainage feature at berm.

Photo 9: Facing downstream (southwest) towards the online wetland pond between Transect 1 and Transect 2.

Photo 10: West end of the on-line wetland pond near Transect 2, facing Tremaine Road.

Photo 11: Facing upstream (northeast) from berm on west side of the on-line wetland pond.

Photo 12: Facing east across wetland pond from berm.

Photo 13: Downstream of Transect 2, facing downstream (south) towards Tremaine Road, showing channel, concrete drainage feature and online pond.

Photo 14: Flooded/wetland area with no channel definition.

Photo 15: Facing downstream (east), showing flooded/wetland area with no channel definition.

Photo 16: Transect 2- Facing upstream (northeast).

Photo 17: Transect 2- Facing downstream (southwest).

Photo 18: Transect 2- Facing upstream (northeast).

Photo 19: Transect 2- Facing upstream (northwest).

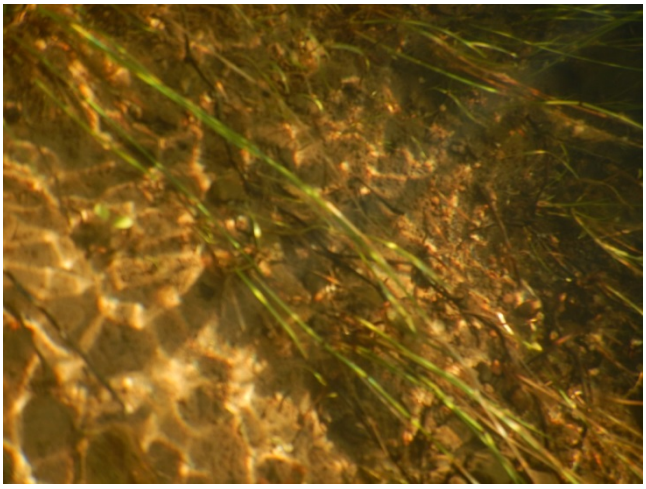

Photo 20: Transect 2- In-water vegetation and gravel substrate.

Photo 21: Facing upstream (northeast) between Transect 2 and 3..

Photo 22: Facing downstream between Transect 2 and 3.

Photo 23: Transect 3- Facing upstream (east).

Photo 24: Transect 3- Facing downstream (west).

Photo 25: Transect 3 – typical channel.

Photo 26: Transect 3- typical channel.

Photo 27: Transect 3- typical channel.

Photo 28: Facing south at pool between Transect 3 and 4.

Photo 29: Transect 4- Facing upstream (east).

Photo 30: Transect 4- Facing downstream (south).

Photo 31: Transect 4- Facing downstream.

Photo 32: Transect 4- Facing downstream (.

Photo 33: Transect 4- Facing downstream (southeast).

Photo 34: Upstream of Transect 4 facing upstream (northeast)at entry point of surficial drainage from adjacent field.

Photo 35: Between Transect 4 and 5 - facing upstream at pool area.

Photo 36: Between Transect 4 and 5 - facing upstream at pool area.

Photo 37: Between Transect 4 and 5 - facing northwest; surficial drainage off adjacent field.

Photo 38: Transect 5- Facing upstream (east).

Photo 39: Transect 5- Facing downstream (west).

Photo 40: Transect 5- typical channel.

Photo 41: Transect 5- typical channel.

Photo 42: Transect 5- Facing downstream (west); typical channel and adjacent field.

Photo 43: Transect 5- Facing upstream (east), towards culverts under CN rail line (end of reach).

Photo 44: Upstream end of Tributary A on downstream side of Brittania Road (south crossing).

Photo 45: Upstream end of Tributary A on downstream side of Britannia Road (south crossing).

Photo 46: Upstream end of Tributary A facing downstream from Britannia Road (south crossing).

Photo 47: Upstream end of Tributary A facing upstream from Britannia Road (south crossing).

Photo 48: Upstream end of Tributary A on upstream side of Britannia Road (south crossing).

Photo 49: Facing downstream from Britannia Road at upper end of Tributary A to Indian Creek (north crossing).

Photo 50: Downstream side of Britannia Road at upper end of Tributary A (north crossing).

Photo 51: Facing upstream from Britannia Road at upper end of Tributary A to Indian Creek (north crossing).

Photo 52: Upstream side of Britannia Road at upper end of Tributary A (north crossing).

Photo 53: Transect 6 – Facing downstream (east)showing overview of flow path, located downstream of the confluence with the north tributary.

Photo 54: Transect 6 – Close-up of flow path through grassy vegetation.

Photo 55: Transect 7 – Facing upstream (east) from transect along the south side of the cattails.

Photo 56: Transect 7 – Close-up of channel in dense cattail vegetation.

Photo 57: Transect 7 – Facing downstream (west) along the north edge of the cattails towards Britannia Road.

Photo 58: Transect 8 - Facing west across north tributary, showing no channel and dry soil patch.

Photo 59: Transect 8 - Facing upstream from dry soil patch showing flow path from Britannia Road.

Photo 60: Transect 8 - Facing downstream from dry soil patch showing flow path to Tributary A.

Photo 61: Facing upstream from 1st Line showing overview of Tributary A.

Photo 62: Facing downstream from 1st Line overview of Tributary A.

Photo 1: Transect B1 – Facing downstream (south) showing outlet of Tributary B into Indian Creek.

Photo 2: Transect B1 – Close-up of channel and substrates.

Photo 3: Transect B1 – Facing upstream (north) showing channel overview through grassy vegetation.

Photo 4: Transect B1 – Facing downstream (south) from start of channel to Indian Creek, showing channel overview through riparian vegetation, approximately 25 m in length.

Photo 5: Facing downstream from fence along agricultural field showing grassy meadow with no channelized feature.

Photo 6: Facing upstream from fence along agricultural field showing plowed field.

Photo 1: Upstream limit of Tributary C within PDA approximately 400 m north of Tremaine Road. Facing downstream (south) showing channel overview through grass field.

Photo 2: Upstream limit of Tributary C within the PDA approximately 400 m north of Tremaine Road. Facing upstream (north) showing channel overview through grass field.

Photo 3: Upstream limit of Tributary C within PDA approximately 400 m north of Tremaine Road showing substrate and channel.

Photo 4: Reach of Tributary C approximately 100 m north of Tremaine Road facing downstream (south) showing channel.

Photo 5: Reach of Tributary C approximately 100 m north of Tremaine Road facing downstream (south) showing substrate and channel overview.

Photo 6: Reach of Tributary C approximately 20 m north of Tremaine Road facing downstream (south) showing substrate and channel overview.

Photo 7: Reach of Tributary C at the intersection of Tremaine Road and Lower Baseline showing dry channel through culvert.

Photo 7: Transect B2 – Downstream overview of channel with straw bales located within the feature.

Photo 8: Transect B2 – Facing upstream from transect showing channel overview and straw bales.

Photo 9: Transect B2 – Close-up of channel and substrates.

Photo 10: Located upstream of Transect B2 along edge of adjacent field showing tractor crossing and no channelization.

Photo 11: Facing downstream (south) from 1st Line showing overview of culvert and feature.

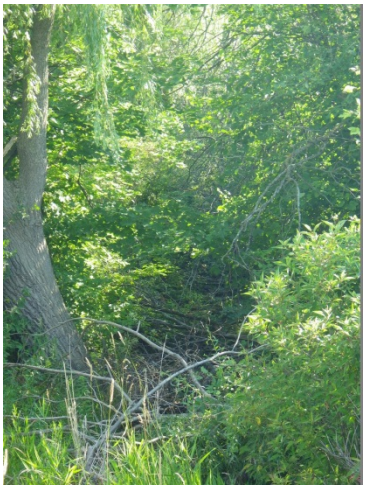

Photo 12: Close-up of feature at 1st Line, facing downstream (south).

APPENDIX D:
PATHWAYS OF EFFECTS

Table 1: Aquatic Effects Assessment - Pathways of Effects for CN Intermodal Milton

Pathway of Effect/Stressor	Applicable (Y/N)	Mitigation Measures	Residual Effects
Vegetation Clearing			
Addition and removal of In-stream organic structure	Y	• Minimize riparian vegetation removals and where it is necessary, use proper clearing techniques and protect retained vegetation. • Design and implement vegetation rehabilitation plan. • Banks to be re-vegetated where cover/structure removal from the banks is required. • Temporary loss of vegetative species which will regrow to pre disturbance level rapidly, little to no tree or woody plan species within the proposed disturbance areas.	Increase in instream organic structure through placement of wood debris toe protection, rock and log constructed riffles, log-rock J-hook with root wad structures, construction of connected wetlands providing vegetation and retention of existing channel portions with wetland components.
Changes in bank stability and exposed soils	Y	• Minimize riparian vegetation removals and where it is necessary, use proper clearing techniques and protect retained vegetation. • Design and implement vegetation rehabilitation plan. • Design and implement erosion and sediment controls. • Reinstate, stabilize and rehabilitate banks and exposed soils.	Increase in vegetative cover; increase in bank stability.
Change in shade	Y	• Minimize riparian vegetation removals and where it is necessary, use proper clearing techniques and protect retained vegetation. • Design and implement vegetation rehabilitation plan including woody species for disturbed areas as necessary. Any minor changes to stream shading will be offset as plantings mature. Existing flow and temperature conditions will not be affected by decreased shade	Increase in vegetative cover; increase in in-stream shading.
Change in external energy and nutrient inputs	Y	• Minimize riparian vegetation removals and where it is necessary, use proper clearing techniques and protect retained vegetation. • Design and implement vegetation rehabilitation plan as necessary	Increase in vegetative cover; decrease in allochthonous nutrient and sediment inputs.
Increased erosion potential	Y	• Minimize riparian vegetation removals and where it is necessary, use proper clearing techniques and protect retained vegetation. • Design and implement vegetation rehabilitation plan as necessary. • Design and implement erosion and sediment controls. Reinstate, stabilize and rehabilitate banks and exposed soils.	Slope grades will be decreased and vegetative cover will be increased, resulting in a decrease in erosion potential
Grading			
Changes in bank stability and exposed soils	Y	• Limit access to water bodies and banks beyond the work area to protect riparian vegetation and minimize bank erosion. • Design and implement erosion and sediment controls. • Reinstate, stabilize and rehabilitate banks.	Increase in vegetative cover, increase in bank stability.
Addition and removal of in-stream organic structure	Y	• Limit access to water bodies and banks to protect riparian vegetation and minimize bank erosion beyond the work area. • Design and implement erosion and sediment controls. • Minimize riparian vegetation removals and where it is necessary, use proper clearing techniques and protect retained vegetation. • Manage excess material, store handle and dispose of all material generated during site preparation, construction and clean-up in a manner that prevents their entry into the watercourse. • Re-instate and install in-stream cover habitat elements (woody debris structures, boulders, overhanging vegetation).	Increase in instream organic structure through placement of wood debris toe protection, rock and log constructed riffles, log-rock J-hook with root wad structures, construction of connected wetlands providing vegetation and retention of existing channel portions with wetland components.
Increased erosion potential	Y	• Limit access to water bodies and banks to protect riparian vegetation and minimize bank erosion. • Design and implement erosion and sediment controls. • Reinstate, stabilize and rehabilitate banks and disturbed areas. • Design drainage system to avoid or minimize changes in drainage patterns.	Slope grades will be decreased and vegetative cover will be increased, resulting in a decrease in erosion potential.
Change in slope	Y	• Limit access to water bodies and banks to protect riparian vegetation and minimize bank erosion. • Design and implement erosion and sediment controls. Stabilize and re-vegetate disturbed areas. • Design drainage system to avoid or minimize changes in drainage patterns.	Slope grades will be decreased, resulting in a decrease in erosion potential.

Table 1: Aquatic Effects Assessment - Pathways of Effects for CN Intermodal Milton

Pathway of Effect/Stressor	Applicable (Y/N)	Mitigation Measures	Residual Effects
Change in land drainage Patterns	Y	• Limit access to water bodies and banks to protect riparian vegetation and minimize bank erosion. • Design and implement erosion and sediment controls. Stabilize and re-vegetate disturbed areas. • Design drainage system to avoid or minimize changes in drainage patterns.	Under the 100 year storm event, a portion of the drainage associated with Tributary A and Indian Creek will be directed towards a channel to the east in order for extreme flows to bypass the site and enter Indian Creek approximately 270 m upstream of the southern Tremaine Road bridge. This alteration will not reduce the potential for erosion in Tributary A under extreme events, but will not impact normal fish habitat usage and access by resident fish in Tributary A or Indian Creek.
Excavation			
Alteration of groundwater flows to surface waters	N	n/a	None
Changes in bank stability and exposed soils	Y	• Design and implement erosion and sediment controls. • Stabilize and re-vegetate disturbed areas. • Reinstate, stabilize and rehabilitate banks and disturbed areas.	Increase in vegetative cover, increase in bank stability.
Change in slope or drainage	Y	• Design and implement erosion and sediment controls. • Stabilize and re-vegetate disturbed areas. • Design drainage system to minimize changes in drainage patterns.	Slope grades will be decreased, resulting in a decrease in erosion potential. Drainage associated with the 100 year storm will be directed into a channel that bypasses the site and enters Indian Creek approximately 270 m upstream of the southern Tremaine Road bridge.
Increased erosion potential	Y	• Design and implement erosion and sediment controls. • Stabilize and re-vegetate disturbed areas. • Reinstate, stabilize and rehabilitate banks and disturbed areas. • Design drainage system to minimize changes in drainage patterns.	Slope grades will be decreased and vegetative cover will be increased, resulting in a decrease in erosion potential.
Removal of topsoil/ Exposed Soils	Y	• Design and implement erosion and sediment controls. • Reinstate, stabilize and rehabilitate disturbed areas. • Manage excess material, store handle and dispose of all material generated during site preparation, construction and clean-up in a manner that prevents their entry into the watercourse.	Increase in vegetative cover, increase in bank stability.
Spoil / material stockpiles	Y	• Design and implement erosion and sediment controls. • Manage excess material, store handle and dispose of all material generated during site preparation, construction and clean-up in a manner that prevents there entry into the watercourse.	None
Dewatering of pit or trench	Y	• All water from dewatering operations is to be managed to prevent erosion and/or release of sediment laden or contaminated water to the waterbody (e.g. settling basin, filter bag, energy dispersion measures). Additionally, the flow rate of dewatering activities will not exceed the capacity of the receiving waterbody.	None
Use of Industrial Equipment			
Use of Mobile Equipment	Y	• Limit access to water bodies to protect fish and minimize bank erosion.	None

Table 1: Aquatic Effects Assessment - Pathways of Effects for CN Intermodal Milton

Pathway of Effect/Stressor	Applicable (Y/N)	Mitigation Measures	Residual Effects
		• Develop and implement a Spills Management Plan. • Implement timing restrictions (warmwater timing window), in-water works permitted from July 1 through Mach 14 of the following year. • Design and implement erosion and sediment controls. Reinstate, stabilize and rehabilitate banks and disturbed areas. • If mobile equipment is required to enter the watercourse the proponent will design and implement isolation/contamination plan to isolate temporary in-water work zones to maintain clean flow to downstream/around the work zone at all times. • Transfer fish in the work area downstream or away from the construction area using appropriate capture, handling, and release techniques to minimize harm and stress. • Manage all water from dewatering operations to prevent erosion and/or release of sediment laden or contaminated water to the waterbody (e.g. settling basin, filter bag, energy dispersion measures). • Management of equipment: operate, store and maintained all equipment and associated materials in a manner that prevents the entry of any deleterious substance to the waterbody. • Additionally any part of the equipment entering the waterbody or operating on the bank shall be free of fluid leaks and externally cleaned/degreased. A plastic spill tray shall be under the concrete coring machine when it is in place at the drilling location above the waterbody. • Debris catchment screens shall be used beneath active work areas where there is a risk of falling debris entering the waterbody.	
Changes in bank stability and exposed soils	Y	• Limit access to water bodies. • Design and implement erosion and sediment controls. • Reinstate, stabilize and rehabilitate banks and disturbed areas.	Vegetative cover will be increased, resulting in a decrease in erosion potential.
Increased Erosion Potential	Y	• Limit access to water bodies and banks to protect fish and riparian vegetation and minimize bank erosion. • Design and implement erosion and sediment controls. • Reinstate, stabilize and rehabilitate banks and disturbed areas.	Slope grades will be decreased and vegetative cover will be increased, resulting in a decrease in erosion potential.
Re-suspension and entrainment of sediment	Y	• Limit access to water bodies and banks to protect fish and riparian vegetation and minimize bank erosion. • Design and implement erosion and sediment controls. • If mobile equipment is required to enter the watercourse the proponent will design and implement isolation/contamination plan to isolate temporary in-water work zones to maintain clean flow to downstream/around the work zone at all times. • Transfer fish in the work area downstream or away from the construction area using appropriate capture, handling, and release techniques to minimize harm and stress. Manage all water from dewatering operations to prevent erosion and/or release of sediment laden or contaminated water to the waterbody (e.g. settling basin, filter bag, energy dispersion measures).	Slope grades will be decreased and vegetative cover will be increased, resulting in a decrease in erosion potential and the risk of re-suspension and entrainment of sediment.
Oil, grease and fuel leaks	Y	• Limit access to water bodies and banks to protect fish and riparian vegetation and minimize bank erosion. • Develop and implement a Spills Management Plan. • Management of equipment: operate, store and maintained all equipment and associated materials in a manner that prevents the entry of any deleterious substance to the waterbody. Additionally any part of the equipment entering the waterbody or operating on the bank shall be free of fluid leaks and externally cleaned/degreased. Debris catchment screens shall be used beneath active work areas where there is a risk of falling debris entering the waterbody.	None
Placement of Material or Structures in Water			
Partial Constriction of Flow	Y	• • A partial constriction of flow will occur when the upstream flow block or "plug" is removed to introduce flow into the new constructed channel. This will occur for a very short period of time while the plug is completely excavated, and is not anticipated to result in any adverse effects.	None
Change in channel morphology or shoreline morphometry/Change in hydraulics	Y	• Implement timing restrictions (warmwater timing window), in-water works permitted from July 1 through March 14 of the following year. • Design temporary flow deflectors to prevent the creation of barriers to fish movement, maintain bank full channel functions, maintain habitat functions the extent possible and limit changes to existing stream morphology that can result in increased localized erosion. All material placed in, above or near the waterbody shall be cleaned, washed and free of oil and grease prior to use and installation. • If isolation of temporary in-water work zones is required the proponent shall design and implement isolation/contamination plan to isolate temporary in-water work zones to maintain clean flow to downstream/around the work zone at all times. • Manage all water from dewatering operations to prevent erosion and/or release of sediment laden or contaminated water to the waterbody (e.g. settling basin, filter bag, energy dispersion measures).	Channel realignment will result in the loss of 11, 503 m^2 (Indian Creek) and 2,594 m^2 (Tributary A), for a total of 14,097 m^2. New channels will be constructed for Tributary A and Indian Creek totaling 14,327 m^2 of new habitat. This will be further complemented by the creation of 70,915 m^2 of riparian and floodplain enhancements that will greatly add to the value of the offsetting. The new, realigned channels have

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		• Limit disturbance of the existing streambed and substrates.	been designed using natural channel design principles and have been designed to replicate the function of the existing channel. Overall fisheries productivity is not expected to decrease.
Change in substrate composition	Y	n/a	No substantial changes to substrate composition are expected as a result of the Project.
Change in aquatic macrophytes	Y	• Design and implement vegetation rehabilitation plan following construction to re-plant riparian vegetation to pre-construction or better condition • Re-instate and install in-stream cover habitat elements (woody debris structures, boulders, overhanging vegetation).	None
Complete constriction of flow	Y	• Implement timing restrictions (warmwater timing window), in-water works permitted from July 1 through March 14 of the following year. • If isolation of temporary in-water work zones is required the proponent shall design and implement isolation/contamination plan to isolate temporary in-water work zones to maintain clean flow to downstream/around the work zone at all times. • Manage all water from dewatering operations to prevent erosion and/or release of sediment laden or contaminated water to the waterbody (e.g. settling basin, filter bag, energy dispersion measures). • Limit disturbance of the existing streambed and substrates.	None
Water Extraction			
Entrainment of fish in pumps, dewatering of downstream areas, obstruction of fish passage	Y	• Design and implement isolation/contamination plan to isolate temporary in-water work zones to maintain clean flow to downstream/around the work zone at all times. • Manage all water from dewatering operations to prevent erosion and/or release of sediment laden or contaminated water to the waterbody (e.g. settling basin, filter bag, energy dispersion measures). Use adequate fish screens to avoid entrainment. • Transfer fish in the work area downstream or away from the construction area using appropriate capture, handling, and release techniques to minimize harm and stress.	None
Fish Passage Issues			
Obstruction (dams, instream structure) that effects fish passage	Y	• Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone to maintain clean flow downstream around the work zone at all times	None
Change in water chemistry/Alteration of migration patterns	Y	• Design stormwater management measures to manage runoff • Implement timing restrictions on in-water work to protect sensitive life stages/processes of fish • Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone to maintain clean flow downstream around the work zone at all times	None
Change in water temperature	Y	• Minimize riparian vegetation removals and where it is necessary, use proper clearing techniques and protect retained vegetation. • Design and implement vegetation rehabilitation plan including woody species for disturbed areas as necessary. Any minor changes to stream shading will be offset as plantings mature. Existing flow and temperature conditions will not be affected by decreased shade	Increase in vegetative cover intended to moderate water temperatures within PDA.
Flow alteration (timing, duration, intensity)	Y	• Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a water body.	Drainage associated with the 100 year storm will be directed into a channel that bypasses the site and enters Indian Creek approximately 270 m upstream of the southern Tremaine Road bridge.
Diversion channels	Y	• Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a water body.	Drainage associated with the 100 year storm will be directed into a channel that bypasses the site and enters Indian Creek approximately 270 m upstream of the southern Tremaine Road

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Pathway of Effect/Stressor	Applicable (Y/N)	Mitigation Measures	Residual Effects
			bridge.
Change in Timing, Duration and Frequency of Flow			
Dewatering	Y	• Design and construct to prevent creation of barriers to fish movement, maintain bank full channel functions, and habitat functions the extent possible. Design and implement containment plan to isolate all work from flow. • Manage all water from dewatering operations to prevent erosion and/or release of sediment laden or contaminated water to the waterbody (e.g. settling basin, filter bag, energy dispersion measures). • Transfer fish in the work area downstream or away from the construction area using appropriate capture, handling, and release techniques to minimize harm and stress. • Implement in-water timing restrictions.	None
Bank erosion	Y	• Design and construct to prevent creation of barriers to fish movement, maintain bank full channel functions, and habitat functions the extent possible. Design and implement containment plan to isolate all work from flow. • Manage all water from dewatering operations to prevent erosion and/or release of sediment laden or contaminated water to the waterbody (e.g. settling basin, filter bag, energy dispersion measures). • Design and implement vegetation rehabilitation plan. • Reinstate, stabilize and rehabilitate banks and disturbed areas to pre-construction configuration and condition (or better) using properly designed and installed stabilization measures.	The new channel has been designed using natural channel design principles, including elements to reduce the risk of erosion. Additionally, riparian and channel bank areas upstream of the proposed realignment will receive treatments to decrease existing erosion. Vegetative cover will be increased, resulting in a decrease in erosion potential.
Scouring of channel beds/Change in substrate composition	Y	• Design and construct to prevent creation of barriers to fish movement, maintain bank full channel functions, and habitat functions the extent possible. Design and implement containment plan to isolate all work from flow. • Manage all water from dewatering operations to prevent erosion and/or release of sediment laden or contaminated water to the waterbody (e.g. settling basin, filter bag, energy dispersion measures). • Design and install in-stream cover habitat elements to replace or re-instate fish cover removed, altered or disturbed during construction. • Re-instate and re-stabilize any portion of the bed of the waterbody disturbed during construction to pre-construction (or better) condition, including: morphological elements (e.g. pools and riffles), and substrates, which may include salvage or re-instatement of native material.	None