Final Fish and Fish Habitat Existing Conditions and Impact Assessment Report

Highway 400 to Highway 404 Link (Bradford Bypass)

Ontario Ministry of Transportation

August 22, 2023

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Revision	Revision date	Name	Details
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2	January 30, 2023	AECOM	Draft Fish and Fish Habitat Existing Conditions and Impact Assessment Report
3	February 9, 2023	AECOM	Draft Fish and Fish Habitat Existing Conditions and Impact Assessment Report
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7	August 22, 2023	AECOM	Final Fish and Fish Habitat Existing Conditions and Impact Assessment Report

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1. Introduction

1.1 Project Overview

The Ontario Ministry of Transportation (the Ministry) has retained AECOM Canada Ltd. (AECOM) to undertake a Preliminary Design and project-specific assessment of environmental impacts for the proposed Highway 400 – Highway 404 Link (Bradford Bypass). The Bradford Bypass (the project) is being assessed in accordance with Ontario Regulation 697/21 (the Regulation).

The Bradford Bypass is part of Ontario's plan to expand highways and public transit across the Greater Golden Horseshoe to fight congestion, create jobs and prepare for the massive population growth expected in the next 30 years. Simcoe County's population is expected to increase to 416,000 by 2031, with the Regional Municipality of York growing to 1.79 million by 2041. The Bradford Bypass has been proposed as a response to this dramatic growth in population and travel demand in the area and the forecasted increase in congestion on key roadways linking Highway 400 to Highway 404.

The project is a new 16.3-kilometre-controlled access freeway. The proposed highway will extend from Highway 400 between 8th Line and 9th Line in Bradford West Gwillimbury, will cross a small portion of King Township, and will connect to Highway 404 between Queensville Sideroad and Holborn Road in East Gwillimbury. There are proposed full and partial interchanges, as well as grade-separated crossings at intersecting municipal roads and watercourses, including the Holland River and Holland River East Branch. This project also includes the design integration for the replacement of the 9th Line structure on Highway 400, which will accommodate the proposed future ramps north of the Bradford Bypass corridor. The Ministry is considering an interim four-lane configuration and an ultimate eight-lane design for the Bradford Bypass. The interim condition will include two general purpose lanes in each direction and the ultimate condition will include four lanes in each direction (one high-occupancy vehicle lane and three general purpose travel lanes in each direction). The interim and ultimate designs are being reviewed as the project progresses. This Report and its findings are based on the project footprint identified within this Report. Should the footprint change or be modified in any way, a review of the changes shall be undertaken, and the Report will be updated to reflect the changes, impacts, mitigation measures, and any commitments to future work.

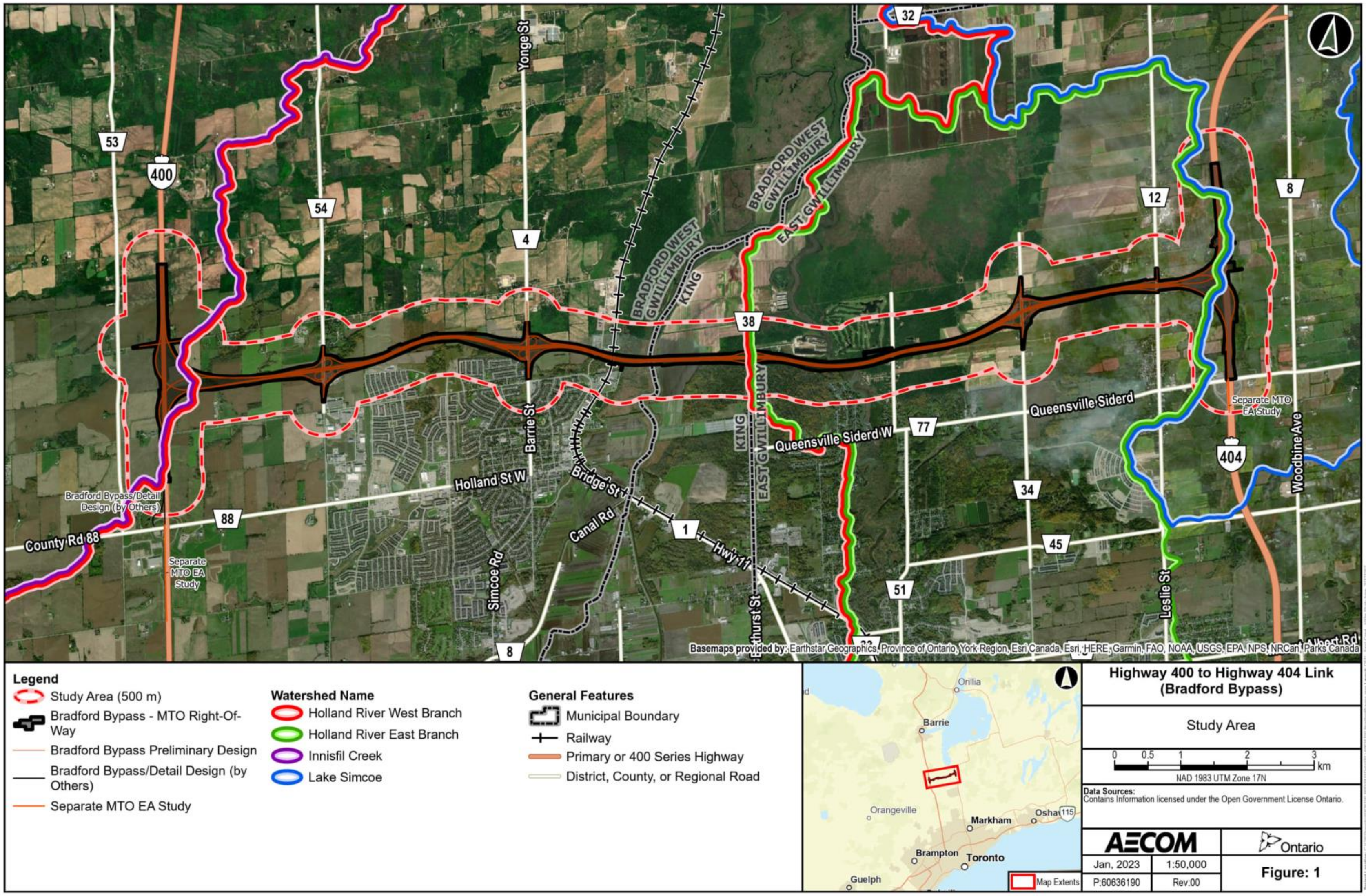
Since the completion of the 2002 Approved EA, several changes have occurred to legislation, policies, and regulations associated with the natural environment. This Draft Fish and Fish Habitat Existing Conditions and Impact Assessment Report (this Report) presents the results of the background review of the fish and fish habitat existing conditions within the Study Area undertaken in 2019, as well as the findings from the field investigations completed by AECOM staff in 2020, 2021, and 2022. This Report also provides a preliminary assessment of the potential impacts of the project on fish habitat features in the Study Area. The assessments of the water features described herein were conducted in accordance with the *Interim Environmental Guide for Fisheries* (the Guide) (MTO 2020a) and the *Pilot MTO/DFO/MNRF Protocol for Protecting Fish and Fish Habitat on Provincial Transportation Undertakings, Version 4* (the Protocol) (2020b). This includes a step-by-step process to identify regulatory review and/or notification requirements. Some of these steps include:

- Identification of the potential for the project to cause the death of fish or harmful alteration, disruption or destruction (HADD) of fish habitat in contravention of the *Fisheries Act*
- Gathering of existing fish and fish habitat data and supplementing through field investigations
- Determination of the presence of aquatic Species at Risk (SAR); and
- Identification of potential MTO Best Management Practices from the *Interim Environmental Guide for Fisheries – Best Management Practices Manual* (MTO, 2020c).

The purpose of this Report is to present the results of the Fish and Fish Habitat Existing Conditions and Impact Assessment documented by AECOM for the project to fulfill the requirements under the *Environmental Guide for Fish and Fish Habitat* (the Guide) (MTO, 2020a) and the *MTO/DFO/MNRF*

Protocol for Protecting Fish and Fish Habitat on Provincial Transportation Undertakings, Version 4 (the Protocol) (MTO, 2020b), and to provide mitigation measures in accordance with the *Environmental Reference for Highway Design* (ERHD; MTO, 2013). The assessment of fish and fish habitat existing conditions are provided in the *Environmental Conditions Report: Preliminary Design and Project – specific assessment of environmental impacts in accordance with Ontario Regulation 697/21 (W.O.#19-2001)* (AECOM, 2022). The general boundaries of the Study Area are shown in **Figure 1, Appendix A** and the watercourse crossings are listed in **Table 1**.

Figure 1-1: Study Area



1.2 Study Area and Site Map

The Study Area is located within Simcoe County (Town of Bradford West Gwillimbury) and the Regional Municipality of York (Township of King and Town of East Gwillimbury). For the purposes of the fisheries assessment, the Study Area includes water features detected through background information review and field investigations within 250 metres (50 metres upstream, 200 metres downstream – where property access was allowed) of the Ministry of Transportation project Right-of-Way (ROW) as shown in **Appendix A.**

Table 1-1 provides the co-ordinates for each water crossing that was assessed as per the Guide within the Fish and Fish Habitat Study Area. Each water feature within 120 metres of the project was assigned a unique identifying number to differentiate the area of investigation for each crossing (e.g., WC1). Crossing IDs are also provided in **Table 1-1** as these were the known proposed structure/culvert locations along each watercourse at the time of producing this Report. Often Crossing IDs are associated with the same Watercourse ID, where the project crosses a watercourse multiple times.

Table 1-1: Location of Works (Template D1)

Watercourse ID	Crossing ID	Highway/Road	Municipality	Latitude	Longitude
WC-1	C10-A-A	Highway 400	Town of Bradford West Gwillimbury, County of Simcoe	44.133927°	-79.638582°
	C10-A-B	Highway 400	Town of Bradford West Gwillimbury, County of Simcoe	44.129274°	-79.637276°
	C10-A-C	Highway 400	Town of Bradford West Gwillimbury, County of Simcoe	44.125713°	-79.636883°
	C10-A-1	Highway 400	Town of Bradford West Gwillimbury, County of Simcoe	44.122177°	-79.634429°
	C10-A-2	Highway 400	Town of Bradford West Gwillimbury, County of Simcoe	44.118484°	-79.635116°
	C10-A-3	Highway 400	Town of Bradford West Gwillimbury, County of Simcoe	44.116431°	-79.634575°
	C10-A-4	Highway 400	Town of Bradford West Gwillimbury, County of Simcoe	44.114536°	-79.634565°
WC-1b	C10-A-5	Highway 400	Town of Bradford West Gwillimbury, County of Simcoe	44.110519°	-79.632596°
WC-1c	C10-A-6	Highway 400	Town of Bradford West Gwillimbury, County of Simcoe	44.101572°	-79.631328°
WC-2	C10-B-1	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.121003°	-79.630461°
	C10-B-2	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.120526°	-79.628956°
	C10-C-1	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.120417°	-79.627337°
	C10-C-2	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.119435°	-79.625691°
WC-3	C11-A-1	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.121319°	-79.618249°
WC-4	C11-A-2	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.120782°	-79.617640°
WC-5	C12-A-1	10th Sideroad	Town of Bradford West Gwillimbury, County of Simcoe	44.123593°	-79.606432°
	C13-A-1	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.128109°	-79.591681°
WC-6	C14-A-1	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.130816°	-79.584746°
Pond 1	NA	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.129027°	-79.578595°

Watercourse ID	Crossing ID	Highway/Road	Municipality	Latitude	Longitude
WC-7	NA	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.133675°	-79.560263°
WC-8	C16-A-2	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.131662°	-79.559019°
	C16-A-3	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.131120°	-79.553062°
WC-9	C16-A-4	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.129915°	-79.567524°
WC-9	CR-4	Younge Street	Town of Bradford West Gwillimbury, County of Simcoe	44.128678°	-79.568377°
	C16-A-1	Bradford Bypass ROW	Town of Bradford West Gwillimbury, County of Simcoe	44.129915°	-79.567524°
WC-10	C17-A-1	Hochreiter Road	Township of King, Regional Municipality of York	44.131257°	-79.545499°
WC-11	C17-B-1	Hochreiter Road	Township of King, Regional Municipality of York	44.131718°	-79.544525°
WC-12	C17-C-1	Hochreiter Road	Township of King, Regional Municipality of York	44.132377°	-79.540511°
WC-13	C17-D-1	Hochreiter Road	Township of King, Regional Municipality of York	44.132613°	-79.539937°
WC-14	C17-E-1	Hochreiter Road	Township of King, Regional Municipality of York	44.132690°	-79.539389°
WC-15	C17-F-1	Hochreiter Road	Township of King, Regional Municipality of York	44.132838°	-79.538915°
WC-16	C18-A-1	Hochreiter Road	Township of King, Regional Municipality of York	44.133081°	-79.537902°
WC-17	C18-B-1	Hochreiter Road	Township of King, Regional Municipality of York	44.133289°	-79.536953°
WC-19	C18-C-1	Hochreiter Road	Township of King, Regional Municipality of York	44.133415°	-79.535066°
WC-20	C18-D-1	Hochreiter Road	Township of King, Regional Municipality of York	44.134016°	-79.533702°
WC-22	C18-E-1	Hochreiter Road	Township of King, Regional Municipality of York	44.133577°	-79.532906°
WC-23	C18-F-1	Bathurst Street	Township of King, Regional Municipality of York	44.135175°	-79.527994°
	C18-G-1	Hochreiter Road	Township of King, Regional Municipality of York	44.134314°	-79.528906°
WC-24	C18-H-1	Bathurst Street	Town of East Gwillimbury, Regional Municipality of York	44.135727°	-79.527618°
WC-25	C20-A-1	Bradford Bypass ROW	Town of East Gwillimbury, Regional Municipality of York	44.136164°	-79.512821°
	C20-B-1	Bradford Bypass ROW	Town of East Gwillimbury, Regional Municipality of York	44.137107°	-79.510612°
WC-26	C22-A-1	Bradford Bypass ROW	Town of East Gwillimbury, Regional Municipality of York	44.142065°	-79.487982°
WC-27	C23-A-1	2nd Concession Road	Town of East Gwillimbury, Regional Municipality of York	44.146607°	-79.478361°
WC-28	C24-A-1	Bradford Bypass ROW	Town of East Gwillimbury, Regional Municipality of York	44.150477°	-79.462309°
WC-29	C25-A-1	Bradford Bypass ROW	Town of East Gwillimbury, Regional Municipality of York	44.151120°	-79.457208°
WC-30	C25-B-1	Leslie Street	Town of East Gwillimbury, Regional Municipality of York	44.152108°	-79.453980°
WC-31	C25-C-1	Bradford Bypass ROW	Town of East Gwillimbury, Regional Municipality of York	44.153147°	-79.449299°

Watercourse ID	Crossing ID	Highway/Road	Municipality	Latitude	Longitude
WC-32	C25-A-2	Highway 404	Town of East Gwillimbury, Regional Municipality of York	44.150441°	-79.440710°
	C26-A-1	Highway 404	Town of East Gwillimbury, Regional Municipality of York	44.151264°	-79.439485°
WC-33	C27-A-1	Highway 404	Town of East Gwillimbury, Regional Municipality of York	44.152139°	-79.438638°
WC-34	C28-A-1	Highway 404	Town of East Gwillimbury, Regional Municipality of York	44.140960°	-79.437545°

2. Project Description

A summary of proposed works at each watercourse crossing is provided below (**Table 2-1)**. Figures are provided in **Appendix A,** which detail the location of each watercourse crossing. Photographs of each location are provided in **Appendix C**. It is anticipated that construction activities (riparian vegetation removal, grading, highway surfacing etc.) associated with the new highway construction will be completed at or within 30 metres of every watercourse crossing, even if a culvert or structure is not proposed to span a watercourse.

Table 2-1: Summary of Proposed Works

Watercourse ID	Crossing ID	Culvert Data	Existing Structure	Proposed Works
WC-1	C10-A-A	N/A	No proposed culvert at this location	N/A
	C10-A-B	N/A	No proposed culvert at this location	N/A
	C10-A-C	N/A	No proposed culvert at this location	N/A
	C10-A-1	Concrete box (2400 x 1200)	Culvert replacement (like-for-like)	Proposing a channel adjustment, the existing (PR-CL-2) and proposed
	C10-A-2	N/A	No proposed culvert at this location	N/A
	C10-A-3	N/A	No proposed culvert at this location	N/A
	C10-A-4	Concrete box (3600 x 1500)	Culvert replacement (like-for-like)	Channel realignment proposed
WC-1b	C10-A-5	N/A	No proposed culvert at this location. However, it needs to be confirmed if a culvert is required	N/A
WC-1c	C10-A-6	N/A	No proposed Culvert at this location	N/A
WC-2	C10-B-1	N/A	Channel realignment proposed to redirect flows to the proposed culvert	N/A
	C10-B-2	N/A	No proposed culvert at this location	N/A
	C10-C-1	Concrete Box (3600 x 1500)	New Culvert	Channel adjustment at the new ramp crossing
	C10-C-2	Concrete Box (3600 x 1500)	New Culvert	Channel adjustment at the new ramp crossing
WC-3	C11-A-1	Concrete Box (2400 x 1500)	New Culvert	Channel adjustment at the new ramp crossing
WC-4	C11-A-2	Concrete Box (2400 x 1500)	New Culvert	Channel adjustment at the new ramp crossings
WC-5	C12-A-1	Corrugated Steel Pipe (CSP) (900)	New culverts	Channel realignment through the 10th Sideroad interchange
	C13-A-1	Concrete Box (1500 x 1200)	New Culvert (PR-CL-BBP-2)	Channel adjustment is required at the crossing location

Watercourse ID	Crossing ID	Culvert Data	Existing Structure	Proposed Works
WC-6	C14-A-1	CSP	New culvert	Channel adjustment required at the crossing
Pond 1	NA	N/A	N/A	N/A
WC-7	NA	N/A	N/A	No proposed culvert at this location
WC-8	C16-A-2	Concrete Box (1800 x 1500)	New culvert	Channel realignment/adjustment across the project
	C16-A-3	N/A	N/A	Channel realignment to redirect flows to the new culvert
WC-9	C16-A-4	Concrete Box (1200 x 1200)	New culvert	Watercourse realignment west of County Road 4 to accommodate the new interchange
WC-9	CR-4	Concrete Box (1200 x 800)	New culvert	N/A
	C16-A-1	Concrete Pipe (750)	Culvert Replacement	EX-CL-14. Proposed work to be coordinated with Metrolinx
WC-10	C17-A-1	N/A	New bridge structure	N/A
WC-11	C17-B-1	N/A	N/A	N/A
WC-12	C17-C-1	N/A	N/A	N/A
WC-13	C17-D-1	N/A	N/A	N/A
WC-14	C17-E-1	N/A	N/A	N/A
WC-15	C17-F-1	N/A	N/A	N/A
WC-16	C18-A-1	N/A	N/A	N/A
WC-17	C18-B-1	N/A	N/A	N/A
WC-19	C18-C-1	N/A	N/A	N/A
WC-20	C18-D-1	New culvert	N/A	N/A
WC-22	C18-E-1	New culvert	N/A	N/A
WC-23	C18-F-1	CSP (900)	New culvert	New grading and relocation of ditches will be required to accommodate the new Inlet control at Bathurst Street
	C18-G-1	CSP (900)	New culvert	New grading and relocation of ditches will be required to accommodate the new Interchange at Bathurst Street
WC-24	C18-H-1	CSP (750)	New culvert to be relocated	New culvert to be relocated to Ramp E-N/S
WC-25	C20-A-1	N/A	New bridge structure	N/A
	C20-B-1	N/A	No proposed culvert at this location	N/A
WC-26	C22-A-1	Concrete Box (1500 x 1200)	New culvert	Minimum watercourse adjustment at the crossing location. Existing pond north of the new crossing. This pond will be impacted by the project and will need to be modified to accommodate the new highway.
WC-27	C23-A-1	Concrete Box (1200 x 1200)	New culverts	Two new culverts are proposed at the new Interchange. New ditches are required to

Watercourse ID	Crossing ID	Culvert Data	Existing Structure	Proposed Works
				accommodate the new interchange (2nd Con. Rd.)
WC-28	C24-A-1	Concrete Box (1500 x 1200)	New culvert	New watercourse adjustment at the BBP crossing
WC-29	C25-A-1	CSP (900)	New culvert	Watercourse adjustment at the BBP crossing
WC-30	C25-B-1	CSP (900)	New culvert	Watercourse adjustment at the BBP crossing
WC-31	C25-C-1	Concrete Box (1800 x 1500)	New culvert	The culvert crossing will impact the existing Leslie Rd/404 Pond. The pond will need to be relocated along the watercourse.
WC-32	C25-A-2	Concrete/Span Bridge (4880 x 3050)	New bridge structure	Adjustment to the existing watercourse to accommodate the new bridge structure
	C26-A-1	Concrete/Span Bridge (4880 x 3050)	Existing bridge to remain	N/A
WC-33	C27-A-1	Concrete/Span Bridge (4880 x 3050)	New bridge structure	Adjustment to the existing watercourse to accommodate the new bridge structure
WC-34	C28-A-1	N/A	No proposed culvert at this location	N/A

3. Background Data Collection

As noted above in **Section 1**, this Report was completed in accordance with the Guide (MTO, 2020a) and the Protocol (MTO, 2020b). A desktop review of all relevant and available documents was completed to obtain information on fish and fish habitat within the Study Area.

The following reports have been reviewed:

- Environmental Assessment Report One – Stage Submission: Highway 400 – Highway 404 Extension Link (Bradford Bypass) W.P. 377-90-00 (McCormick Rankin Corporation, 1997a) (the 1997 EA).
- Natural Environment and Agricultural Biophysical Assessment: 400 – 404 Extension Link. (McCormick Rankin Corporation, 1997b) (Appendix G to the 1997 EA).

A review of available background information was completed using several online sources, topographic maps, aerial imagery and other sources of natural heritage information provided by the Ontario Ministry of Natural Resources and Forestry (MNRF). These resources were reviewed to obtain existing fisheries data, such as species composition, records of aquatic SAR, fish sanctuaries, migration barriers, watershed and drainage systems and associated wetlands. These resources include:

- MNRF Make-a-Map: Natural Heritage Information Centre (NHIC, 2022)
- MNRF Ontario Land Information Ontario (LIO) base mapping data (MNRF, 2019a)
  - Aquatic resource area line segment
  - Aquatic resource area polygon segment
- Watershed mapping
- Fisheries and Oceans Canada (DFO) Aquatic Species at Risk (SAR) On-line mapping (DFO, 2022)
- Range Map extents - Species at Risk – Canada (Ontario Ministry of the Environment, Conservation and Parks [MECP], 2022)
- MNRF Fish ON-Line (MNRF, 2021; accessed October 2021)
- Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement – Second Edition (MNRF, 2010)
- Aerial photography (Google, 2022)
- Lake Simcoe Fish Community Objectives (OMNR, 2011)
- West Holland River Subwatershed Management Plan (LSRCA, 2010)
- The East Holland River Subwatershed Management Plan (LSRCA, 2010)
- Maskinonge River Subwatershed Plan (LSRCA, 2010)
- Innisfil Creek Subwatershed Health Check (NVCA, 2013)
- Historical records of American Eel (*Anguilla rostrata*) (Endangered [ESA], No status [SARA]) were returned in the Holland River and Holland River East Branch (NHIC, 2022).

Information request letters were submitted on December 4, 2019, to the Midhurst and Aurora District MNRF offices, the Lake Simcoe Region Conservation Authority (LSRCA), the Nottawasaga Valley Conservation Authority (NVCA) and the Ministry of Environment, Conservation and Parks (MECP) to obtain/confirm fisheries data associated with the watercourses within the Study Area (**Table 1-1**) as part of the preparatory works to Preliminary Design (*Fish and Fish Habitat Existing Conditions Report,* *Highway 400 – Highway 404 Link, W.O. # 19-2001*; AECOM, 2020). The information requests included the following:

- Watercourse names and crossing locations
- Watercourse classifications
- Habitat information/location
- Fish community data
- Absence/presence of any vulnerable species and/or critical habitat
- In-water work timing window
- MNRF management objectives
- Groundwater discharge areas; and
- Benthic invertebrate data.

A similar request was submitted to the MECP with regards to confirming the presence/absence of any aquatic SAR records within the Study Area, and the response received on December 16, 2019, did not confirm the presence of any aquatic SAR in the Study Area. However, as discussed with William Treaty First Nations on December 1, 2022, it was mentioned that both American Eel (*Anguilla rostrata;* ESA – END, SARA – NAR) and Northern Sunfish (*Lepomis peltastes*; ESA – SC, SARA – SC) had been previously found in the Holland River.

DFO's online aquatic SAR mapping has been reviewed and no records of federally listed SAR were returned for the Holland River and Holland River East Branch. A copy of agency correspondence can be found in **Appendix B**.

4. Fish and Fish Habitat Existing Conditions

AECOM ecologists conducted a detailed fish and fish habitat assessment of the water features in the vicinity of the Study Area between September 14 to 18, 2020 (i.e., the summer assessments), with spring field investigations occurring over multiple days in June 2021. Field investigations were also completed in the spring of 2022 (May 19 and June 9) due to changes to the Study Area boundary that required further review for potential fish habitat. Due to some of the precipitation that occurred prior to the spring 2022 field investigations, it is worth noting that some of the assessed sites may have had higher than normal water levels at the time of investigation. Fisheries assessments were conducted in accordance with the requirements under the 2020 Protocol. Fisheries ecologists visited the sites to document existing habitat conditions to assist in determining whether the proposed works may result in a HADD, or the death of fish, and therefore requires a Request for Review by DFO and potentially a *Fisheries Act Authorization.* **Table 4-1** summarizes the fish habitat conditions at each anticipated crossing location based on Template D2A, and **Table 4-2** summarizes the existing fish community at each structure based on Template D2B of the Guide (MTO 2020).

A full description of existing conditions is available in the *Environmental Conditions Report: Preliminary Design and project-specific assessment of environmental impacts in accordance with Ontario Regulation 697/21 (W.O.#19 -2001)* (AECOM, 2022). Through the background information review, consultation with MNRF, and fish habitat and fish community assessments, it was determined that 17 watercourses were permanent features that provided direct fish habitat, five were intermittent features that provided direct fish habitat, six were intermittent and provided indirect habitat, and two were ephemeral and provided indirect habitat. Of the remaining 21 aquatic features, 20 were ephemeral and did not provide habitat, and one was permanent and did not provide habitat. Critical Habitat (SARA) was not identified at any site. C17-A-1 and C20-A-1 act as migratory corridors for fish to reach upstream spawning habitats and are specialized habitats that fish use for spawning and nursery. These two crossings, as well as C16-A-1, are also mapped spawning habitats for muskellunge species. A photographic record of the existing conditions was completed during the field surveys and is provided in **Appendix C**. Field notes recorded during the fish habitat assessments are provided in **Appendix D**.

4.1 Innisfil Creek Subwatershed (WC-01)

The Innisfil Creek Subwatershed (identified on **Figure 1-1**) consists of four main creek systems, Innisfil Creek, Bailey Creek, Beeton Creek, and Penville Creek. These watercourses drain the southeast portion of the Nottawasaga River watershed (NVCA, 2013). Headwaters of Penville Creek originate just south of Bond Head and flow north through agricultural lands before entering Innisfil Creek, north of Newton Robinson. Surface water quality and stream habitat in the Innisfil Creek Subwatershed is poor compared to the rest of the Nottawasaga River watershed (NVCA, 2013). Penville Creek has been identified as having ‘below potential’ or ‘impaired’ reaches throughout its system, which can be attributed to the intensive agricultural lands in proximity to the watercourse (NVCA, 2006). The NVCA (2013) identifies the stream health of Penville Creek as being largely influenced by a lack of natural land cover and the dominance of intensive agricultural land use. The headwaters of Penville Creek and its upstream tributaries support coolwater habitat according to the NVCA (2006), which covers the portion of the Study Area along which Penville Creek travels. Downstream of the 6th Line, the NVCA characterizes Penville Creek as a watercourse with a warmwater thermal regime due to a lack of riparian vegetation (NVCA, 2006).

4.1.1 C10-A-A to C10-A-C (WC-1): Tributary to Penville Creek

This tributary of Penville Creek flows north to south along the east side of Highway 400 to its confluence with another assessed reach of Penville Creek on the south side of the 9th Line (C10-A-1). Penville Creek is located approximately 3.6 kilometres southwest of the Highway 400 interchange location downstream of the Study Area.

Within the assessed upstream reach (C10-A-A), the Tributary to Penville Creek within the ROW is dominated by dense invasive phragmites throughout the channel and riparian lands. No defined channel and no flowing water could be observed through the dense phragmites, which were present for approximately 80 metres along the east ditch along Highway 400, and for approximately 40 metres east downstream of the culvert outlet. The phragmites were present within the entire highway ROW within the assessed reach of C10-A-A. Due to the dense phragmites, lack of a defined channel, and no substrate sorting noted throughout this reach, suggesting only ephemeral flow, C10-A-A would not be characterized as direct fish habitat. However, based on aerial imagery that shows this feature is connected to fish-bearing watercourses downstream (i.e., C10-A-C, C10-A-A) would be considered indirect fish habitat for a coolwater fish community. C10-A-A flows south and connects with the assessed portion of C10-A-C approximately 850 metres downstream. C10-A-A also appears to have an intermittent flow regime due to the lack of defined banks and no obvious transition from the channel bottom to riparian lands.

Within the mid-section of this assessed reach, C10-A-B outlets from the east side of Highway 400 and flows into the Tributary of Penville Creek approximately 125 metres downstream to the east of the highway. The highway crossing consisted of a 1.2 metre by 0.8 metre concrete box culvert. Clear water was observed flowing in the channel at the time of the site inspection. The assessed reach of C10-A-B consisted predominately of runs (90%) with sparse riffles (10%). The wetted width of the channel was 0.8 metres on average, with an average depth of 0.05 metres. Recent rainfall events during the previous days may have resulted in elevated water levels in the channel. No pools were noted, and no fish were observed during the site visit. Dip netting was attempted where feasible, but no fish captured were recorded. The substrate consisted of silt and sand with clay sections. No aquatic vegetation was noted. No barriers to fish passage were noted throughout the ROW. Access was limited beyond the ROW, but no barriers to fish passage could be observed further downstream toward the Tributary of Penville Creek. Given the defined banks, substrate sorting observed, and direct connection to downstream watercourses that have confirmed direct fish habitat presence (i.e., C10-A-C), it is anticipated that fish could access and use the C10-A-B reach. Water depths were suitable for fish access during the site visit, and no fish passage barriers were noted. Fish use may only be seasonal in nature, but C10-A-B would be characterized as a permanent feature with direct fish habitat for a coolwater fish community.

C10-A-C is downstream of both C10-A-A and C10-A-B and receives flows from these assessed reaches upstream. Within the assessed reach, C10-A-C flows south along the highway ROW ditch, then flows in a southeast direction through a modified channel before crossing the 9th Line via a concrete box culvert. The ROW portion of the channel has been straightened but consisted of runs, pools, riffle, and flats, with an average wetted width of 0.4-1.2 metres and an average depth of 0.25 – 0.8 metres. Grasses lined the channel banks, and no riparian trees or shrubs were noted. The substrate consisted of a mix of silt, sand, cobble and muck. Small-bodied fish were captured at this location via electrofishing (Blacknose Dace and Brook Stickleback), and small-bodied fish were observed throughout the entire C10-A-C reach. Within the straightened (the feature appeared to be used as the property boundary between the two residential properties), a wetland-like portion of the channel downstream, dense cattails were present for approximately 80 m as the channel travelled east between two residential properties. The channel banks throughout this portion of the reach were less prominent, and flow appeared to disperse through the cattails. Soil has also been pushed into the bankfull limits on the north side of the channel, which may have altered the flow path of the channel. Further downstream, the channel meanders south through a narrow (10 m) grassed area between a gravel driveway and manicured lawn. This area was predominantly riffle and run habitat with cobble and gravel substrates. Riparian trees provided shade over the watercourse, and defined banks were present throughout this section. At the downstream end of the assessed reach, the watercourse flows west along the 9th Line before entering a concrete box culvert and continuing to flow south, where it connects with C10-A-1 approximately 150 m downstream from the assessed portion of C10-A-C. A deep pool (1.5-2 m) was present at the culvert inlet, and the channel had steep banks lined with cattails and phragmites. To the west of the culvert inlet underneath the 9th Line, a ditch inlet is present that captures roadside and highway drainage. During elevated water levels, fish can access this area. Small-bodied fish were observed entering the driveway culvert to the west of the 9th Line culvert. C10-A-C would be considered a permanent feature due to the substrate sorting observed, fish captured/observed through the reach and defined banks along much of the channel. Therefore, based on site observations and fish captures, C10-A-C would be considered direct fish habitat for a coolwater fish community.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2**.

4.1.2 C10-A-1 to C10-A-4 (WC-1): Tributary to Penville Creek

This tributary of Penville Creek flows north to south along the east side of Highway 400 to its confluence with another Penville Creek tributary approximately 1 kilometre downstream of the Study Area and eventually drains to Penville Creek approximately 3.6 kilometres south-west of the Highway 400 interchange location.

Within the assessed upstream reach (C10-A-1), the Tributary to Penville Creek is representative of an incised system with a morphology that primarily consists of runs and riffles. Substrates were mainly comprised of silt, clay, and gravel in order of dominance. Banks were steep but stable due to dense vegetation. The average mean wetted width was narrow at 0.3 metres, and the average mean water depth was 0.1 metres. Undercut banks and organic debris provided minimal instream cover. The riparian cover was high (90-100% cover), which consisted of primarily wet meadow herbaceous cover and the occasional riparian shrub. The immediate riparian land consisted of a grassed meadow for 30+ metres on either side of the creek. Surrounding lands outside of the grassed meadow were primarily agricultural fields and the highway ROW. No barriers to fish passage or groundwater indicators were observed.

Within the mid-portion of the reach (C10-A-2 and C10-A-3), the channel flows south along Highway 400 and functions as a highway drainage ditch. The majority of the channel in this portion consists of a straight run with a wetted width of 0.3 metres and depth of 0.15 metres. Pools were observed and had an average depth of 0.2 metres and width of 1.0 metres. Riparian vegetation consisted of grasses and cattails with no trees.

Within the assessed downstream reach, the tributary is representative of a channelized, deeply incised system with a morphology that primarily consists of runs, riffles, and flats. On the east side of Highway 400, the channel turns sharply to the west to flow underneath Highway 400 via a concrete box culvert. At the culvert inlet, a pool feature is present at the bend with a depth of 0.3 metres. The outside bank at the culvert inlet was also eroding. The culvert itself may function as a seasonal fish barrier due to the shallow laminar flow (< 3 centimetres) observed overtop of the concrete culvert base. No natural substrate was observed inside the culvert at the inlet. West of the Highway 400 ROW, the channel continues west via a deeply incised highway channel feature. Substrates were mainly comprised of clay, silt, gravel, and cobble in order of dominance. Banks were steep but stable due to them being densely vegetated. The in-stream cover was low and was comprised of cobble and overhanging banks. Shore cover was low (1-29%). The riparian buffer between the agricultural field and the channel was approximately 15 metres across. Riparian vegetation was dominated by wet meadow herbaceous cover and the occasional riparian shrub. Surrounding lands were primarily agricultural fields and the highway. No barriers to fish passage or groundwater indicators were observed.

The tributary appeared to be permanent based on the presence of stream-bed material and defined banks observed during field investigations, and fish were captured at both the upstream (C10-A-1) and downstream (C10-A-4) locations during the spring 2021 field investigations (Blacknose Dace and Creek Chub). For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2**. This reach can be characterized as providing direct fish habitat to a coolwater fish community. The assessed reach is generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed).

4.2 West Holland River Subwatershed (WC-1b to WC-24)

The West Holland River subwatershed (identified on **Figure 1-1**) is drained by the West Holland River, which flows in a northeast direction into Cook's Bay (Lake Simcoe). The main tributaries of the West Holland River include:

- Ansnorveldt Creek
- Glenville Creek
- East Kettleby Creek
- 400 Creek
- Pottageville Creek
- South Schomberg River
- North Schomberg River
- Fraser Creek
- Scanlon Creek
- William Neeley Creek
- Coulson's Creek, and
- Holland Marsh and its extensive canal and Municipal Drain system (LSRCA, 2010).

The headwaters originate from discharge springs and seepages along the northern parts of the Oak Ridges Moraine (LSRCA, 2010). However, tributaries to the West Holland River that do not originate on the Oak Ridges Moraine, like Fraser Creek, have different characteristics such as temperature regime and substrate, and thus fish community assemblages may differ from other Holland River Tributaries (LRSCA, 2010).

This subwatershed has a large range of thermal regimes, from cold headwater communities to diverse, warm large-order systems (LRSCA, 2010). The main branch of the West Holland River from the mouth to Highway 9 is considered warmwater habitat; this includes Eastern, Western and Holland Landing Creeks and all municipal and agricultural drainage systems which is applicable to the watercourses found in the Study Area (LRSCA, 2010). However, Fraser Creek and many of its tributaries, closer to the subwatersheds' western boundaries, are considered cold/cool water habitats. In the West Holland River, many watercourses have been channelized to accommodate agricultural development, especially in the Fraser Creek and direct tributaries of the Holland Marsh. Many of these systems are recognized as Municipal drains (LSRCA, 2010).

4.2.1 C-10-A-5 (WC-1b): Tributary to Fraser Creek – A

WC-1b at the C10-A-5 crossing travels underneath Highway 400 and McKinstry Road, approximately 1.2 kilometres north of Highway 88. WC-1b flows west and outlets into another Fraser Creek tributary approximately 600 metres downstream from the assessment location. Within the assessed reach of the watercourse, WC-1b was dominated by dense cattails within and along the banks of the channel. Cattails were present throughout the entire cross-section of the feature. Lands directly on either side of the channel consisted of active agricultural cropland. The Highway 400 crossing consisted of a concrete box culvert, while the crossing at McKinstry Road was a CSP. Non-turbid flow was observed during the site visit, but recent rain within the past 24-28 hours may have contributed to elevated water levels observed during the site investigation. The average depth was approximately 3 centimetres, and the average wetted width was 0.8 metres. The channel was historically altered/straightened between the two farm fields downstream, with gave the channel defined, steep banks. The entire channel length observed consisted of a run, with no pools observed. No substrate sorting was noted, and the channel had a U-shaped cross-section with no clear transition between the bottom of the channel and the banks.

Therefore, WC-1b would be considered an intermittent feature that provides indirect fish habitat for a warmwater fish community.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2**. The assessed reach is generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed).

4.2.2 C10-A-6 (WC-1c): Tributary to Fraser Creek – B

Based on available background information, this tributary of Fraser Creek (MNRF, 2019a) was classified as a warmwater system. The tributary flows north to southeast just north of County Rd 88, flowing under Highway 400, where it meets its confluence with another Fraser Creek tributary approximately 1.12 kilometres downstream and beyond the scope of the Study Area.

Within the assessed upstream reach, the Tributary of Fraser Creek (C10-A-6) is representative of a channelized headwater/drainage ephemeral system with a large riverstone armouring and a scour pool at the culvert inlet. Ditch drainage from the highway entered the culvert inlet from the north and south, and a separate channel entered the ROW lands from the west, which appears to originate from a small subdivision further west. The substrates in the pool and culvert were mainly comprised of silt and sand in order of dominance throughout the run section. The average mean wetted width of the pool was 1.0 metres, and the average mean water depth was 0.3 metres at the time of inspection. Terrestrial grasses were growing throughout the ditch features to the north, south, and west at the time of inspection. The riparian cover was high (90-100% cover), which consisted of primarily wet meadow herbaceous cover, and the occasional riparian shrub. The immediate riparian land consisted of a grassed meadow section, coniferous trees to the west, and Highway 400 within 30 metres of either side of the feature. An approximately 3 m change in elevation was present approximately 10 metres upstream from the culvert inlet, likely creating a barrier to fish passage (if fish were present). No groundwater indicators were observed at the time of inspection. The scour pool at the culvert inlet was dip netted, but no fish were captured.

Within the assessed downstream reach (C10-A-6), the feature was choked out by dense cattails and terrestrial grasses and no defined banks were observed at the time of inspection. There was a debris jam at the culvert outlet, which could be the reason for the plunge pool at the culvert's inlet. The feature appeared to be ephemeral based on the lack of a defined stream bottom or permanent/defined banks, and the presence of terrestrial grasses throughout the channel. As a result, this crossing is characterized as not fish habitat. For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The assessed reach is generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed).

4.2.3 C10-B-1 and C10-B-2 (WC-2a): Tributary to Fraser Creek – 1

Based on available background information, this tributary of Fraser Creek was classified as a warmwater system. The creek runs north to southeast just east of Line 9, east of Highway 400, where it meets its confluence with another Fraser Creek tributary between sites C10-C-1 and C10-B-2, which were assessed as well.

Within the assessed reaches for C10-B-1 and C10-B-2, this tributary to Fraser Creek appeared to be a drainage swale with no defined channel banks or substrate sorting. The swale was actively farmed through as part of the larger agricultural crop field. During the 2020 inspection, the swale had crops growing through it, and in 2021 the field was recently tilled. The substrates/soil were mainly comprised of topsoil, sand, and clay. No riparian vegetation was present other than a grassed meadow portion of the reach downslope of a hedgerow at C10-B-2. However, this grassed location had no defined feature or swale present. This site appears to have an ephemeral flow regime and would not be characterized as fish habitat.
For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2** (background fish community data was provided by NDMNRF, but fish are likely only found downstream in WC-2).

4.2.4 C10-C-1 and C10-C-2 (WC-2): Tributary to Fraser Creek – 2

Based on available background information, this tributary of Fraser Creek is a warmwater system that flows north to south, crossing under Line 8 between Highway 400 and County Rd 54. Its confluence with Fraser Creek is approximately 400 metres downstream of the Study Area.

C10-C-1 and C10-C-2 are two separate crossings on the same watercourse and are located approximately 200 metres from each other. Both crossings are located in a forested valley area approximately 80 metres wide. Within the assessed upstream reach (C10-C-1), the Tributary to Fraser Creek is representative of a naturalized system with a morphology that primarily consists of runs, riffles, and pools during the summer site inspection and runs during the spring site inspection (AECOM 2020, AECOM 2021). Substrates were mainly comprised of clay and cobble in order of dominance. The channel was lined with heavy woody debris at the time of inspection that provided instream and overhanging cover. The average bankfull width was 1.5 metres, and the average water depth was 0.15 metres during the spring inspection. Undercut banks and boulders provided additional instream cover. Evidence of high flows and eroding banks was observed on both sides of the channel. Surrounding forested lands provide 90-100% shore cover. No barriers to fish passage or groundwater indicators were observed.

Within the assessed downstream reach (C10-C-2), the tributary is representative of a naturalized system with a morphology that primarily consisted of isolated pools during the summer site investigations and flats during the spring investigations. The channel was partially dry during the summer investigation; water was only present in pool sections. Substrates were mainly comprised of clay, silt, and muck in order of dominance and were consistent throughout the reach. Steep incised valley lands surrounded the channel, and the surrounding forest provides 90-100% shade cover. During the spring 2021 field investigations, no aquatic life was observed (no fish, frogs, tadpoles etc.). Standing water was observed during the spring inspection, and there was a wetted width of 4 metres and an average water depth of 0.15 metres. A vulnerable (severe erosion) left bank was noted at the C10-C-2 crossing. Log jams observed may hinder fish passage, most notably during low flow conditions. Potential agricultural runoff is possible from upland farming activities.

The tributary appeared to be permanent based on the presence of streambed material and defined banks observed during the field investigations. Water flow was stagnant during the spring investigation, but this may be due to the multiple log and debris jams observed. NDMNRF (2019a) records indicate that Creek Chub and White Sucker were captured approximately 800 metres downstream of site C10-C-2, and during the 2020 fluvial geomorphology investigations, unidentified small-bodied fish were observed approximately 650 metres downstream of the crossing. However, no fish were captured or observed during AECOM’s 2021 fish assessment surveys. Based on field observations and available background information, the watercourse can be characterized as direct warmwater fish habitat. For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2**. The assessed reach is generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed).

4.2.5 C11-A-1 (WC-3): Tributary to Fraser Creek – 3

This tributary of Fraser Creek was characterized as a warmwater system based on background information and flowed north to south between Highway 400 and Sideroad 10. The confluence with another Fraser Creek tributary is approximately 370 metres downstream of the Study Area (i.e., WC-3 - C10-A-1 and C10-A-2).

Within the assessed upstream reach, this tributary is representative of a naturalized system with a morphology that consists of runs, riffles, and pools. Riffles had an average wetted width of 1.2 metres, and a depth of 0.03 metres, and pools had an average wetted width of 1.5 metres and depth of 0.15 metres. Substrates were mainly comprised of clay, cobble, silt, and boulders in order of dominance. The watercourse flows south through a wet meadow that transitions to a dense thicket north of the ROW. The channel is heavily incised, and the left bank is severely eroded in multiple locations. Evidence of high flow periods and sediment deposition were observed. During the spring 2021 investigations, a large amount of overhanging and woody debris was observed. The surrounding thicket provides 90-100% shore cover. At the upstream end and center ROW, refuge pools were observed. Both pools had small-bodied fish present at the time of inspection. Surrounding lands were primarily agricultural fields outside of the forest thicket. No barriers to fish passage or groundwater indicators were observed.

Within the assessed downstream reach, similar channel characteristics were noted as the upstream reach. The tributary is representative of an incised system with a morphology that primarily consists of flats and runs. No pool features were noted, though, in the downstream reach. Substrates were mainly comprised of clay, silt, and sand in order of dominance, with sections of exposed clay substrate in multiple locations. The watercourse flows out of the thicketed area in a southwest direction into an agricultural area with active crop fields on either side of the creek. There is a thin riparian buffer parallel to the channel between the two agricultural fields. Further downstream, the tributary had a deeper, more incised channel that contained deeper water that flowed at a slower velocity. Banks were observed to be unstable due to high flow periods. Dense vegetation provided seasonal stability to the steep, vulnerable banks. Surrounding herbaceous and shrub vegetation provides 60-90% shore cover. At the edge of the forested thicket where the watercourse entered the agricultural lands, the C11-A-2 tributary entered the C11-A-1 channel from the east bank.

The C11-A-1 tributary is characterized as a permanent warmwater feature that provides direct fish habitat based on the presence of flowing water during both field investigations and the fish captured during the spring 2021 field investigation. For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. Creek Chub, Northern Redbelly Dace, and Brook Stickleback were captured during AECOM's 2021 fish assessment surveys. The fish community assemblage of this tributary can be found in **Table 4-2**. The assessed reach is generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed).

4.2.6 C11-A-2 (WC-4): Tributary to Fraser Creek – 4

This tributary of Fraser Creek flows west through an actively cropped agricultural field to its confluence with C11-A-1, as shown in the figures. Approximately 370 metres further downstream, the tributary converges with the Tributary of Fraser Creek - 3 (i.e., WC-3, C10-A-1 and C10-A-2).

This feature consists of a farm field drainage swale at the upslope end (to the east), which originates in an actively cropped farm field. A poorly defined eroded swale was observed in the hedge row, and a tile drain outlet was noted in the forested area, which outlets into a man-made ditch. The ditch runs along the southern edge of the forested area, 3-5 metres into the forest from the edge of the field. The drainage channel outlets into a phragmites patch. The swale and channel of C11-A-2 were entirely dry at the time of the site investigations. This site appears to have an ephemeral flow regime, and due to the steep slope at the outlet at C11-A-1, fish would not be expected to inhabit C11-A-2 even during elevated water levels and is, therefore, not fish habitat.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2**.

4.2.7 C12-A-1 and C13-A-1 (WC-5): Tributary to Fraser Creek – 5

This tributary of Fraser Creek is a warmwater system that originates as a swale along the east side of Sideroad 10 and flows northeast and then southeast to converge with WC-6 south of the Study Area.

The upstream end of this feature is labelled as C12-A-1 along Sideroad 10 in the Study Area. The swale generally travels northeast through a thicket and forested lands. At the upstream end of the Study Area, the feature is characterized as a roadside ditch on the east side of Sideroad 10. No connection to the west side of Sideroad 10 was observed, and no defined feature was observed on the west side of Sideroad 10 that would be considered fish habitat. The bottom of the ditch on the east side of Sideroad 10 was wet and muddy throughout, but there were no defined banks/channels or evidence of substrate sorting. Similar characteristics were found further downstream, where the feature travels through a thicket area dominated by willow trees, buckthorn, sensitive fern, and jewelweed. A small cattail depression was noted in the thicket area that held stagnant water. No substrate sorting was noted throughout, and only small pockets of standing water in the cattails were observed. Sparse trees and dense shrubs shaded the area to the northeast of the road. Approximately 180 m downstream (northeast) of Sideroad 10, the feature outlets into an online pond. The pond is approximately 15 metres wide and 60 metres long, with a depth of greater than 2 metres. The pond outlets to the northeast, crosses a residential driveway and continues to flow through a forested area. The pond itself has sparse riparian trees that provide minimal shading, and the lands surrounding the pond were manicured lawn. Submerged aquatic vegetation was present along the shoreline, and sparse cattails were present at the northwest end of the pond. Algae was also present along the border of the pond. An abundance of small-bodied fish were observed, and seine pulls were completed along the shoreline. The only fish species captured were Fathead Minnows. Downstream of the pond, the channel was poorly defined, with non-continued banks and substrate sorting in some sections of the channel. The average wetted depth was less than 3 centimetres, and the wetted width was 0.8 metres on average.

Upstream of the online pond, C12-A-1 is characterized as an ephemeral feature that provides indirect fish habitat due to the lack of substrate sorting, no defined banks throughout the assessed reach, and dense vegetated observed in the drainage path. Additionally, no flowing water was observed during both field investigations. The pond itself would be considered a permanent feature with direct fish habitat due to the water depth observed, fish species observed/captured, and aquatic vegetation noted. Downstream of the online pond, C12-A-1 would be characterized as an intermitted feature that provides seasonally direct fish habitat due to poorly defined non-continuous banks, minimal substrate sorting, and lack of pools/refuge areas for fish.

North of the Study Area, beyond the wooded area, this tributary turns and flows southeast back into the Study Area. Where it crosses back into the ROW (C13-A-1), the tributary has a 15-metre grassed riparian buffer with a poorly defined channel flowing through the center. On either side of the grassed riparian buffer, actively cropped farm fields are present. Dense grasses were noted along the wetted channel and clear water was observed. The entire channel length consisted of a run feature with an average wetted width of 0.2 metres and a depth of 0.03 metres. No pools or riffles were observed. A farm field access road cuts through the center of the grassed riparian buffer and disrupts channel flow and form. Fish sampling was attempted, but no fish were captured. Due to the presence of flowing water during both field investigations, the C13-A-1 reach within the Study Area is considered direct warmwater fish habitat. However, this feature may only function as seasonal fish habitat during the summer months if flows are reduced because there are no pools for refuge and water depths were shallow. No fish barriers to downstream fish habitat were noted during the field investigation.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2**. The assessed reaches are generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed).

4.2.8 C14-A-1 (WC-6): Tributary to Fraser Creek – 6

This feature is a tributary of Fraser Creek but is characterized as a swale with an origin in a small wetland depression surrounded by a wooded area. There was no standing water present during the spring field inspection, and there was no defined channel, sediment sorting, or distinct morphology present upstream or downstream of the ROW crossing area along the mapped feature. The surrounding lands consisted of a densely forested area, with the mapped tributary within a forest clearing with dense shrubs and grasses. A poorly defined lowland swale feature was noted in the forested area along the southern edge of the Study Area but was also dry with no standing water and no wet soils. Beyond the Study Area, this feature converges with WC-5 just north of a large Stormwater Management (SWM) pond. This tributary appears to have an ephemeral flow regime due to the lack of channel features, and dry soils noted in the Study Area and is not considered fish habitat.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2** (background fish community data was provided by NDMNRF, but fish are likely only found downstream in WC-5).

4.2.9 WC-7: Tributary to West Holland River – 3

WC-7 is located along the northern edge of the 120 Study Area boundary in proximity to WC-8, approximately 150 metres west of Artesian Industrial Parkway. WC-7 flows southwest in a similar manner as WC-8 through an actively farmed agricultural field. WC-7 was not investigated in the field because there was not a crossing location associated with this feature, but it appears to be a poorly defined ephemeral drainage swale similar to WC-7. Therefore, this feature is not fish habitat.

4.2.9.1 Pond 1

This pond feature was identified on aerial photographs and investigated to determine the presence and extent of fish habitat that it may provide. During the field investigation, it was determined that the pond is an offline feature. No direct inlet or outlet to the pond could be identified in the field or from aerial imagery. The pond is a small, isolated wetland feature that is likely groundwater-fed. Due to the rainfall that had occurred within the 72 hours prior to the beginning of the investigation, the size/depth of the pond may have been increased during the site visit. The pond was oval-shaped and measured approximately 15 metres wide and 25 metres long, with a depth of over 1 metre. The surrounding lands consisted of dense forested lands and shrubs, which made accessing the pond shoreline difficult. Cattails were present along the shoreline with an abundance of woody debris. The middle of the pond was open water, but no fish were observed during the field investigation. Due to the offline nature of the pond, the pond itself is not considered fish habitat under the Federal *Fisheries Act*.

4.2.10 CR-4 and C16-A-4 (WC-9)

Crossing C16-A-4 is a tributary of WC-9 and is located on the east side of Younge Street. The feature drains in a southerly direction and outlets directly into WC-9 along the edge of the Study Area. The feature at the C16-A-4 crossing location had no defined feature, and no flow was noted during the site visit. The feature crosses a farm access road via an old, partially crushed CSP. The feature consisted of a poorly define agricultural swale with no defined banks, no substrate sorting, and terrestrial grasses throughout the feature. Based on these field observations, the feature at C16-A-4 would be considered an ephemeral feature that does not provide fish habitat.

The CR-4 crossing to the south and the section of WC-9 adjacent to County Road 4 (CR-4) were assessed as part of a separate, Early Works project. The description for the fish and fish habitat conditions for CR-4 can be found in AECOM's (2021) *Fish and Fish Habitat Assessment Technical Memorandum – Highway 400 - Highway 404 Link (Bradford Bypass) County Road 4 Early Works (GWP 2008-21-00).* Since any work at these features will occur as part of the County Road 4 Early Works project, this watercourse crossing will not be discussed further in this Report.

4.2.11 C16-A-3 and C16-A-2 (WC-8): Tributary to West Holland River – 2

This tributary to the West Holland River flows west to east to its confluence with the Tributary to West Holland River - 1 approximately 500 metres downstream. The location of the assessed reaches is approximately 450 metres northwest of the 8th Line and Artesian Industrial Parkway intersection.

Within the assessed upstream reach (C16-A-3), this tributary to the West Holland River - 2 is characterized as an agricultural swale that flows west to east. The origin of this feature is in an agricultural field west of a hedgerow where the investigation was completed. The swale was dry during both field investigations and transected multiple agricultural fields. Surrounding crops were not growing within the channel at some locations, suggesting that the swale may have high ephemeral flows during the spring and rain events. The downstream portion of the swale enters a small hedgerow section that shades the swale, but no water, no substrate sorting, or defined banks were observed. The site appears to have an ephemeral flow regime and is not fish habitat. For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2** (background fish community data was provided by NDMNRF, but fish are likely only found downstream in WC-9).

Within the assessed downstream reach (C16-A-2), similar agricultural swale characteristics were present as described in C16-A-3. The drainage swale was actively farmed, though and had crops planted throughout the feature. This feature had no defined banks, and no substrate sorting was noted. Therefore, this feature is characterized as an ephemeral feature as well and is also not fish habitat. For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2** (background fish community data was provided by NDMNRF, but fish are likely only found downstream in WC-9). The assessed reaches are generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed).

4.2.12 C16-A-1 (WC-9): Tributary to West Holland River – 1

This tributary to the Holland River - 1 is located approximately 220 metres west of Artesian Industrial Parkway and crosses under the Canadian National (CN) railway. The watercourse is representative of a naturalized system with a morphology that primarily consists of flats, runs, and pools. Approximately 50 metres upstream of the CN railway crossing, the channel consisted of pools approximately 2.5 metres wide and 1.0 metres deep, with flats 1.5 metres wide and 1.0 metres deep. Dense cattails and grasses lined the channel banks. Substrates were mainly comprised of clay, gravel, silt, and cobble in order of dominance. The watercourse has a moderate flow that drains east through an industrial area and then continues under the CN railway, crossing southeast until its confluence with West Holland River. Riparian vegetation consisted of dense thicket/forest in the upstream reaches, then open wet meadow/wetland towards the downstream reach of the surveyed area. Nearly the entire channel was shaded by thicket vegetation and woody debris overhanging the channel.

At the railway crossing, the channel flows underneath the railway via a corrugated steel pipe (CSP) culvert. At the CSP inlet and outlet, and downstream (east) of the crossing, the tributary is representative of a naturalized system with a morphology that primarily consists of flats and pools. Substrates were mainly comprised of muck. The watercourse enters a wetland feature with multiple channels and backwater locations. There were no defined banks, with the riparian lands consisting of riparian grass hummocks. Deep (>1 metre) pools were observed at the inlet and outlet of the railway crossing, and an abundance of small-bodied fish were observed both upstream and downstream of the crossing. Dense riparian grasses and cattails were noted along the channel as well, and multiple backwater pools and channels were present downstream of the crossing in the wetland feature.

The tributary appeared to be permanent based on the presence of stream-bed material, defined banks, and deep pool features and provides warmwater habitat based on the available fish community data (MNRF, 2019). For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. Creek Chub and Brook Stickleback were captured during AECOM's 2021 fish assessment surveys. The fish community assemblage of this tributary can be found in **Table 4-2**. There is also known Northern Pike spawning habitat in the wetland feature downstream (east) of the railway crossing based on available background information and NDMNRF consultation (**Appendix B**). Therefore, this site provides direct fish habitat.

4.2.13 C17-A-1 (WC-10): West Holland River

The West Holland River is a warmwater system that flows south to north, eventually outletting into Cook's Bay (Lake Simcoe) approximately 8 kilometres downstream of the Study Area.

Both the upstream and downstream assessed reaches had similar characteristics throughout the Study Area and are representative of a naturalized system with a morphology that primarily consists of flats. Substrates were estimated to be mainly comprised of silt and muck. The wetted width of the river was approximately 95 metres. The river is deep, slow-moving, and is bordered by dense cattails and phragmites on either side of the river that create a riparian buffer. On the east side, the riparian buffer of cattails and phragmites transitions to agricultural lands, and on the west side, the riparian lands transition into a larger forested area. Riparian vegetation was approximately 45 metres wide on the east side and 85 metres wide on the west side. Banks were stable as a result of the thick vegetative growth, and there were no signs of erosion observed. Water was turbid and sediment-laden with poor visibility. Algae blooms were observed during the investigations and suggest nutrient loading from surrounding agricultural drains and adjacent agriculture practices. Dense aquatic vegetation was observed along each side of the river, which consisted primarily of floating pond lilies and duckweed.

The West Holland River acts as a migratory corridor for fish to reach upstream spawning habitat and specialized habitats that fish use for spawning and nursery (e.g., slower-moving areas with instream cover). The section of the river within the Study Area is a confirmed spawning habitat for muskellunge species (MNRF, 2019).

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2**. The assessed reach is characterised as direct warmwater fish habitat with known significant fish habitat features (migratory and spawning functions).

4.2.14 C17-B-1 (WC-11) – Tributary to West Holland River - 3

This Tributary to the West Holland River-3 is a wide (5 metres), deep (> 1 metre), channelized agricultural drain that collects and conveys all the surrounding agricultural drains in the adjacent fields. The channel appears to flow south through the ROW to its confluence with the West Holland River, approximately 20 metres from the south of the ROW. No flow was observed, and the surrounding lands were flat, so the flow direction was difficult to determine but assumed to flow south to the river. This drain was highly productive, with evidence of intensive nutrient loading. The water in the channel was obscured by a thick layer of duckweed and algae blooms. There was a steep berm on the west side which separated this drain from the West Holland River. There were small shrubs and riparian cattails along the west bank, with a narrow (1 metre) strip of cattails before an actively farmed crop field on the east side. The downstream habitat was homogenous with the upstream habitat. Minnow traps were set in the drainage feature, and a single Northern Redbelly Dace was captured; therefore, this feature is characterized as direct warmwater fish habitat.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2**.

4.2.15 C17-C-1 to C18-E-1 (WC-12 to WC-22)

All of the following tributaries are concentrated in a small area approximately 1 kilometre east of the West Holland River. These drainage features appear to be interconnected and drain towards the West Holland River (WC-10) and the Tributary to the West Holland River – 3 (WC-11)

C17-C-1 to C18-D-1 are similarly characterized agricultural drains that are channelized drains that flow through actively farmed agricultural fields. No flowing water was present at the time of inspections. However, depending on the drain, some of them were dry at the time of inspection or only had moist soils (C17-C-1, C17-D-1, C17-F-1, C18-B-1), while others had standing water present (C17-E-1, C17-F-1, C18-A-1, C18-C-1, C18-D-1). All of these drainage channels were less than 1 metre wide with a defined U-shape to the channel. Of note, C18-A-1 and C18-D-1 had standing water present and were directly connected to the ditch along Hochreiter Road. Standing water was noted in Hochreiter Road along a majority of the 1 kilometre stretch that these drains feed into, and therefore may serve as seasonal fish habitat if water is present and fish can access this feature from C17-B-1 (WC-11), which is known direct warmwater fish habitat. Furthermore, C18-A-1 and C18-D-1 may also serve as poor seasonal fish habitats due to their connection with Hochreiter Road. Small-bodied fish were observed in C18-A-1, but these small-bodied fish were too small to capture with dip nets. Due to the shallow water depths and poor connection with the Hochreiter Road ditch, both C18-A-1 and C18-D-1 are only considered seasonal fish habitats. The agricultural drains are expected to dry up during the summer months or extended periods of no rain. The substrates for all these features are composed of the same topsoil, fine silt, and clay soil present in the surrounding agricultural fields. Due to the farming practices in the area that created these drainage features, along with the lack of substrate sorting observed and active crop planting in portions of the drainage features, the C17-C-1 to C18-C-1 would be characterized as ephemeral features. C18-D-1, which functions as a roadside ditch, did have defined banks and minimal substrate sorting. C18-D-1 is therefore characterized as an intermittent feature.

C18-E-1 (WC-22) is located on the south side of Hochreiter Road and appears to be a dry forested swale with no defined banks or flow direction. Upon inspection, there were no wet soils or substrate sorting observed. The surrounding lands consisted of a forested thicket with moisture-tolerant shrubs and trees. Based on these observations, C18-E-1 is characterized as an ephemeral feature and is not considered fish habitat.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2** (background fish community data was provided by NDMNRF for all the features discussed above, but fish are likely only found in WC-16, WC-20, and WC-22). The assessed reaches are generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed).

4.2.16 C18-F-1 to C18-H-1 (WC-23 to WC-24)

These two features are located around the intersection of Bathurst Street, Hochreiter Road, and the entrance road to two marinas further east. All of these features appear to be channelized features that were created near wetland or lowland features that now hold water and may not be directly connected to nearby watercourses unless water levels are elevated.

C18-H-1 (WC-24) is located at the northwest corner of Bathurst Street and Hochreiter Road. This feature is a channelized roadside drain that runs parallel to Bathurst Street and the marina entrance road. The channel appears to flow north to another sizeable agricultural drain through forested and agricultural fields until its confluence with the West Holland River. The deeply incised channel contains stagnant water, and the banks are well-vegetated and stable, although steep. There is limited in-stream cover that is dominated by woody debris and leaf litter. The shore cover is dense and dominated by forest. The channel morphology consisted of flats, with an average wetted width of 5 metres and depth of 0.7 metres. There was no observable flow throughout the assessed area during the spring 2021 investigations. Dense overhanging trees provide 80+% shading through the assessed area.

C18-G-1 (WC-23) is at the southwest corner of Bathurst Street and Hochreiter Road. A small ephemeral swale runs through the forest and connects with the road drainage along Bathurst Street. High ground in the swale along Hochreiter Road (WC-22) appears to split the flow, with a small portion of WC-22 flowing east to WC-23. The feature (WC-23) is channelized along Bathurst Street as a roadside drain. The roadside drain flows north and appears to flow into C18-F-1 at the Bathurst Street and Hochreiter Road intersection, but no direct connection underneath the roads could be observed. The deeply incised channel contains slow to stagnant flow. Banks are well-vegetated and stable, although steep. There is limited in-stream cover that is dominated by woody debris, aquatic macrophyte and leaf litter. Shore cover is dense and dominated by forested lands. The entire channelized area was considered flat as well, with the deepest point measured at 0.7 metres and the average wetted width of 2.2 metres.

C18-F-1 (WC-23) is located on the east side of Bathurst Street on either side of the marina entrance road. This feature collects flow from several road drains along the east side of Bathurst Street and appears to flow north to a large drain that ultimately conveys all flow into the East Holland River (WC-25). The deeply incised channel contains slow to stagnant flow. Banks were well vegetated and stable, although steep. The in-stream cover was moderate and dominated by aquatic macrophytes and woody debris. The riparian cover was low and dominated by riparian shrubs and overhanging woody debris. There was no flow observed throughout the assessed reach during the spring 2021 investigation. There was no flow observed at the entrance culvert underneath the marina driveway. Dense duckweed and cattails were observed at the northeast section of the feature at Bathurst Street and the marina entrance. East along the marina entrance on the south side, the was channel wide and well shaded by overhanging trees and woody debris with minimal floating or emerging aquatic vegetation in this area.

No fish were captured by AECOM at any of the above sites during the spring or summer 2021 field investigations. However, based on the available background information and amount (both depth and width) of water observed in these drainage features during the site investigation, all three drainage features are characterized as direct warmwater fish habitat. The assessed reaches are generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed). For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2**.

4.3 East Holland River Subwatershed (WC-25 to WC-31)

The East Holland River Subwatershed is drained by the East Holland River, which generally flows in a northerly direction into Cook's Bay (Lake Simcoe). The main branches of the East Holland River include the Main Branch, flowing westward from a point west of Musselman's Lake, the Aurora Branch, Wesley Corners Creek, and Bogart Creek (LRSCA, 2010). The Main Branch and the Aurora Branch join north of the Town of Aurora to form the East Holland River and continue to flow north to discharge into Cook's Bay (LSRCA, 2010). This subwatershed also has a significant number of ephemeral watercourses that dry up during the summer seasons (LRSCA, 2010).

Like the West Holland River Subwatershed, the East Holland River Subwatershed has a large range of thermal regimes; cold to coolwater tributaries feed the warmwater Main Branch. Many watercourses in the subwatershed have also been channelized to accommodate agricultural development (many of which are recognized as Municipal Drains) (LSRCA, 2010). In the Study Area, the main branch of the East Holland River from the mouth to Lloydtown Aurora Road/St. John's Sideroad West (approximately 5 kilometres south of Highway 9) is considered warmwater habitat (LRSCA, 2010). As noted above, the warmwater habitat applies to the Western, Eastern and Holland Landing Creeks, and all municipal and agricultural drainage systems.

4.3.1 C20-A-1 (WC-25): East Holland River

The East Holland River flows south to north towards its confluence with the West Humber River, approximately 3.5 kilometres north of the Study Area.

Within the assessed upstream reach, the East Holland River is representative of a naturalized system with a morphology that primarily consists of flats (homogenous throughout the investigated reach). Substrates were estimated to be mainly comprised of silt, muck, and clay in order of dominance. The river is wide (approximately 80 metres), deep, and slow-moving. The immediate shoreline of the entire riparian area is dominated by a cattail thicket approximately 10-20 metres wide. On the east side, the river is bordered by a golf course immediately beyond the riparian lands. On the east side, a Marina is present south of the Study Area, which has altered the shoreline with sheet piling and dock structures. On the east bank north of the ROW (within the Study Area), a narrow wetland feature is present along with a backwater area that would serve as a refuge for juvenile fish and a potential spawning area for warmwater fish species. No signs of erosion were observed along the banks, and the water was turbid and sediment-laden. No barriers to fish passage or groundwater indicators were observed. Dense aquatic vegetation was present along the shoreline adjacent to the thick cattail border, which consisted predominantly of floating pond lilies, duckweed, and milfoil. Trees also lined a majority of the shoreline outside of the marina area, but due to the cattail border along the river, there was minimal shading of the river from the trees.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The East Holland River acts as a migratory corridor for fish to reach upstream spawning habitat and specialized habitats that fish use for spawning and nursery areas (e.g., slower-moving areas with instream cover). The East Holland River is also confirmed spawning habitat for muskellunge species (MNRF, 2019). Therefore, the East Holland River would be considered fish habitat. The fish community assemblage of this tributary can be found in **Table 4-2**

4.3.2 C20-B-1 (WB-1): Silver Lakes Golf Course Pond

The pond (C20-B-1) is located on the Silver Lakes Golf Course and is approximately 60 metres from the East Holland River shoreline. The pond is characterized as an offline feature, and no direct connection to the East Holland River was observed during the site inspections. Discussions with the maintenance superintendent during the summer field investigations revealed that the East Holland River floods over Hole 2 every few years and, as a result, impacts this pond (AECOM, 2020).

The pond is next to Hole 2 on the golf course. The golf course maintains the area surrounding the pond right up to within 0.5 metres of the riparian zone. The riparian zone is comprised of wetland vegetation, and the banks are steeply sloped. Substrates were estimated to be mainly comprised of clay, silt, and sand in order of dominance. Riparian cover shaded a minimal portion of the pond (1-29%). Within the littoral zone, emergent vegetation was most prominent. Aquatic vegetation identified in the pond includes cattails, duckweed, white pond lily, and coontail.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The landowner did not permit fish collection; however, maintenance staff confirmed that the feature contains fish. The fish community assemblage of this tributary can be found in **Table 4-2.** Due to the lack of a permanent and direct connection to the East Holland River or any other permanent fish-bearing watercourse, it is our understanding that the pond is not considered fish habitat as per the Federal *Fisheries Act*.

4.3.3 C22-A-1 (WC-26): Holborn Drain

This tributary of the East Holland River flows south to north and is located in agricultural fields between Younge Street and the 2nd Concession Road. The Holborn Drain runs approximately 800 metres north to a wetland complex that eventually drains into the East Holland River.

Within the assessed upstream reach, the Holborn Drain consists of a channelized agricultural drain. During the spring 2021 site investigation, the channel was dry, with no flowing or standing water observed. The crossing location for C22-A-1 is in the middle of an agricultural area where the water feature separates two fields that are actively being farmed. A narrow (approximately 10 metres) grassed buffer along the channel separates the two fields that provide no trees or shading of the channel. The channel outlets into an online agricultural pond north of the ROW. The pond was covered in a dense layer of duckweed and algae. Riparian grasses surrounded the pond along the slopes. No trees or shrubs were noted in the area. A water pump was observed in the southern section of the pond, indicating that the pond is likely used for irrigation. Drainage ditches enter the channel from the hedgerows to the east and west immediately south of the pond, both of which were also dry during the spring 2021 inspection. Further north of the pond, a second online pond is present on the north side of the access road. A small CSP connects the ponds underneath the farm access road.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. Pumpkinseed and Brown Bullhead were observed during AECOM’s 2020 field investigation. The fish community assemblage of this tributary can be found in **Table 4-2**. The observation of fish and the presence of water in the pond during both site inspections indicate that the pond is direct warmwater fish habitat. The upstream channel to the south of the pond would be considered seasonal fish habitat, given it was dry during the spring inspection. The assessed reach is generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed).

4.3.4 C23-A-1 (WC-27): Ravenshoe/ Boag Drain

The Ravenshoe/Boag Drain flows south to north along the east side of the 2nd Concession Rd and into a wetland complex approximately 1.2 kilometres downstream of the Study Area, which eventually drains into the East Holland River.

Within the assessed upstream reach, the Ravenshoe/Boag Drain is representative of a channelized roadside drain that runs parallel with 2nd Concession Rd. During the spring 2021 field inspection, the channel appeared to have been dredged recently (within the past year or so). Both banks appeared slightly unstable throughout the entire reach and were artificially steepened during the clean-out works. However, the left bank was protected by vegetation, while the right bank was vulnerable to erosion. Emergent vegetation (primarily cattails) was observed. During the spring 2021 field investigation, the feature was dry, with sparse cattails and grasses observed. No water was present throughout the entire ROW in spring 2021, and no direct connections were observed to nearby watercourses were observed. The surrounding lands included a sod farm to the east and a crop field to the west on the far side of 2nd Concession Road. The downstream section of this feature was homogenous with the upstream section.

The drain appeared to be intermittent based on the presence of defined banks (that were recently dredged) and scouring of the bottom observed during the field investigations. Due to the lack of water observed during the spring investigation, a lack of substrate sorting, and no observed direction connection to fish habitat downstream, C23-A-1 is considered not fish habitat. For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2**. The assessed reach is generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed).

4.3.5 C24-A-1 (WC-28): Tributary to Ravenshoe/ Boag Drain – 1

This tributary of the Ravenshoe/Boag Drain drains in a northeast direction to its confluence with the Ravenshoe/Boag Drain approximately 960m north of the Study Area. The assessed reach was located approximately 850 metres southwest of the Holborn Road/Leslie Street intersection.

The feature consisted of a farm field drainage swale throughout the entire Study Area, which originated in an actively cropped farm field to the southwest. No defined feature was observed during field investigations, and the feature was entirely dry at the time of the site visit. This site appears to have an ephemeral flow regime and is not considered fish habitat.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2** (fish community data was provided by NDMNRF, but fish are likely only found downstream).

4.3.6 C25-A-1 (WC-29): Tributary to Ravenshoe/ Boag Drain – 2

This tributary of the Ravenshoe/Boag Drain flows south to north, approximately 200 metres west of Leslie Street and 500 metres south of Holborn Road. The confluence with another tributary to the Ravenshoe/Boag Drain is approximately 650 metres downstream of the Study Area.

The feature is located in a grassed swale between two actively farmed crop fields. A poorly defined swale with no prominent banks was observed through the grassed area. A small, ponded area (15x15 metres) was present at the northern end of the assessment area, potentially caused by a small earth berm from access road construction between the two farm fields. The ponded feature had cattails and shallow waters. No water was present in the swale upstream or downstream of the small, ponded area during the site investigation. Due to the lack of defined banks, terrestrial grasses throughout a majority of the drainage path, and lack of substrate sorting observed, C25-A-1 is characterized as an ephemeral feature. The swale feature is considered indirect fish habitat based on the standing water observed and the connection to WC-31 (direct fish habitat) approximately 200 metres north of the Study Area.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2** (fish community data was provided by NDMNRF, but fish are likely only found downstream).

4.3.7 C25-B-1 (WC-30): Tributary to Ravenshoe/ Boag Drain – 3

This tributary of the Ravenshoe/Boag Drain travels south to north and is located immediately east of Leslie Street in an active agriculture field. This feature converges with another tributary to Ravenshoe/Boag Drain approximately 370 metres north of the Study Area. This feature was observed to be a dry, agricultural swale in an actively farmed field with no defined feature. Goldenrod, asters, and other terrestrial grass/ herbaceous species grew in the feature. From what was observed, this site appears to have an ephemeral flow regime, and the swale feature is not considered to be fish habitat.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2** (fish community data was provided by NDMNRF, but fish are likely only found downstream).

4.3.8 C25-C-1 (WC-31): Tributary to Ravenshoe/ Boag Drain – 4

This tributary of the Ravenshoe/Boag Drain flows in a northwest direction to its confluence with the Ravenshoe/Boag Drain approximately 800m north of the Study Area. Within the Study Area, this feature includes an online agricultural pond with a drop structure outlet. Dense grasses and cattails with sparse riparian trees. The pond itself is located directly within the ROW. Downstream of the pond, a riparian buffer approximately 30 metres wide is present with grasses and trees between two actively cropped farm fields. The pond drop outlet structure appears to be a type of hicken-bottom feature, but it was unclear how it functions during the site visit. It is not anticipated that fish could traverse the drop structure upstream into the pond, therefore limiting fish passage throughout the assessed reach. It appears the pond was constructed by creating an earth berm at the northern edge of the ROW and is approximately 5 metres wide at the top and 8 metres from top to bottom of the berm. The channel was dry downstream of the outlet pool, with moist soils observed at the time of the spring inspection. There were no pools or standing water observed in the outlet channel during the summer investigation, and a large patch of invasive Phragmites was observed around the pond outlet pool.

The inlet of the pond was located to the south of the pond and consisted of a small inlet channel approximately 0.2 metres wide and 0.15 metres deep with a predominantly silt substrate. The inlet channel was buffered by 30 metres of riparian area with trees and shrubs. No barriers to fish passage were noted between the pond and the upstream reach. The pond itself was surrounded by grasses and shrubs with cattails along the border and had open water with no floating aquatic vegetation.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. Creek Chub and Brook Stickleback were captured during AECOM's 2021 fish assessment surveys. The fish community assemblage of this tributary can be found in **Table 4-2**. Given the presence of flowing water upstream of the pond and the fish captured within the pond itself, both the channel and pond are considered direct warmwater fish habitat. The pond may limit the use and function of the downstream channel by restricting flows, but fish would be expected to inhabit this area as well when water is present. The assessed reach is generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed).

4.4 Maskinonge River Subwatershed (WC-32 to WC-34)

Tributaries of the Maskinonge River begin in agricultural areas in the eastern half of the subwatershed and flow west towards Lake Simcoe. The Maskinonge River is the only named watercourse in the subwatershed. The Maskinonge River ranges from cold headwater communities influenced by the Oak Ridges Moraine in the south of the watershed to diverse, warm, large, order systems (LRSCA, 2010). The Maskinonge River's northern and main Branches (closer to Lake Simcoe) are classified as warmwater habitat; however, the more southern tributaries (i.e., within the Study Area) are classified as cold to coolwater (LRSCA, 2010). Geographically, this subwatershed exists in a small portion of the Oak Ridges Moraine, limiting the amount of its tributaries influenced by groundwater and thus, coldwater habitat is rare. Land use in the subwatershed is dominated by agriculture, with natural areas interspersed throughout (LRSCA, 2010).

4.4.1 C25-A-2 and C26-A-1 (WC-32): Tributary to Maskinonge (Jersey) River – 1

This tributary of the Maskinonge (Jersey) River flows in a northeast direction under Highway 404 through a box culvert to its confluence with another Maskinonge River tributary approximately 1 kilometre downstream of the Study Area.

Within the assessed upstream reach (C25-A-2), the Tributary to Maskinonge River is representative of an intermittent system that appeared to be more of a swale or catchment feature. Substrates were mainly comprised of boulders and rip rap at the culvert inlet, with sand, silt, and detritus in order of dominance further upstream of the culvert. The upstream section was mostly dry during the spring field investigation, with only small sections of standing water approximately 50 metres upstream where the drainage feature enters a small, forested area. The majority of plant species present being drought tolerant terrestrial species. Upstream of Highway 404, the channel was poorly defined.

Within the assessed downstream reach (C26-A-1), the tributary is representative of a naturalized feature with a small meandering channel through a cattail/phragmites patch. Substrates were mainly comprised of silt, sand, muck, and detritus in order of dominance. This section was dry at the culvert at the time of inspection in the summer but had standing water present inside the culvert at the outlet during the spring investigation. Downstream of the highway, the channel drained into a dense patch of cattail/phragmites. The feature's flow is restricted by the dense vegetation within and adjacent to the drainage path.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this tributary can be found in **Table 4-2** (fish community data was provided by NDMNRF, but fish are likely only found downstream). Given the lack of flowing water during both investigations, minimal standing water, and the poorly defined channel that was observed, this crossing is characterized as indirect fish habitat. The assessed reach is generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed).

4.4.2 C27-A-1 (WC-33): Maskinonge River (Jersey River)

This section of the Maskinonge (Jersey) River flows is adjacent to the Study Area and flows in a northerly direction. The channel itself is located outside of the proposed ROW, but the 120 m Study Area does contain a portion of the river.

Within the assessed upstream reach (Jersey River-upstream), the Maskinonge River is representative of a naturalized permanent system with a riffle/run morphology. Substrates were mainly comprised of silt, sand, boulder, and gravel in order of dominance. The average wetted width was 3.0 metres in the run section and approximately 2.0 metres m in the riffle section, and the average water depth was 0.3 metres in the run section and 0.1 metres in the riffle section at the time of inspection. Vascular macrophytes, organic debris, and boulders provided a fair amount of in-stream cover. The riparian cover was high (80% cover) and consisted of primarily wet meadow herbaceous cover, and deciduous trees. The immediate riparian land consisted of a woodlot and a grassed meadow for 30+ m on either side of the feature. The feature appeared to be permanent based on the presence of substrate sorting in the thalweg and the defined banks. Debris jams present in the reach could potentially lead to migratory obstructions. No groundwater indicators were observed at the time of inspection. Within the assessed downstream reach, the channel exhibited similar channel morphology and riparian characteristics as the upstream reach. A large riffle feature was noted in the downstream reach, and the channel bed was meandering with a defined bankfull channel with steep banks on either side of the wetted channel. Channel banks were partially scoured/undercut, indicating high flows do occur within the watercourse. Woody debris was present both in-stream and overhanging, which consisted of large fallen trees within the upstream and downstream reaches.

Due to the background fisheries information available, fish captured upstream in a tributary of the Maskinonge (Jersey) River, defined banks, substrate sorting, and aquatic vegetation observed, this watercourse is characterized as a permanent feature that provides direct fish habitat for a warmwater fish community. The assessed reach is generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed). For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. The fish community assemblage of this watercourse can be found in **Table 4-2**.

4.4.3 C28-A-1 (WC34): Tributary to Maskinonge (Jersey) River – 2

This tributary of Maskinonge (Jersey) River -2 (C28-A-1) flows in a northeast direction under the Highway 404 – Queensville Side Road interchange through four concrete arch culverts to its confluence with another tributary to the Maskinonge River approximately 865 metres downstream of the Study Area.

Within the assessed upstream reach, the Tributary to Maskinonge River - 2 is representative of a channelized permanent/intermittent system with a morphology that primarily consisted of runs and a pool at the culvert outlet and diffused wetland area with no defined channel, but water present throughout. Substrates were mainly comprised of silt, muck, and detritus at the culvert outlet pool and muck, silt, and detritus in order of dominance throughout the run section. The average mean wetted width was 1.6

metres, and the average mean water depth was 0.18 m at the time of inspection. Vascular macrophytes and cobbles provided a fair amount of in-stream cover. The riparian cover was high (90-100% cover), which consisted of primarily phragmites, cattails, wet meadow herbaceous cover, and the occasional riparian shrub. The immediate riparian land consisted of a grassed meadow for 30+ metres on either side of the feature, and the area is within a catchment basin created to collect runoff from the highway 404 and Queensville Sideroad interchange. The lack of a defined feature within the phragmites/cattail stand could indicate that the area has the potential to be a seasonal barrier to fish passage during drought conditions. No groundwater indicators were observed at the time of inspection.

Within the assessed downstream reach, the tributary is representative of a small, incised, channelized feature that had a morphology of runs and pools. Substrates were mainly comprised of muck, silt, muck, and detritus, in order of dominance. The average wetted width in the run section was 0.5 metres, while the average wetted width in the pool section was approximately 2.25 metres. The average wetted depth in the run section was approximately 0.25 metres, while the average wetted depth in the pool section was approximately 1.0 metres. As the channel exits the existing culvert, it is narrowed by riprap and grass species. A section of severe erosion was noticed on the left bank approximately 50 metres downstream from the culvert outlet, and a plunge pool was present at the same section. The right bank seemed relatively stable in comparison at the time of inspection. Undercutting was observed on both the right and left banks throughout the reach. The in-stream cover was moderate (60%) and was comprised of overhanging and instream vascular macrophytes and undercut banks. The shore cover was moderately high (60-89%) and was comprised of phragmites, cattails, and water-tolerant grasses. Algae was observed in the pool section and on some rocks in the riffle section.

For site specific information, refer to **Table 4-1** for the fish and fish habitat conditions summary. Fish community assemblage of this tributary can be found in **Table 4-2**. During the 2022 spring investigation, the conductivity in the water was too high for the electrofisher to operate properly. However, thirty (30) Brook Stickleback and one (1) Northern Redbelly Dace were captured via dip-netting. As a result, this crossing is characterized as direct fish habitat. The assessed reach is generally non-limiting throughout (i.e., no sensitive, important, or exceptional habitat was observed).

Table 4-1: Existing Fish and Fish Habitat Conditions Summary Table (Template D2A)

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
Waterbody Name: Tributary to Penville Creek – 1 **Crossing Locations:** C10-A-A (WC-1)	2022-06-09	Intermittent	Cool (MNRF, 2019a)	**Indirect** **Habitat**: No defined channel and no flowing water could be observed. Dense phragmites were present for approximately 80 m along the east ditch along Highway 400 and for approximately 40 m east downstream of the culvert outlet. The phragmites were present within the entire highway ROW within the assessed reach.	Muck, detritus, silt.	NA – no defined feature observed.	Dense phragmites**.**	**Opportunity:** Remove invasive phragmites.	N/A
Waterbody Name: Tributary to Penville Creek – 1 **Crossing Locations:** C10-A-B, C10-A-C (WC-1)	2022-06-09	Permanent	Cool (MNRF, 2019a)	**Direct** **Upstream Habitat**: C10-A-B – consisted predominately of runs (90%) with sparse riffles (10%). No pools were noted, and no fish were observed during the site visit. No barriers to fish passage were noted throughout the ROW. **Downstream Habitat**: C10-A-C – the ROW portion of the channel was straightened but consisted of runs, pools, riffles, and flats. Grasses lined the channel banks, and no riparian trees or shrubs were noted. Within the modified portion of the channel downstream, dense cattails were present for approximately 80 m as the channel travelled east between two residential properties. The channel banks throughout this portion of the reach were less prominent, and flow appeared to disperse through the cattails. Soil has also been pushed into the bankfull limits on the north side of the channel, which may have altered the flow path of the channel. Further downstream, the channel meanders south through a narrow (10 m) grassed area between a gravel driveway and manicured lawn. This area was predominantly riffles and runs with cobble and gravel substrate. Riparian trees provided shade over the watercourse, and defined banks were present throughout this section.	**Upstream**: Silt/sand/ gravel. **Downstream:** silt/sand/cobble/muck.	**Upstream:** runs (90%) with sparse riffles (10%). **Downstream:** runs (50%), riffles (30%), pools (10%), flats (10%).	Cattails and phragmites patches at the downstream end.	**Opportunity:** Remove invasive phragmites. Restore channel form at impacted/ straightened section where the soil has been pushed into bankfull limits.	N/A

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
Waterbody Name: Tributary to Penville Creek – 1 **Crossing Locations:** C10-A-1, C10-A-2, C10-A-3 and C10-A-4 (WC-1)	2020-09-14 and 2020-09-21	Permanent	Cool (MNRF, 2019a)	**Direct** **Upstream Habitat**: Permanent watercourse runs south through the agricultural field before becoming channelized adjacent to Highway 400. The Channel upstream of the Highway crossing is deeply incised (evidence of high flow periods) and densely vegetated. Banks were steep but stable due to vegetation. Undercut banks and organic debris provided minimal instream cover. Bank vegetation provided overhanging cover that resulted in 90 – 100% shore cover. Riparian vegetation was dominated by wet meadow herbaceous cover and the occasional riparian shrub. **Downstream Habitat**: Permanent watercourse which runs west through the Highway ROW and into an agricultural field to the west. Channel is widened in this reach, with a more naturalized substrate morphology (i.e., run, riffle and pool sections). Banks were steep but stable due to vegetation. The in-stream cover was low and was comprised of cobble and overhanging banks. Shore cover was low (1-29%). The riparian buffer between the agricultural field and the channel was approx. 15 m across. Riparian vegetation was dominated by wet meadow herbaceous cover and the occasional riparian shrub.	**Upstream**: Silt/clay/ gravel **Downstream:** Clay/silt/gravel/cobble	**Upstream:** Channelized, narrow width, incised and a 90% run with 10% riffle morphology. **Downstream:** Channelized, wide channel deeply incised, and a 70% run, 10% flat and 10% riffle morphology.	**Upstream:** no vascular macrophytes or woody debris to provide in-stream cover. Bank and overhanging vegetation are dense and dominated by vascular macrophytes and wet meadow herbaceous species. **Downstream:** no aquatic macrophytes providing in-stream cover. Bank vegetation is dense and dominated by vascular macrophytes and wet meadow herbaceous species.	**Opportunity**: Channelized watercourse morphology from C10-A-2 to the culvert inlet at C10-A-4 could be naturalized.	N/A
Waterbody Name: **Crossing Locations:** C10-A-5, (WC-1b)	2022-06-09	Intermittent	Warmwater (AECOM, 2022)	**Indirect** **Habitat:** WC-1b was dominated by dense cattails within and along the banks of the channel. Cattails were present throughout the entire cross-section of the feature. Lands directly on either side of the channel consisted of active agricultural cropland. The average depth was approximately 3 cm, and the average wetted width was 0.8 m. The channel was historically altered/straightened between the two farm fields downstream, which gave the channel defined, steep banks. The	Silt/sand/gravel/muck.	Straightened/ channelized.	Cattails.	**Opportunity:** Restore/widen riparian vegetation lands.	N/A

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
				entire channel length observed consisted of a run, with no pools observed. No substrate sorting was noted, and the channel had a U-shaped cross-section with no clear transition between the bottom of the channel and the banks.					
Waterbody Name: **Crossing Locations:** C10-A-6, (WC-1c)	2022-06-09	Ephemeral/ Intermittent	Warm (NDMNRF, 2022)	**Not fish Habitat** **Upstream Habitat:** a channelized drainage system with large riverstone bank stabilization in place. The feature morphology was confined to largely the culvert inlet pool (20%), which was approximately 30cm deep, and inside the culvert (80%). An approximately 3m drop in elevation was present just before the culvert inlet, creating a possible barrier to fish passage. Water was present in the culvert inlet, but it should be noted that it had rained significantly within the 72hrs prior to the inspection. **Downstream Habitat:** wetland feature with no defined channel beyond the culvert outlet. A debris jam was present at the culvert outlet. Approximately 5m downstream from the culvert outlet.	Silt (80%)/sand (20%)	Culvert inlet plunge pool (20%); inside culvert (80%)	Water-tolerant terrestrial vegetation and cattails were present throughout the feature, choking the “channel” both in the upstream and downstream reaches	**Opportunity:** Remove debris jam from culvert outlet and downstream of culvert; repair bottom of the culvert	N/A
Waterbody Name: Tributary to Fraser Creek – 1 **Crossing Locations:** C10-B-1 and C10-B-2 (WC-2a)	2020-09-14	Ephemeral	Warm (MNRF, 2019a)	**Not Fish Habitat** **Habitat:** Ephemeral drainage swale in an actively farmed agricultural field. No substrate sorting and no defined channel were observed. Swale is actively farmed through and appears to be planted/tilled regularly.	topsoil/sand/clay.	N/A	Agriculture	N/A	N/A
Waterbody Name: Tributary to Fraser Creek – 2 **Crossing Locations:** C10-C-1 and C10-C-2 (WC-2)	2020-09-14 and 2021-06-02	Permanent (dries up downstream at crossing C10-C-2).	Warm (MNRF, 2019a)	**Direct** **Upstream Habitat:** Moderate flow, natural morphology. Channel lined with heavy woody debris provides instream and overhanging cover. Undercut banks and boulders provide additional instream cover. Evidence of high flows and eroding banks on both sides of the channel. The surrounding forest provides 90-100% shore cover.	**Upstream:** Clay/cobble. **Downstream:** Clay/silt/muck	**Upstream:** **Summer:** run/ pool/riffle **Spring:** no pools observed. **Downstream:** **Summer:** pool/riffle (i.e., cobble substrates, dry	The surrounding forest is dominated by willow and cedar species, lowland shrubs.	**Constraints:** Vulnerable (severe erosion) left bank at C10-C-2 crossing. Log jams observed may hinder fish passage, most notably during low flow conditions.	N/A

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
				Downstream Habitat: Channel was partially dry during the investigation; water was only present in pools sections. The substrate was consistent throughout the reach. Steep incised valley lands surrounding channel. Surrounding forest provides 90-100% shore cover. **Spring:** No aquatic vegetation observed. No aquatic life noted - no fish, frogs, tadpoles observed.		during the investigation) **Spring:** flats		Potential seasonal obstructions due to low flow. **Opportunities**: Restore and repair left bank erosion; remove seasonal obstructions to fish passage; and remove invasive species present on site.	
Waterbody Name: Tributary to Fraser Creek – 3 **Crossing Locations:** C11-A-1 (WC-3)	2020-09-21 And 2021-06-02	Permanent	Warm (MNRF, 2019a)	**Direct** **Upstream Habitat:** Natural watercourse flows south through a wet meadow that transitions to a dense thicket below the north ROW. Watercourse exhibits a natural channel and substrate morphology. Channel is heavily incised, and the left bank is severely eroded. Evidence of high flow periods and sediment deposition. Surrounding thicket provides 90-100% shore cover. **Spring:** Channel has a natural meandering profile through the forested area. Steep slightly unstable banks provide undercut cover and resulted in a large amount of instream and overhanging woody debris. Pools were observed, most notably at upstream end and center ROW point that provide refuge during summer months for fish. Small-bodied fish were observed at both pool locations. **Downstream Habitat:** Semi-channelized watercourse flows out of the thicketed area upstream in a southwest direction through agricultural fields. There is a thin riparian buffer parallel to the channel. This reach had a deeper, more incised channel that contained deeper water that flowed at a slower velocity. Banks were both unstable due to high flow periods. Dense vegetation provided seasonal stability to the steep, vulnerable banks. Surrounding herbaceous and shrub vegetation provides 60-90% shore cover.	**Upstream**: Clay/cobble/silt/boulder **Downstream:** clay/silt/ sand	**Upstream:** Run/ riffle/ pool **Downstream:** Flat/ pool	**Upstream:** Dense thicket dominated by riparian shrubs (dogwood, cherry) and trees (green ash, buckthorn, elm) surrounds channel, no in-stream vegetation. **Downstream:** Dense overhanging vegetation consisting of aquatic macrophytes, wet meadow herbaceous species and riparian shrub. Limited instream cover consisting of aquatic macrophytes and undercut banks.	**Constraint:** Banks were slightly unstable, works in the area should consider avoiding and/or stabilizing these areas.	N/A

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
				Spring: Similar channel morphology and characteristics as upstream end. No significant pools features observed at downstream end. Channel enters farm field and channelized drainage swale between two farm fields, which probably provides poor fish habitat. Clay substrate noted through run sections at downstream end.					
Waterbody Name: Tributary to Fraser Creek – 4 **Crossing Locations:** C11-A-2 (WC-4)	2020-09-21 and 2021-06-02	Ephemeral	Warm (MNRF, 2019a)	**Not Fish Habitat** **Habitat:** Phragmites lined channel is approximately 20 cm wide. The substrate looks wet, but the channel was dry upon inspection. **Spring**: Indirect fish habitat. Feature consists of a farm field drainage swale at the upslope end to the east, which originates in an actively cropped farm field. A poorly defined eroded swale was observed in the hedge row, and a tile drain outlet was noted in the forested area which outlets into a man-made ditch. The ditch runs along the southern edge of the forested area, 3-5 m into the forest from the fields edge. Drainage channel outlets into C11-A-1 near a phragmites patch. Channel was entirely dry at time of site visit.	Silt/sand/clay	N/A	Dense in channel vegetation growth dominated by phragmites and cattail near the channel outlet into C11-A-1. Narrow riparian buffer (1 m) on both sides of the channel.	N/A	N/A
Waterbody Name: Tributary to Fraser Creek – 5 **Crossing Locations:** C12-A-1 (WC-5)	2020-09-17 and 2021-06-02	Ephemeral (upstream of pond), permanent (pond), intermittent (downstream of pond).	Warm (MNRF, 2019a)	**Indirect** (channel); **Direct** (pond) **Habitat:** Swale runs north through thicket and forest. The ground was wet and muddy throughout, but there was no defined banks/channel. The thicket was dominated by willow trees, buckthorn, sensitive fern, jewelweed wet and riparian species. A small cattail depression at the origin of the swale contains stagnant water. No substrate sorting, small pockets of standing water in cattails. Sparse trees and dense shrubs shade area to the northeast of road. Feature enters wooded lands further to the northeast on private lands. Approximately 180 m downstream (northeast) of Sideroad 10, the feature outlets into an online pond. The pond is approximately 15 m wide and 60 m	Clay/detritus/silt/muck	N/A	Small depression was filled with phragmites and cattail. Swale runs through dense forest/ thicket. Pond: Submerged aquatic vegetation was present along the shoreline, and sparse cattails were present at the northwest end of the pond. Algae was also present along the border of the pond.	N/A	N/A

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
				long, with a depth of greater than 2 m. The pond outlets at the northeast end of the pond, crosses a residential driveway, and continues to flow through a forested area. The pond itself has sparse riparian trees that provided minimal shading, and the lands surrounding the pond were manicured lawn. An abundance of small-bodied fish were observed, and seine pulls were competed along the shoreline. Downstream of the pond, the channel was poorly defined with non-continues banks and substrate sorting in some sections of the channel. Average wetted depth was less than 3 cm, and the wetted width was 0.8 m on average.					
Waterbody Name: Tributary to Fraser Creek – 5 **Crossing Locations:** C13-A-1 (WC-5)	2020-09-18 and 2021-06-02	Intermittent	Warm (MNRF, 2019a)	**Direct** **Habitat:** Natural swale through meadow and agricultural field. Riparian buffer runs parallel to the swale and is approximately 15 m wide. There is no defined channel nor distinct morphology present. **Spring:** Entire feature within the ROW consists of a 15 m grassed area with a channelized feature through the middle. Dense grasses noted along the wetted channel with clear water observed. No pools observed. Channel originated from hedgerow upstream to the north and enters scrubland to the south with sparse shrubs and trees. Patch of phragmites noted at the downstream end. Farm field access road cuts through center of grasses riparian feature and disrupts channel flow and form.	Muck/detritus	N/A	Swale is densely vegetated with cattail and phragmites. Riparian vegetation is a mixture of wet and dry tolerant species.	N/A	N/A
Waterbody Name: Tributary to Fraser Creek – 6 **Crossing Locations:** C14-A-1 (WC-6)	2020-09-18 and 2021-06-02	Ephemeral	Warm (MNRF, 2019a)	**Not fish habitat** **Habitat:** Swale with origin in small wetland depression surrounded by thicket that is dominated by wet tolerant species. There was no standing water present at the time of inspection. There is no defined channel nor distinct morphology present upstream or downstream of ROW crossing area.	Muck/detritus	N/A	Forest (white birch, poplar, conifer), with wetland depression and wet open meadow.	N/A	N/A

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
				Lowland swale feature with no defined edges was noted in the forested area downstream of the ROW, but area was dry with no standing water and no wet soils. Approximately 200 m downstream there is a poorly defined feature that was dry, with cattails and pockets of moist soils.					
Waterbody Name: Pond 1 **Crossing Locations:** NA	2022-06-09	N/A	N/A	**Not fish habitat** **Habitat:** The pond is an offline feature. The pond was an oval shaped and measures approximately 15 m wide and 25 m long, with a depth of over 1 m. The surround lands consisted of dense forested lands and shrubs. The middle of the pond was open water, but no fish were observed during the field investigation. Cattails were present along the shoreline, and riparian trees/shrubs provided shading of approximately 25% of the pond.	Detritus/muck.	N/A	Cattails	N/A	N/A
Waterbody Name: Tributary to West Holland River – 3 **Crossing Locations:** (WC-7)	NA	Ephemeral	Warm (AECOM, 2021)	**Not fish habitat** **Upstream Habitat:** WC-7 flows southwest in a similar manner as WC-8 through an actively farmed agricultural field. WC-7 was not investigated in the field because there was not a crossing location associated with this feature, but it appears to be a poorly defined ephemeral drainage swale similar to WC-7. Therefore, this feature is not fish habitat.	N/A	N/A	Agricultural crop	N/A	N/A
Waterbody Name: Tributary to West Holland River – 1 **Crossing Locations:** C16-A-1 (WC-9)	2020-09-18, 2021-06-15, and 2021-08-12	Permanent	Warm (MNRF, 2019a)	**Direct** **Upstream Habitat:** Watercourse has a moderate flow that drains east through an industrial area, then continues under a railway crossing heading south/ southeast until its confluence with West Humber River. Valley land surrounding channel is dense thicket/forest on the upstream reaches then open wet meadow/wetland towards the downstream reach. Watercourse has a natural morphology and is deeply incised through a primarily clay substrate. Channel is completed shaded by thicket and woody debris overhanging the channel.	**Upstream**: Clay/gravel/silt/cobble Downstream: muck	**Upstream:** Flat/ run/ pool Downstream: Flat/ Pool	**Upstream:** upstream is dominated by an agricultural thicket/ deciduous swamp community that transitions into a shallow cattail marsh community close to the rail crossing and downstream. **Downstream:** Overhanging cattails and grasses shaded parts of the channel; grass hummocks provide additional shading.	**Constraints:** N/A **Opportunities:** Maintain wetland and cattail marsh to the extent possible to ensure Northern Pike spawning habitat.	Mapped Northern Pike spawning habitat

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
				Downstream Habitat: Watercourse enters a wetland feature with multiple channels and backwater locations. No defined bankfull or channel banks. with riparian grass hummocks and deep (>1 m) water observed. Dense riparian grasses and cattails.					
Waterbody Name: Tributary to West Holland River – 2 **Crossing Locations:** C16-A-2 and C16-A-3 (WC-8)	2020-09-18, 2021-06-15, and 2021-08-12	Ephemeral	Warm (MNRF, 2019a)	**Not fish habitat** **Upstream (A-3):** Data for this agricultural swale was taken at approx. 15 m downstream from the crossing location. Watercourse has its origin in an agricultural field west of a hedgerow where the investigation was completed. The watercourse was a dry swale that transected multiple agricultural fields (soy). The swale seems to have a natural meander and a poorly defined channel; however, the surrounding crop was not growing within the channel, suggesting that the swale may have flow during spring and high flow periods. During the spring field visit, the entire drainage swale was dry and planted with crops. **Downstream (A-2):** Downstream habitat homogenous to upstream habitat.	Clay/ sand (dry)	N/A	Agricultural crop	N/A	N/A
Waterbody Name: Tributary to West Holland River – 1 **Crossing Locations:** C16-A-4 (WC-9)	2022-06-09	Ephemeral	Warm (MNRF, 2019a)	**Not fish habitat** **Habitat:** a poorly defined swale feature with no defined banks nor flow was observed during the site visit. The feature crosses a farm access road via a partially crushed, old CSP culvert.	topsoil	Swale feature	Terrestrial grasses were growing throughout the feature	N/A	N/A
Waterbody Name: West Holland River **Crossing Locations:** C17-A-1 (WC-10)	2020-09-15 and 2021-06-14	Permanent	Warm (MNRF, 2019a)	**Direct** **Upstream Habitat:** River flows in a northeast direction. Wide (+ 90 m), deep and slow-moving river bordered by wetland (open fen and shallow marsh) on the west bank and a narrow wetland (shallow marsh) riparian buffer that transitions to agriculture on the east bank. Banks were stable and are bordered by thick vegetative growth; no signs of erosion were observed. Water	It is estimated to be dominated by silt/ muck/ clay.	Flat (homogenous throughout investigated reach)	Instream vegetation was dominated emergent and submergent (dominated by cattail and aquatic macrophytes along the shoreline and floating (dominated by duckweed and along the river's littoral zone). Little overhanging cover or shade in main channel	N/A	Acts as a migratory corridor for fish to reach upstream spawning habitat and specialized habitats that fish use for spawning, nursery (e.g. slower moving areas with instream cover).

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
				is turbid and sediment laden. River displays a natural morphology. Algae blooms observed during the investigation suggests nutrient loading from surrounding agricultural drains and adjacent agriculture practices. **Downstream Habitat:** Downstream habitat feature homogenous to upstream habitat.			Riparian grass and scrub land. Agricultural crop land use to the east, forested lands and wetland to the west. Cattail thicket along shoreline can be walked through during spring conditions (was not possible to walk through during 2020 investigations)		Confirmed spawning habitat for muskellunge species (MNRF, 2019).
Waterbody Name: Tributary to West Holland River – 2 **Crossing Locations:** C17-B-1 (WC-11)	2020-09-15 And 2021-06-14	Permanent	Warm (MNRF, 2019a)	**Direct** **Upstream Habitat:** Wide (+ 5m), deep and channelized agricultural drain that collects and conveys all the surrounding agricultural drains in the adjacent fields. The channel flows south through the alignment to its confluence with the West Holland River, approximately 20 m from the south ROW. Highly productive, evidence of intensive nutrient loading. Water in the channel obscured by a thick layer of duckweed and algae blooms. **Downstream Habitat:** **Summer investigation:** Downstream habitat feature homogenous to upstream habitat. **Spring investigation:** Steep berm bank on west side separating channel from West Holland River. Small shrubs and riparian cattails along the west bank, with a narrow (1m) strip of cattails before actively farmed crop field on the east side.	Silt/muck/detritus.	Flat	Cattails, milfoil, duckweed	**Constraint:** Downstream right bank classified as unstable and vulnerable during spring investigations. **Opportunity:** Restore and stabilize vulnerable bank.	N/A
Waterbody Name: Unnamed Drain – 1 **Crossing Locations:** C17-C-1 (WC-12)	2020-09-15 And 2021-06-14	Ephemeral	Warm (MNRF, 2019a)	**Not fish habitat** **Habitat:** Channelized agricultural drain through a cornfield. No water was present in the channel upon inspection. The soil was dry, and there was dense vegetative growth within the channel.	N/A	N/A	Agriculture	N/A	N/A
Waterbody Name: Unnamed Drain – 2	2020-09-15 And 2021-06-14	Ephemeral	Warm (MNRF, 2019a)	**Not fish habitat** **Habitat:** Channelized agricultural drain through a cornfield. No water was present at the time of inspection. However, the soil was still saturated,	N/A	N/A	Agriculture	N/A	N/A

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
Crossing Locations: C17-D-1 (WC-13)				and there was minimal vegetation growth in the channel. Banks were shallow; however, there was a defined U shape to the channel. The channel substrate is composed of the same fine silt and clay soil present in the surrounding agricultural fields.					
Waterbody Name: Unnamed Drain – 3 **Crossing Locations:** C17-E-1 (WC-14)	2020-09-15 And 2021-06-14	Ephemeral	Warm (MNRF, 2019a)	**Not fish habitat** **Habitat:** Conditions are the same as what was recorded for the C17-D-1 crossing location.	N/A	N/A	Agriculture	N/A	N/A
Waterbody Name: Unnamed Drain – 4 **Crossing Locations:** C17-F-1 (WC-15)	2020-09-15 And 2021-06-14	Ephemeral	Warm (MNRF, 2019a)	**Not fish habitat** **Habitat:** Conditions are the same as what was recorded for the C17-D-1 crossing location.	N/A	N/A	Agriculture	N/A	N/A
Waterbody Name: Unnamed Drain – 5 **Crossing Locations:** C18-A-1 (WC-16)	2020-09-15 and 2021-06-14	Ephemeral	Warm (MNRF, 2019a)	Direct – poor seasonal habitat. Small-bodied fish were observed in channel. Fish likely accessed the ditch during overnight rainfall. Poor seasonal habitat at best. Fish become stranded after rainfalls. **Habitat:** Channelized agricultural drain adjacent to access road and mixed vegetable crop. The channel's upstream reach was dry with saturated soil, and the downstream reach contained standing water. The channel was narrow (0.5 m wide), the banks were shallow, and there was no in-stream vegetative growth. The ground is composed of the same fine silt and clay soil present in the surrounding agricultural fields.	Summer: Clay/silt/sand Spring: Downstream: Muck	Flat	Agriculture	**Opportunity:** Downstream outlet into the ditch at Hochreiter Road is elevated, which cuts off access into the ditch. **Constraint:** Downstream banks are unstable and vulnerable	N/A
Waterbody Name: Unnamed Drain – 6 **Crossing Locations:** C18-B-1 (WC-17)	2020-09-15 And 2021-06-14	Ephemeral	Warm (MNRF, 2019a)	**Not fish habitat** **Habitat:** Channelized agricultural drain through cabbage crop. Channel was dry upon investigation; however, the soil was partially saturated in sections. Banks were steep straight banks with a deeply incised channel. Channel contained minimal vegetation growth. The ground is composed of the same	Silt/clay/sand	N/A	Agriculture	N/A	N/A

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
				fine silt and clay soil present in the surrounding agricultural fields.					
Waterbody Name: Unnamed Drain **Crossing Locations:** WC 18	2020-09-15 And 2021-06-14	Ephemeral	Warm (MNRF, 2019a)	**Not fish habitat** **Habitat:** Channelized agricultural drain through cabbage crop. Channel was dry upon investigation. Banks were steep straight banks with a deeply incised channel. No direct connection to Hochreiter Road ditch. The ground is composed of the same fine silt and clay soil present in the surrounding agricultural fields.	Silt/clay/sand	N/A	Agriculture	N/A	N/A
Waterbody Name: Unnamed Drain – 7 **Crossing Locations:** C18-C-1 (WC-19)	2020-09-15 and 2021-06-14	Ephemeral	Warm (MNRF, 2019a)	**Not fish habitat** **Habitat:** Conditions are the same as what was recorded for the C18-B-1 crossing location.	Silt/clay/sand	N/A	Agriculture	N/A	N/A
Waterbody Name: Unnamed Drain – 8 **Crossing Locations:** C18-D-1 (WC-20)	2020-09-15 And 2021-06-14	Intermittent	Warm (MNRF, 2019a)	**Direct** **Habitat:** Channelized roadside / agricultural drain that collects flow from all the surrounding agricultural drains and drains west into C17-B-1 and, ultimately, the West Holland River. Channel is deeply incised, and the banks are steep and densely vegetated. There was no in-stream vegetation or shore cover. The water was turbid (dark brown) and appeared to be slow or stagnant.	Silt/muck/clay	Flat	Agriculture Spring: milfoil and algae	**Opportunity/ Constraint:** Downstream and upstream left banks were vulnerable upon spring inspection while downstream and upstream right bank was eroding upon spring inspection. Downstream fish passage obstructions were observed.	N/A
Waterbody Name: Unnamed Drain – 9 **Crossing Locations:** C18-E-1 (WC-22)	2020-09-15, and 2021-08-12	Ephemeral	Warm (MNRF, 2019a)	**Not fish habitat** **Habitat:** Channelized roadside drain that runs on the parallel, 10 m south of Hochreiter Road. Channel was dry upon investigation. Channel runs through a forest dominated with deciduous species (white cedar and sugar maple dominated). Banks are shallow, and the channel was not well defined. Channel was densely lined with woody debris; however, there was no vegetation growth. Shore cover was high (90-100%) due to the surrounding forest community. Ground cover was partially saturated soil and leaf litter. Not directly connected to fish habitat.	N/A	N/A	Forest	N/A	N/A

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
Waterbody Name: Tributary to West Holland – 2 **Crossing Locations:** C18-F-1 (WC-24)	2020-09-16 and 2021-06-14	Permanent	Warm (MNRF, 2019a)	**Direct** **Habitat: Summer:** Channelized roadside drain that runs parallel to Bathurst Street. The channel flows north to another sizeable agricultural drain through forest and agricultural fields until its confluence with the West Holland River. The deeply incised channel contains slow to stagnant flow. Banks are well vegetated and stable, although steep. There is limited in-stream cover that is dominated by woody debris and leaf litter. Shore cover is dense and dominated by forest (White Cedar, Sugar Maple dominated). **Spring:** No observable flow throughout assessed area. Deep 80cm pool of standing water at SW corner of Dense overhanging trees provide 80+% shading through assessed area. Assessed channels appear to be ditch features that were created near wetland or lowland features that now hold water - may not be watercourse features with flow.	Silt/detritus/muck/clay	Flat	The surrounding forest is dominated by white cedar, sugar maple, birch and ash. Wet meadow herbaceous species dominate bank vegetation. There was no in-stream vegetation present.	N/A	N/A
Waterbody Name: Tributary to West Holland – 3 **Crossing Locations:** C18-G-1 (WC-23)	2020-09-15, 2021-06-16, and 2021-08-12	Intermittent	Warm	**Direct** **Habitat:** **Summer:** The crossing location for C18-G-1 is in the adjacent forest, where a small ephemeral swale runs through the forest and connects with the road drainage along Bathurst Street. However, upon investigation, the watercourse is channelized along Bathurst Street as a roadside drain. The roadside drain flows north and drains into C18-E-1 at the Bathurst Street and Hochreiter Road intersection. The deeply incised channel contains slow to stagnant flow. Banks are well vegetated and stable, although steep. There is limited in-stream cover that is dominated by woody debris, aquatic macrophyte and leaf litter. Shore cover is dense and dominated by forest (White Cedar, Sugar Maple dominated).	Silt/ detritus/ muck/ clay	Flat	The surrounding forest is dominated by white cedar, sugar maple, birch and ash. Wet meadow herbaceous species dominate bank vegetation—limited aquatic macrophytes dominated by cattail.	N/A	N/A

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
Waterbody Name: Tributary to East Holland River **Crossing Locations:** C18-H-1 (WC-23)	2020-09-15 and 2021-06-14	Intermittent	Warm (MNRF, 2019a)	**Direct** **Habitat: summer:** The roadside drain collects flow from several road drains along the east side of Bathurst Street and flows north to a large drain that ultimately conveys all flow into East Holland River. The deeply incised channel contains slow to stagnant flow. Banks are well vegetated and stable, although steep. The in-stream cover was moderate and was dominated by aquatic macrophytes and woody debris. Shore cover is low and dominated by riparian shrubs and overhanging woody debris. **Spring:** No flow observed throughout assessed downstream reach. No flow direction observed at entrance culvert underneath marina driveway. Dense duckweed and cattails at northeast channel at Bathurst and marina entrance. East along marina entrance on south side, channel is well shaded by overhanging trees and woody debris with minimal floating or emerging aquatic vegetation in this area.	Silt/ detritus/ muck/ clay	Flat	Surrounding riparian buffer was dominated by willow and wet tolerant herbaceous species. Beyond the riparian buffer, there is mowed grass and a cultural meadow. Aquatic macrophytes provide in-stream cover and are dominated by sedges and rushes with cattails and milfoil present	N/A	N/A
Waterbody Name: East Holland River **Crossing Locations:** C20-A-1 (WC-25)	2020-09-16 and 2021-06-15	Permanent	Warm (MNRF, 2019a)	**Direct** **Upstream Habitat:** River flows north to its confluence with the Main branch of the Holland River. Wide (+ 80 m), deep and slow-moving river bordered by wetland (MAS3 and SWD6 and Golf course) on the east bank and a narrow wetland (CUM1 and SWD3 and Marina) west bank. Banks were stable and are bordered by thick vegetative growth; no signs of erosion were observed. Water is turbid and sediment laden. River displays a natural morphology. **Downstream Habitat:** Downstream habitat feature homogenous to upstream habitat.	Estimated to be dominated by silt/muck/clay.	Flat (homogenous throughout investigated reach)	Instream vegetation was dominated by emergent and submergent (cattail and milfoil) along the shoreline and floating (duckweed and pond lilies) along the river's littoral zone.	N/A	Acts as a migratory corridor for fish to reach upstream spawning habitat and specialized habitats that fish use for spawning, nursery (e.g. slower moving areas with instream cover). Confirmed spawning habitat for muskellunge species (MNRF, 2019).

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
Waterbody Name: Silver Lakes Golf Course Pond **Crossing Locations:** C20-B-1	2020-09-16	Permanent	Unknown	**Not fish habitat** **Habitat:** The pond is next to Hole 2 on the golf course. The golf course maintains the area surrounding the pond right up to within 0.5m of the riparian zone. The riparian zone is comprised of wetland vegetation, and the banks are sloped. Discussions with the maintenance superintendent revealed that the river floods over Hole 2 and impacts this pond every couple of years (AECOM, 2020).	Estimated to be dominated by clay/silt/sand	Pond – not connected to East Holland River. Shore cover shaded 1-29% of pond.	Along the edge of the pond, submergent and emergent vegetation was dominated. The most dominant species included: duckweed, white water lily, coon-tail, cattails	N/A	N/A
Waterbody Name: Holborn Drain **Crossing Locations:** C22-A-1 (WC-27)	2020-09-16 and 2021-06-15	Permanent pond with intermittent drainage channel to the south.	Warm (MNRF, 2019a)	**Direct** **Habitat: summer:** The crossing location for C22-A-1 is in the middle of an agricultural area where the water feature separates two fields that were actively being farmed. The water feature, which flows north, consisted of a wetland area with an approximate 3m riparian buffer upstream of the ROW and two water retention ponds on the downstream side of the ROW. The agricultural field on the west side of the watercourse was wet at the time of inspection, and a water pump was observed in most southern water retention pond. **Spring:** Channel was dry north of culvert to the pond. Pond was covered in consistent layer of algae and duckweed. Pond connects to additional pond further north under farm access road. Drainage ditches enter channel from hedgerows to the east and west, both of which were also dry. Pond is used for watering field - pumps installed.	Estimated to be dominated by Silt/clay/muck	**Upstream:** channelized 100% flats (homogeneous throughout the area of investigation) **Downstream:** channelized	**Upstream:** emergent and floating vegetation dominated. cattails, duckweed, grass **Downstream:** Floating and emergent vegetation dominated: duckweed, cattails. goldenrod, asters	N/A	N/A
Waterbody Name: Ravenshoe/ Boag Drain **Crossing Locations:** C23-A-1 (WC-27)	2020-09-16 and 2021-06-15	Intermittent	Warm (MNRF, 2019a)	**Not fish habitat** **Upstream Habitat: Spring:** Channelized roadside drain that runs parallel with 2nd Concession Road. Channel looked as if it had been dredged recently (within the past year or so). Both banks appeared slightly unstable throughout the entire reach. However, the left bank was protected by vegetation, while the right bank was vulnerable to erosion. **Summer:** Dry	N/A	N/A	Dominated by emergent vegetation within ditch line. (dominant species was cattails)	N/A	N/A

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
				ditch feature with sparse cattails and grasses. No water observed throughout entire ROW, and no direct connections observed to nearby watercourses. Sod farm to the east, crop field to the west. **Downstream Habitat:** Downstream habitat feature homogenous to upstream habitat.					
Waterbody Name: Tributary to Ravenshoe/ Boag Drain – 1 **Crossing Locations:** C24-A-1 (WC-28)	2020-09-17 and 2021-06-17	Ephemeral	Warm (MNRF, 2019a)	**Not fish habitat** **Habitat:** Dry agricultural swale with no defined feature and actively planted crops.	N/A	N/A	Agricultural crops.	N/A	N/A
Waterbody Name: Tributary to Ravenshoe/ Boag Drain – 2 **Crossing Locations:** C25-A-1 (WC-29)	2020-09-17 and 2021-06-17	Ephemeral	Warm (MNRF, 2019a)	**Indirect** **Habitat:** No defined channel through grass swale separating two actively farmed crop fields. A small ponded area (15x15m) was present in the northern end of the assessment area, potentially caused by small earth berm from access road construction. Pond has cattails and shallow waters. Swale captures overland flow from farm fields, no water present in swale other than ponded area.	N/A	N/A	Agricultural crops, goldenrod, aster, grass sp.	N/A	N/A
Waterbody Name: Tributary to Ravenshoe/ Boag Drain – 3 **Crossing Locations:** C25-B-1 (WC-30) Summer 2020: Watercourse observed from Leslie Road 130 m d/s from crossing due to PTE Access	2020-09-17 and 2021-06-17	Ephemeral	Warm (MNRF, 2019a)	**Not fish habitat** **Habitat:** Dry agricultural swale in actively farmed field with no defined feature.	N/A	N/A	Dominated by goldenrod and grass species	N/A	N/A
Waterbody Name: Tributary to Ravenshoe/ Boag Drain – 4	2020-09-17 and	Pond – permanent; channel upstream/downstream – intermittent.	Warm (MNRF, 2019a)	**Direct** **Habitat:** Online man-made pond with drop structure outlet. Dense grasses	Silt/muck	Flat	Dominated by cattails and grasses with some phragmites	**Constraint:** Upstream banks both slightly unstable and vulnerable.	N/A

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
Crossing Locations: C25-C-1 (WC-31)	2021-08-12			and cattails with sparse riparian trees. Downstream of pond - 30 metres wide riparian section with grasses and trees between two active crop fields. Pond drop outlet structure appears to be a type of hicken-bottom feature, but unclear. May be simple overflow type structure. Not passable upstream for fish. May allow unintended downstream passage of fish during storm events. Earth berm approximately 5 m wide at top, and 8 m from top to bottom on downstream (west) side. Channel is dry downstream of outlet pool with moist soils. No pools or standing water observed. Patch of Phragmites around outlet pool.				**Opportunity:** Online pond creates fish passage barrier and alters flow of watercourse.	
Waterbody Name: Tributary to Maskinonge (Jersey) River – 1 **Crossing Locations:** C25-A-2 and C26-A-1 (WC-32)	2020-09-16 and 2021-06-17	Intermittent	Warm (MNRF, 2019a)	**Indirect** **Upstream Habitat: C26-A-1:** This section was dry upon inspection, with the majority of plant species present being drought tolerant terrestrial species. There was no defined channel, but the crossing was in a valley created by the adjacent agricultural field and Highway 404. It appeared that the channel might diverge at culvert when it does run. Just over 200m upstream from the crossing, the channel becomes more defined with steep banks and exposed tree roots. **Downstream Habitat: C25-A-2:** This section was dry at the culvert at the time of inspection. Once beyond the section of the water feature that was altered for the highway, the feature opened into a wetland. Wetland vegetation species were dominated by cattail and phragmites. The wetland became channelized approximately 200m downstream from the crossing. The channel's flow is controlled by the wetland vegetation that thickly grows over the entire water feature.	Silt/sand/muck/detritus	**Upstream:** swale **Downstream:** Wetland, small meandering channel within wetland observed during fluvial geomorphology assessment.	**Upstream:** Dominated by grasses, asters, and goldenrods, but there were cattails present. Riparian grasses and shrubs along drainage swale for 50 m before swale enters forested area. 50 m. **Downstream:** dominated by cattail and phragmites	N/A	N/A
Waterbody Name:	2022-05-19	Permanent	Warm (MNRF, 2019a)	**Direct** **Habitat:** naturalized, meandering channel with a riffle run morphology.	Silt (65%), sand (25%), boulder (5%), gravel (5%)	Run (95%), riffle (5%)	Unidentified submergent vegetation and various grass species	N/A	N/A

Waterbody ID	Date	Flow	Thermal Regime	Fish Habitat*	Substrate Type (in order of dominance)	Channel Morphology	Vegetation	Constraints and Opportunities	Significant Fish Habitat
Crossing Locations: C27-A-1, (WC-33)				Clear water was flowing south to north. Some bank slumping was observed but the banks were well vegetated with water tolerant species. Woody debris was observed throughout the reach and shore cover was moderate (60-90%).					
Waterbody Name: **Crossing Locations:** C28-A-1, (WC-34)	2022-05-19	Permanent	Warm (MNRF, 2019a)	**Direct** **Upstream Habitat:** Wetland feature with no defined banks throughout most of reach; water was present, but not confined within the wetland feature. A pool was present at the culvert inlet. Vegetation cover was high (90-100%) and was dominated by phragmites and cattails. **Downstream Habitat:** channelized feature that narrows by riprap placement at the culvert exit and remains slightly incised. Bank erosion was observed on the left bank and undercut banks were observed throughout the reach. The in stream cover was moderate (60%) and was comprised of the undercut banks and the vascular macrophytes, both instream (20%) and overhanging (50%).	**Upstream:** wetland feature: detritus, silt, muck **Culvert pool:** Cobble, gravel, sand **Downstream:** muck (60%), silt (30%), and detritus (10%).	**Upstream:** wetland (90%); culvert pool (10%) **Downstream:** run (60%); pool (40%).	**Upstream:** phragmites, cattails, herbaceous vegetation **Downstream:** Phragmites, cattails, herbaceous vegetation	**Opportunity:** Remove phragmites Stabilize eroding banks.	N/A

* Fish habitat is defined in subsection 2(1) of the Fisheries Act to include all waters frequented by fish and any other areas upon which fish depend directly or indirectly to carry out their life processes. The types of areas that can directly or indirectly support life processes include but are not limited to spawning grounds and nursery, rearing, food supply and migration areas.

Table Description:

Waterbody ID	Name of waterbody and Crossing # / Station
Date	Insert date field investigations occurred (DD/MM/YYYY), as applicable
Flow	Ephemeral, Intermittent, Permanent
Thermal Regime	Warm, Cool, Cold
Fish Habitat	Direct, Indirect, Not Fish Habitat
Substrate Type	Boulder, cobble, rubble, gravel, sand, muck, etc.
Channel Morphology	E.g., Riffles, runs, pools, undercut banks, etc.
Vegetation	Riparian & In-stream species; emergent, submergent and floating aquatic vegetation
Constraints and Opportunities	E.g., Perched culvert, eroding bank, fish passage barrier, undersized CSP
Significant Fish Habitat	E.g., specialized habitat that supports critical life functions, areas contributing to fisheries productivity, etc.

Table 4-2: Fish Community Summary (Template D2B)

Waterbody ID	Date	Fish Species Present	Year Class(es)	Species at Risk Present	In-water Works Timing Window
C10-A-A (WC-1): Tributary to Penville Creek	■ Indirect fish habitat				■ In-water work is permitted from July 16 – March 14.
C10-A-B to C10-A-4 (WC-1): Tributary to Penville Creek	■ June 9, 2022 ■ June 1, 2021 ■ June 9, 2022	■ C10-C-C: Electrofished upstream flats and pools: five (5) Brook Stickleback and one (1) Blacknose Dace ■ C10-A-1: Electrofished runs throughout Study Area: five (5) Blacknose Dace and three (3) Creek Chub captured ■ C10-A-4: Electrofished deep pool at culvert inlet: eleven (11) Creek Chub and one (1) Blacknose Dace captured ■ MNRF, 2019a : Blacknose Dace, Blacknose Shiner, Bluntnose Minnow, Brassy Minnow, Brook Stickleback, Brown Bullhead, Common Shiner, Creek Chub, Fathead Minnow, Finescale Dace, Johnny Darter, Largemouth Bass, Longnose Dace, Mottled Sculpin, Northern Redbelly Dace, Pumpkinseed, Rainbow Darter, Rainbow Trout, Rock Bass, White Crappie and White Sucker.	■ Adult and juvenile.	■ No	■ In-water work is permitted from July 16 – March 14.
C10-A-5 (WC-1b)	■ Indirect fish habitat				■ In-water work is permitted from July 16 – March 14.
C10-A-6 (WC-1c)	■ Not fish habitat				
C10-B-1 and C10-B-2: Tributary to Fraser Creek – 1	■ Not fish habitat				
C10-C-1 and C10-C-2 (WC-2): Tributary to Fraser Creek – 2	■ June 2, 2021	■ No fish captured during electrofishing attempt by AECOM. No fish observed ■ MNRF, 2019a: Black Crappie, Blacknose Dace, Bluegill, Bluntnose Minnow, Bowfin, Brook Stickleback, Brown Bullhead, Central Mudminnow, Common Carp, Common Shiner, Creek Chub, Fathead Minnow, Golden Shiner, Goldfish, Hornyhead Chub, Johnny Darter, Largemouth Bass, Lepomis sp., Northern Pike, Pumpkinseed, Rock Bass, Smallmouth Bass, White Sucker and Yellow Perch. ■ LSRCA, 2003: Brook Stickleback, White Sucker	■ NA	■ No	■ In-water work is permitted from July 16 – March 14.
C11-A-1 (WC-3): Tributary to Fraser Creek – 3	■ June 2, 2021	■ Electrofished multiple deeper pools in Study Area: fifteen (15) Creek Chub, two (2) Northern Redbelly Dace, one (1) Brook Stickleback captured ■ MNRF, 2019a: Blacknose Dace, Bluntnose Minnow, Brook Stickleback, Central Mudminnow, Common Shiner, Creek Chub, Fathead Minnow, Johnny Darter, Largemouth Bass, Lepomis sp., Longnose Dace, Northern Pike, Northern Redbelly Dace, Pumpkinseed and White Sucker.	■ Adult and juvenile.	■ No	■ In-water work is permitted from July 16 – March 14.
C11-A-2 (WC-4): Tributary to Fraser Creek – 4	■ Not fish habitat				
C12-A-1 (WC-5): Tributary to Fraser Creek – 5	■ Indirect fish habitat				■ In-water work is permitted from July 16 – February 28.
C13-A-1 (WC-5): Tributary to Fraser Creek – 5	■ June 2, 2021	■ Attempted to dip net channel – too shallow to electrofish. No fish captured ■ MNRF, 2019a: Blacknose Dace, Bluntnose Minnow, Brook Stickleback, Central Mudminnow, Common Shiner, Creek Chub, Fathead Minnow, Johnny Darter, Largemouth Bass, Lepomis sp., Longnose Dace, Northern Pike, Northern Redbelly Dace, Pumpkinseed and White Sucker.	■ NA	■ No	■ In-water work is permitted from July 16 – March 14.
C14-A-1 (WC-6): Tributary to Fraser Creek – 6	■ Not fish habitat				
Pond 1	■ Not fish habitat				
C16-A-1 (WC 9): Tributary to West Holland River – 1	■ August 12, 2021	■ Electrofished; captured Creek Chub and Brook Stickleback ■ MNRF, 2019a: Blacknose Dace, Bluntnose Minnow, Bowfin, Brook Stickleback, Brown Bullhead, Carps and Minnows, Central Mudminnow, Common Shiner, Creek Chub, Emerald Shiner, Fathead Minnow, Golden Shiner, Johnny Darter, Largemouth Bass, Northern Pike, Northern Redbelly Dace, Pumpkinseed, Rock Bass, White Sucker, Yellow Perch (record from 300 m u/s of C16-A-1 crossing). ■ LSRCA, 2003: Brown Bullhead, Central Mudminnow, Fathead Minnow, White Sucker, Brook Stickleback, Eastern Blacknose Dace ■ LSRCA, 2002: Brook Stickleback, Common Shiner, Creek Chub, Eastern Blacknose Dace, Fathead Minnow, Minnow family, Northern Redbelly Dace	■ Adult and juvenile.	■ No	■ In-water work is permitted from July 16 – February 28.
C16-A-2 (WC-8): Tributary to West Holland River – 2; WC-7: Tributary to West Holland River – 3	■ Not fish habitat				
C16-A-3 (WC-9): Tributary to West Holland River – 1	■ August 12, 2021	■ Electrofished run and pool features in upstream ZDA: thirteen (13) Creek Chub and one (1) Brook Stickleback captured	■ Adult and juvenile.	■ No	■ In-water work is permitted from July 16 – February 28.

Waterbody ID	Date	Fish Species Present	Year Class(es)	Species at Risk Present	In-water Works Timing Window
		▪ MNRF, 2019a: Blacknose Dace, Bluntnose Minnow, Bowfin, Brook Stickleback, Brown Bullhead, Carps and Minnows, Central Mudminnow, Common Shiner, Creek Chub, Emerald Shiner, Fathead Minnow, Golden Shiner, Johnny Darter, Largemouth Bass, Northern Pike, Northern Redbelly Dace, Pumpkinseed, Rock Bass, White Sucker and Yellow Perch.			
C16-A-4 (tributary to WC 9)	▪ Not fish habitat				
C17-A-1 (WC-10): West Holland River	▪ NA	▪ Fish sampling not attempted due to sufficient background information available for the West Holland River ▪ MNRF, 2019a: Rock Bass, Brook Stickleback, Northern Pike, Johnny Darter/ Tessellated Darter, Pumpkinseed, Largemouth Bass, Emerald Shiner, Yellow Perch, Black Crappie, Walleye, Common Carp, Golden Shiner, Bluntnose Minnow and Spottail Shiner. ▪ Pers Comm: American Eel.	▪ NA	▪ No	▪ In-water work is permitted from July 16 – February 28.
C17-B-1, C18-A-1, C18-D-1 (WC-11, 16, 20, 21)	▪ June 15, 2021	▪ C17-B-1: Two minnow traps set in channel: one (1) Northern Redbelly Dace captured ▪ C18-A-1: Small-bodied fish observed in agricultural drain but were too small to dip net/capture ▪ MNRF, 2019a: Black Crappie, Bluntnose Minnow, Bowfin, Brook Stickleback, Brown Bullhead, Common Carp, Creek Chub, Emerald Shiner, Fathead Minnow, Golden Shiner, Goldfish, Johnny Darter, Johnny Darter/ Tessellated Darter, Largemouth Bass, Lepomis sp., Northern Pike, Pumpkinseed, Rock Bass, Spottail Shiner, Walleye, White Sucker, Yellow Perch.	▪ Adult Northern Redbelly Dace ▪ YoY small-bodied fish	▪ No	▪ In-water work is permitted from July 16 – March 14.
C17-C-1 to C17-F-1; C18-B-1, C18-C-1, C18-E-1 (WC-12-15, 17-19, 22)	▪ Not fish habitat				
C18-F-1 to C18-H-1 (WC-23 to WC-24)	▪ June 15, 2021	▪ Minnow traps set in each of the three locations, but no fish were captured ▪ MNRF, 2019a: Black Crappie, Bluntnose Minnow, Bowfin, Brook Stickleback, Brown Bullhead, Common Carp, Creek Chub, Emerald Shiner, Fathead Minnow, Golden Shiner, Goldfish, Johnny Darter, Johnny Darter/ Tessellated Darter, Largemouth Bass, Lepomis sp., Northern Pike, Pumpkinseed, Rock Bass, Spottail Shiner, Walleye, White Sucker, Yellow Perch.	▪ NA	▪ No	▪ In-water work is permitted from July 16 – March 14.
C20-A-1 (WC-25): East Holland River	▪ NA	▪ Fish sampling not attempted due to sufficient background information available for the East Holland River ▪ MNRF, 2019a: Brown Bullhead, Bowfin, Common Carp, Northern Pike, Pumpkinseed, Largemouth Bass, Golden Shiner, Spottail Shiner, Black Crappie, Rock Bass, Yellow Perch and Fathead Minnow. ▪ Pers comm: American Eel.	▪ NA	▪ No	▪ In-water work is permitted from July 16 – February 28.
C20-B-1 (WB-1): Silver Lakes Golf Course Pond	▪ Not fish habitat				
C22-A-1 (WC-26): Holborn Drain	▪ Sept 17, 2020	▪ Minnow traps were set in the pond feature in the ROW: four (4) pumpkinseed and four (4) Brown Bullhead were captured ▪ MNRF, 2019a: Brown Bullhead, Carps and Minnows, Central Mudminnow, Creek Chub, Fathead Minnow, Golden Shiner, Largemouth Bass, Northern Pike, Pumpkinseed, Smallmouth Bass and White Sucker. ▪ LSRCA, 2003: Central Mudminnow, Creek Chub, Northern Pike, Smallmouth Bass	▪ Juvenile	▪ No	▪ In-water work is permitted from July 16 – February 28.
C23-A-1 (WC-27): Ravenshoe/ Boag Drain	▪ Not fish habitat				
C24-A-1 (WC-28): Tributary to Ravenshoe/ Boag Drain – 1	▪ Not fish habitat				
C25-A-1 (WC-29): Tributary to Ravenshoe/ Boag Drain – 2	▪ Indirect fish habitat				▪ In-water work is permitted from July 16 – March 14.
C25-B-1 (WC-30): Tributary to Ravenshoe/ Boag Drain – 3	▪ Not fish habitat				
C25-C-1 (WC-31): Tributary to Ravenshoe/ Boag Drain – 4	▪ August 12, 2021	▪ The pond feature in ROW was electrofished: one (1) Brook Stickleback and sixteen (17) Creek Chub were captured ▪ MNRF, 2019a: Brown Bullhead, Carps and Minnows, Central Mudminnow, Creek Chub, Fathead Minnow, Golden Shiner, Largemouth Bass, Northern Pike, Pumpkinseed, Smallmouth Bass and White Sucker.	▪ Adult and juvenile.	▪ No	▪ In-water work is permitted from July 16 – February 28.
C26-A-1 and C25-A-2 (WC-32): Tributary to Maskinonge (Jersey) River – 1	▪ Indirect fish habitat				▪ In-water work is permitted from July 16 – March 14.
C27-A-1 (WC-33): Maskinonge (Jersey) River	▪ May 19, 2022	▪ MNRF, 2019a: Black Crappie, Blacknose Dace, Bluegill, Bluntnose Minnow, Bowfin, Brook Stickleback, Brown Bullhead, Central Mudminnow, Common Carp, Common Shiner, Creek Chub, Emerald Shiner, Etheostoma sp., Fathead Minnow, Golden Shiner, Hornyhead Chub, Johnny Darter, Johnny Darter/ Tesselated Darter, Largemouth Bass, Mimic Shiner, Mottled Sculpin, Northern Pike, Northern Redbelly Dace, Pumpkinseed, Redfin Shiner, White Sucker and Yellow Perch.	▪ NA	▪ No	▪ In-water work is permitted from July 16 – March 14.
C28-A-1 (WC-34): Tributary to Maskinonge (Jersey) River – 3	▪ May 19, 2022	▪ Downstream of the feature was electrofished, and conductivity was too high to shock, but one (1) Northern Redbelly Dace and thirty (30) Brook Stickleback were captured via dip netting.	▪ Adult and juvenile.	▪ No	▪ In-water work is permitted from July 16 – March 14.

Waterbody ID	Date	Fish Species Present	Year Class(es)	Species at Risk Present	In-water Works Timing Window
		■ MNRF, 2019a: Black Crappie, Blacknose Dace, Bluegill, Bluntnose Minnow, Bowfin, Brook Stickleback, Brown Bullhead, Central Mudminnow, Common Carp, Common Shiner, Creek Chub, Emerald Shiner, Etheostoma sp., Fathead Minnow, Golden Shiner, Hornyhead Chub, Johnny Darter, Johnny Darter/ Tesselated Darter, Largemouth Bass, Mimic Shiner, Mottled Sculpin, Northern Pike, Northern Redbelly Dace, Pumpkinseed, Redfin Shiner, White Sucker and Yellow Perch.			

Notes: 1 In-water work timing window based on MNRF guidelines (2013).
2 In-water work timing window confirmed in correspondence with MNRF Midhurst District.
3 historic record, no longer considered present

5. Preliminary Impact Assessment

The following provides a summary of the proposed activities in or near water identified by drainage engineers, structural engineers, and the design team during this Preliminary Design stage. Note, only watercourses that provide direct or indirect habitat have been carried forward from the Existing Conditions section to this Impact Assessment. Reports such as the (fluvial report) and (drainage report) will discuss the potential impacts on the watercourses characterized as Not Fish Habitat.

5.1 Description of Proposed Works

5.1.1 General construction activities within 30 metres of a watercourse

General construction activities that occur within 30 metres of a watercourse or drainage feature could have the potential to cause a HADD. Some of the more common general construction activities that will take place within 30 metres of identified drainage features and watercourses are identified below:

- Use of industrial equipment
- Vegetation clearing/ grubbing
- Excavation
- Grading
- Riparian planting; and
- Organic debris management.

5.1.2 No In-water Work Required

Below is an overview of activities at bridge and culvert crossing locations where no action for the crossing structure is proposed.

5.1.2.1 C10-A-A(WC-1)

- At the time of this Report, no proposed culvert at this location.

5.1.2.2 C10-A-B(WC-1)

- At the time of this Report, no proposed culvert at this location.

5.1.2.3 C10-A-C(WC-1)

- At the time of this Report, no proposed culvert at this location.

5.1.2.4 C10-A-2(WC-1)

- At the time of this Report, no proposed culvert at this location.

5.1.2.5 C10-A-3(WC-1)

- At the time of this Report, no proposed culvert at this location.

5.1.2.6 C10-A-5(WC-1b)

- At the time of this Report, no proposed culvert at this location.

5.1.2.7 C17-B-1(WC-11)

- At the time of this Report, no proposed culvert at this location.

5.1.2.8 C18-A-1(WC-16)

- At the time of this Report, no proposed culvert at this location.
- The proposed work to adjust buried drainage (tile system) is to be discussed with Drainage Superintendent.

5.1.2.9 C20-B-1(WC-25)

- At the time of this Report, no culvert proposed at this location.

5.1.2.10 C26-A-1(WC-32)

- Existing bridge (EX-CL-404-2) to remain

- Grading with the associated road construction
- Highway resurfacing.

5.1.2.11 C28-A-1(WC-34)

- At the time of this Report, no culvert proposed at this location.

5.1.3 Proposed In-Water Work

The details of the proposed in-water works are provided in **Table 5-1**.

Table 5-1: Proposed Works

Waterbody ID/ /Crossing ID/ Culvert ID	Existing Structure				New Structure				
	Type	Length (m)	Width (mm)	Height (mm)	Type	Length (m)	Width (mm)	Height (mm)	Proposed In-water Work
Innisfil Creek Subwatershed									
WC-1 / C10-A-1/ PR-CL-2	Concrete Box	18.0	2400	1200	Open-foot (concrete)	30.0	4920	2400	Like-for-like replacement
WC-1/ C10-A-1/ PR-CL-400-2	Concrete Box	107.0	3600	1500	Open-foot (concrete)	114.3	5500	2400	Like-for-like replacement. Channel realignment will be required. Existing Culvert ID: EX-CL-400-5.
WC-1/ C10-A-3/Berm	N/A	N/A	N/A	N/A	Earthen Berm				An earthen berm will be constructed to direct runoff from Bradford Bypass ramps to the SWM pond. After surface water has been treated by SWM pond it will outlet back to WC-1 and flow west under Highway 400. Possible channel adjustment associated with the tie-in to the watercourse will be confirmed in Detail Design.
Holland River Subwatershed									
WC-3/C11-A-1/PR-R-BBP-4	N/A	N/A	N/A	N/A	Open-foot (Concrete)	52.0	4920	2400	New Culvert. Channel adjustment at the new ramp crossing. Ditching will be required.
WC-5/C10- C-1/ PR-R-BBP-6A	N/A	N/A	N/A	N/A	Open-foot (concrete)	60.0	12000	2400	New Culvert. Channel realignment through 10th Sideroad interchange.
WC-5/ C12-A-1/ PR-R-10IC-2	N/A	N/A	N/A	N/A	Concrete	42.9	900	900	New Culvert. Channel realignment through 10th Sideroad interchange.
WC-5/ C12-A-1/ PR-R-10IC-3	N/A	N/A	N/A	N/A	Concrete	41.3	900	900	New Culvert. Channel realignment through 10th Sideroad interchange.

Waterbody ID/ /Crossing ID/ Culvert ID	Existing Structure				New Structure				
	Type	Length (m)	Width (mm)	Height (mm)	Type	Length (m)	Width (mm)	Height (mm)	Proposed In-water Work
WC-5/C10-C-2/ PR-R-BBP-6B	N/A	N/A	N/A	N/A	Open-foot (concrete)	73.0	2400	12000	New Culvert. Channel realignment
WC-5/ C13-A-1/ PR-CL-BBP-2	N/A	N/A	N/A	N/A	Concrete Box	96.1	1800	1200	New Culvert. Minimal channel adjustments at the crossing.
WC-3/C11-A-1 / PR-R-BBP- 8A	N/A	N/A	N/A	N/A	Open-foot (concrete)	45.0	12000	2400	New culvert. Channel realignment.
WC-3/C11-A-2 / PR-R-BBP- 8B	N/A	N/A	N/A	N/A	Open-foot (concrete)	50.0	12000	2400	New culvert. Channel realignment.
WC-1/C-10-A-3/ PR-R-BBP-9	N/A	N/A	N/A	N/A	Concrete	76.4	900	900	New culvert. Channel realignment.
WC-1/C-10-A-3/ PR-R-BBP-10	N/A	N/A	N/A	N/A	Open-foot (concrete)	35.9	5500	2400	new culvert. Channel realignment.
WC-1/C-10-A-4/ PR-R-BBP-11	N/A	N/A	N/A	N/A	Open-foot (concrete)	46.0	55000	2400	New culvert. Channel realignment
WC-9/ CR-4/ PR-R-C4IC-4	N/A	N/A	N/A	N/A	Concrete	43.2	900	900	New culvert. Watercourse realignment east of County Rd 4 to accommodate the new interchange
WC-10/ C17-A-1/ Holland River Bridge	N/A	N/A	N/A	N/A	Bridge structure	Control span lengths: 120m	120000	8000	Bridge structure over Holland River. 6-7 piers are expected to span the PSW to the west of the river and remain out of the wetted portion of the river itself. Piers are anticipated to be constructed above the normal annual water level (active channel) but likely below the 2-year return level. Temporary in-water works will be required, but a permanent footprint is not anticipated within the active channel.

Waterbody ID/ /Crossing ID/ Culvert ID	Existing Structure				New Structure				
	Type	Length (m)	Width (mm)	Height (mm)	Type	Length (m)	Width (mm)	Height (mm)	Proposed In-water Work
WC-20/ C18-D-1/ PR-CL-BBP-6A	N/A	N/A	N/A	N/A	TBD	20.1	TBD	TBD	Proposed work to adjust the drain should be discussed with the Drain Superintendent of the Town of Bradford East Gwillimbury.
WC-20/ C18-D-1/ PR-CI-BBP-6B	N/A	N/A	N/A	N/A	TBD	19.4	TBD	TBD	It is proposed to realign the south ditch and redirect flows westerly. Works to adjust the drain should be discussed with the Drain Superintendent of the Town of Bradford East Gwillimbury.
WC-23/ C18-F-1/ PR-CL-BBP-7	N/A	N/A	N/A	N/A	CSP	99.2	1200	1200	New Culvert. Grading and relocation of ditches will be required to accommodate the interchange at Bathurst St.
WC-23/ C18-H-1/ PR-CL-BBP-8	N/A	N/A	N/A	N/A	CSP	74.6	1200	1200	New Culvert. Grading and relocation of ditches will be required to accommodate the interchange at Bathurst St.
WC- 23/C18-G-1/ PR-R-BST-2	N/A	N/A	N/A	N/A	Concrete	30.2	1200	1200	New culvert. Proposed realignment associated with the Bathurst St Interchange.
WC-23/ C18-H-1/ PR-R-BST-3	N/A	N/A	N/A	N/A	Concrete	34.6	1200	1200	New culvert. Proposed realignment associated with the Bathurst St Interchange.
WC-23/ C18-H-1/ PR-R-BST-4	N/A	N/A	N/A	N/A	Concrete	30.3	1200	1200	New culvert. Proposed realignment associated with the Bathurst St Interchange.
Holland River East Branch Subwatershed									
WC-25/ C20-A-1/ Holland River East Branch Bridge	N/A	N/A	N/A	N/A	Bridge	Control span lengths: 120m	120000	8000	New Bridge over Holland River East Branch will possibly consist of 9 piers. Piers are anticipated to be constructed above the normal annual water level, but likely below the 2-year return level. Temporary in-water works may be required, but a permanent footprint is not anticipated below the annual average water level.

Waterbody ID/ /Crossing ID/ Culvert ID	Existing Structure				New Structure				
	Type	Length (m)	Width (mm)	Height (mm)	Type	Length (m)	Width (mm)	Height (mm)	Proposed In-water Work
WC-26/ C22-A-1/ PR-CL-BBP-11	N/A	N/A	N/A	N/A	Open foot (concrete)	97.0	30000	30000	Watercourse adjustment at the BBP crossing. Existing online pond north of the new crossing. This pond will be impacted by the BBP, and it will likely need to be modified to accommodate the new highway.
WC-29/ C25-A-1/ PR-CL-BBP-16	N/A	N/A	N/A	N/A	CSP	91.0	900	900	Watercourse adjustment at the crossing location.
WC-31/ C25-C-1/ PR-R-404-1	N/A	N/A	N/A	N/A	Concrete Box	82.5	5360	2400	This new culvert crossing will impact the existing Leslie St/ Highway 404 pond. The pond will need to be relocated along the watercourse.
WC-31/C25-C-1/ PR-R-404-2	N/A	N/A	N/A	N/A	Concrete Box	32.0	5360	2400	The new BBP culvert crossing will impact the existing Leslie St./ Highway 404 pond. The pond will need to be relocated along the watercourse.
WC-31/ C25-C-1/ PR-R-404-3	N/A	N/A	N/A	N/A	Concrete Box	34.8	5360	2400	This new culvert crossing will impact the existing Leslie St/ Highway 404 pond. The pond will need to be relocated along the watercourse.
Maskinonge River Subwatershed									
WC-32/ C26-A-1/ PR-R-404-9	N/A	N/A	N/A	N/A	Concrete	69.0	750	750	New culvert. Drainage under Highway 404.
WC-32/ C25-A-2/ PR-R-404-10	N/A	N/A	N/A	N/A	Open foot (concrete)	67.0	4880	3050	Adjustment to the existing watercourse to accommodate the new bridge structure.
WC-33/ C27-A-1/ PR-R-404-11	N/A	N/A	N/A	N/A	Open Foot (concrete)	63.0	4880	3050	Adjustment to the existing watercourse to accommodate the new bridge structure.

5.2 Step 2 - MTO Routine Works

Project activities were assessed against the list of MTO Routine Works in Table 2 of the Protocol (MTO, 2020b). Routine works are those within the MTO ROW, which includes the shoulders and paved areas that do not occur within the waterbody and can be mitigated to prevent sediment/debris from entering an aquatic feature. Proposed works associated with drainage (where no in-water work is proposed within fish habitat), electrical, signage, and pavement resurfacing are all covered by MTO Routine Works. At this time, it is not anticipated that any of the proposed in-water works can be completed under MTO Routine Works. Activities such as culvert replacements and extensions, culvert and ditch clean-outs, channel tie-ins, grading within 30 metres of a watercourse, and riparian vegetation removal have all been carried forward to Step 3.

5.3 Step 3 - MTO Best Management Practices

Project activities for all the culvert replacements, extensions, clean-outs, and modifications (liner installation) in fish habitat were assessed against the MTO Best Management Practices (BMP) Manual for Fisheries (MTO, 2020c) to determine which activities can be addressed by BMPs as per Step 3 in the Protocol. Application of BMPs requires adherence to the Operational Constraints and Protection Measures identified in each BMP. Certain conditions and provisions are outlined in each BMP (e.g., work must be completed within the allowable in-water work timing window, etc.), which must be met to remain in compliance. Applicable notification procedures are required for the use of BMPs. **Table 5-2** summarizes the activities carried forward from Step 2 and the applicable BMP.

Table 5-2: Summary of Construction Activity and Associated BMP

Activity	Associated BMP
Vegetation removal within the road ROW to accommodate the road widening and culvert replacements	Maintenance of Riparian Vegetation in Existing Right-of-Way BMP (C10-A-4; C25-C-1; C25-A-2)
Culvert like-for-like replacement	Like-For-Like Culvert Replacement BMP (C10-A-1; C10-A-2)
Culvert removal and replacement with extension	None, carried to Step 4 (Section 5.4)
Culvert Clean-out	Culvert Maintenance BMP (C18-D-1)
Channel Realignment	None, carried to Step 4 (Section 5.4)
Ditch Maintenance	Ditch Maintenance Within 30 metres of a Watercourse (To Be Determined)
New culvert installation	None, carried to Step 4 (Section 5.4)
New Bridge construction	Clear Span Bridges BMP (C25-A-2)

There are no applicable BMPs for the proposed culvert replacements that are not like-for-like (i.e., those that require extensions), installing a culvert liner, or channel/ pond realignments; therefore, these proposed works will be carried forward for a full impact assessment.

5.4 Step 4 - Fisheries Assessment Protocol

Step 4 of the Protocol is a Fisheries Assessment Process that applies to project activities that may impact fish habitat and that do not qualify as MTO Routine Works (Step 1) nor meet the conditions of the MTO BMP Manual for Fisheries (Step 3).

5.4.1 Potential Impacts

The proposed activities associated with the work described in **Section 5.1** that did not meet the requirements listed under MTO Routine Works or Fisheries BMP have been assessed to determine the potential impacts to the fish and fish habitat. Potential impacts to fish habitat have been identified using the Pathway of Effects (PoE) diagrams provided in the Guide. The PoE diagrams are used to display how activities may impact the aquatic environment and determine the mitigation and protection measures required to minimize or avoid these impacts. This is accomplished through the pathways, stressors, and residual effects flow charts, and has been developed for both in-water and land-based construction activities.

5.4.2 Pathways of Effects Assessment

The following is a summary of the potential negative effects on fish and fish habitat, which may result from activities associated with the proposed work that is applicable to all works described in **Section 5.1** unless specifically noted. The Aquatic Effects Assessment Table (Template D3) is provided in **Appendix E**.

Land-based Activities

- Use of industrial equipment may result in alterations to contaminant concentrations from fuel or fluid leaks. An increase in sediment may result from increased erosion potential where industrial equipment has exposed and loosened soils. Cleaning or maintenance of structures may result in changes to contaminant and sediment concentrations if wash water can enter a waterbody
- Vegetation clearing may result in alterations to sediment concentrations and habitat structure and cover because of increased erosion potential and sediment deposition. Changes in food supply and nutrient concentrations may result from the loss of external inputs with a reduction in riparian vegetation. The use of herbicides may result in changes to contaminant concentrations
- Grading may result in alterations to sediment concentrations and habitat structure and cover because of increased erosion potential and sediment deposition.

In-water Activities

- Placement of material or structures in water can result in changes in channel or shoreline morphology, aquatic macrophytes, and substrate composition. This can lead to changes in sediment concentration, habitat structure and cover, food supply, nutrient concentrations and may result in direct or indirect impacts to fish and fish habitat
- Removal of aquatic vegetation may result in changes in dissolved oxygen concentrations, food supply, nutrient concentrations, habitat structure and cover, sediment concentrations or contaminant concentrations because of the release of sediment, nutrient inputs, habitat, and light penetration
- Use of industrial equipment below the high-water mark (HWM) could result in impacts to fish and fish habitat as well as alterations to sediment concentrations from the release of sediment or an increase in contaminant concentrations from fluid leaks from equipment
- The installation of in-water work isolation measures may result in incidental entrainment and potential death of fish and limit access for fish to habitats
- Any dewatering and pumping of isolated in-water work areas could displace or kill fish and change access to and composition of habitat features. Alterations to flows could increase erosion and scour potential and result in alterations to temperatures and concentrations of sediment, food, contaminants, or nutrients, and water extraction using pumps could result in death of fish by entrainment in pumps and machinery
- Improper management of wastewater can result in a change in water temperature, change in migration access to habitat, change of dissolved oxygen concentration, changes in nutrient concentrations, change in contaminant concentrations and introduction of pathogens, disease vectors and exotics

- Alterations to flows could increase erosion and scour potential and result in alterations to temperatures and concentrations of sediment, food, contaminants, or nutrients
- Changes to fish passage could result in changes in water chemistry/temperature and flow alternation, which may lead to incidental entrainment, impingement or mortality of resident species and changes to habitat access
- Structure removals could result in changes to channel morphology or shoreline morphology and habitat structure or cover.

5.5 Mitigation

The following is a description of design and mitigation measures prescribed in the Mitigation Measures Master Table in Section 5: Impact Assessment and Mitigation of the Guide (MTO, 2020a) designed to mitigate or avoid the potential negative effects identified above. The mitigation measures provided are based on Preliminary Design. These measures shall be confirmed and finalized during Detail Design.

5.5.1 Site Specific Mitigation Measures

Associated Ontario Provincial Standard Specifications (OPSS) and MTO Central Region Special Provisions (SP) are also listed in **Section 5.6**.

Operational Constraints

- An Access Management Plan shall be created to limit access to waterbodies and banks to protect riparian vegetation and to minimize bank disturbance
- In-water work below the high-water mark (HWM) and work on watercourse banks shall be carried out during the appropriate timing window (See **Table 5-1** for applicable crossings):
    - Permitted in-water timing window of July 16 – March 14 (i.e., no in-water work is permitted from March 15 – July 15), or
    - Permitted in-water timing window of July 16 – February 28 (i.e., no in-water work is permitted from March 1 – July 15).

Management Practices and Controls

- Isolated in-water work areas must be cleared of fish prior to the commencement of work. Fish must be released unharmed downstream. Intakes of pumps and hoses for de-watering of in-water work areas shall be screened to avoid impingement and/or entrainment of fish (as per OPSS 182)
- The contractor shall develop and implement an Erosion, and Sediment Control (ESC) plan to contain/isolate exposed soils, stockpiled materials, and unstable areas in the work zone to prevent the release of sediment to all waterbodies and ensure the work site is stabilized prior to removal of ESC measures following construction (as per OPSS 805). Site-specific ESC plans should be developed for each watercourse crossing where work is proposed within 30 metres of a watercourse
- Design and implement an in-water work area isolation plan to maintain clean flow around the work area where in-water work is proposed (as per OPSS 805 and OPSS 517). The design shall:
    - Use only clean materials free of particle matter for temporary cofferdams
    - Manage flow withdrawal and discharge to prevent erosion and the release of sediment to a waterbody, and
    - Ensure work zones are stabilized against high flows at the end of each workday.

- Design and install culverts to prevent the creation of barriers to fish movement and maintain bankfull channel functions and habitat functions to the extent possible. Where permanent in-water structures are placed in fish habitat, naturalize these areas by placing riverstone below the 2-year high-water mark (as per OPSS 825 and 1005). Design and install in-stream cover to replace or re-instate fish cover removed, altered, or disturbed during construction
- Watercourses requiring realignment shall be designed using Natural Channel Design principles as discussed in the Fluvial Geomorphological Assessment Report: Highway 400 – Highway 404 Link (Bradford Bypass) (AECOM, 2022)
- As per OPSS 182, any fish isolated in the work area shall be transferred (using appropriate capture, handling, and release techniques to prevent harm and minimize stress) downstream or away from the construction area. A Licence to Collect Fish for Scientific Purposes (LCFSP) shall be obtained prior to the start of any fish relocation works. Fish screens shall be used to avoid entrainment of fish in pumps or hoses
- Design and implement a work area containment plan to isolate all above-water work to prevent the release of sediment or other contaminants to a waterbody (as per OPSS 517). The design shall include regular inspection, repair, removal, and disposal of isolation measures and materials. Work zones should be clearly delineated before work to avoid unintentional intrusions into nearby natural areas
- Where possible, organic material barriers (i.e., fibre roll barrier, sediment log, coir rolls etc.) shall be used in the drainage ditches to mitigate sediment transport
- Materials used or generated during construction (i.e., organics, soil, woody debris, temporary stockpiles, construction debris, etc.) shall be stored and managed in a way that prevents the release of these materials to a waterbody. This shall include storing materials a safe distance from a waterbody (i.e., greater than 30 metres from any watercourse) and/or isolation measures (as per OPSS 182)
- Dewatering operations shall be managed to prevent erosion or the release of sediment-laden water to a waterbody (as per OPSS 805)
- A Spills Management Plan shall be prepared and shall include materials, instructions, education, and emergency numbers. The plan shall be kept onsite at all times, communicated to work crews and be properly implemented in the event of accidental spills (Spill Prevention and Response Contingency Plan as per OPSS 182)
- Operate, store, and maintain equipment and associated materials in a manner and at a distance that prevents the entry of any deleterious substance from entering a waterbody (as per OPSS 182). Any part of equipment entering the waterbody or operating from the bank shall be cleaned, free of fluid leaks and in good working condition
- The contractor shall refer to and incorporate mitigations and obtain permits highlighted in the Wildlife Management Plan, Access Management Plan, Erosion and Sediment Control Plan, Invasive Species Management Plan, among others that shall be developed at a later stage of the project.

Rehabilitation

- Stabilize any portion of the bed of a waterbody disturbed during construction to pre-construction conditions (or better). This shall include substrates (as per OPSS 182 and OPSS 1005)
- Stabilize the banks of a waterbody that have been disturbed during construction to pre-construction conditions or better (as per OPSS 182 and OPSS 804). This shall include

riparian vegetation or stone material, temporary measures, and the avoidance of hard engineering; an ESCP shall be developed, and

- Stabilize and re-vegetate soils exposed or disturbed during construction, including new or cleaned-out ditches (as per OPSS 182).

Monitoring

- Should a permit under the Endangered Species Act and/or Authorization under the Fisheries Act be required, the construction and post-construction monitoring shall incorporate all requirements of these approvals
- In-water and near-water work shall be monitored to ensure mitigation measures are properly implemented, functioning, maintained and repaired as needed, and removed following construction (as per OPSS 182), and
- Erosion and Sediment Control in accordance with MTO NSSP (OPSS 805 and SP805F01).

5.6 Environmental Provisions

The following OPSSs and MTO Central and West Region SPs are recommended for evaluation and inclusion during Detail Design:

- Environmental Protection During Work in Watercourses and on Watercourse Banks in accordance with OPSS 182
- Temporary Erosion and Sediment Control Measures in accordance with OPSS 805 and Erosion and Sediment Control in accordance with MTO NSSP (OPSS 805 and SP805F01)
- Environmental Incident Management Under Legislation Protecting the Environment and Natural Resources in accordance with OPSS 100
- Management of Excess Materials in accordance with OPSS 180
- General Environmental Protection in accordance with MTO NSSP
- Maintenance of Existing Drainage in accordance with MTO NSSP
- Spill Prevention and Response Contingency Plan in accordance with MTO NSSP
- Timing of in-water Work in accordance with SSP101F23
- Construction Specification for Dewatering in accordance with OPSS 517
- Placement of Aggregates in Waterbodies in accordance with OPSS.PROV 825, and
- Material Specification for Aggregates – Streambed Material with OPSS.PROV 1005.

Design considerations tables were prepared for the proposed works at each crossing and are presented in **Table 5-3** to **Table 5-8** below.

Table 5-3: Design Considerations for Innisfil Creek Subwatershed (WC-01)

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Preliminary Design
In-water Works Timing Window	Reported to be a coolwater thermal regime (MNRF, 2019a). No in-water works are permitted from March 15 – July 15 (MNRF, 2019b [Appendix B]).	The construction schedule and in-water work will be planned to comply with the in-water work timing window.
Fish Passage	Maintain fish passage at culvert replacements and new culvert installations. At the time that this Report was completed, it is anticipated that if the flow rates remain below the following, there will likely not be issues with fish passage: C10-A-1: 1.1m/s; C10-A-4: 0.62m/s	Culverts shall be countersunk a minimum of 10% to maintain fish passage. Timing restrictions for in-water works shall be implemented to protect the sensitive life stages/processes of migratory and resident fish. Fish screens shall be used to avoid the entrainment of fish in pumps or hoses. Recommend culvert design in future stages aim to meet the velocities listed in the previous column.
Significant Fish Habitat	The crossings C10-A-1 and C10-A-4 are significant fish habitat and provide direct habitat for migration, spawning, feeding, and/or rearing, and are generally non-limiting throughout. No habitat classified as critical by the Species at Risk Act (SARA) was identified.	Timing restrictions for in-water works shall be implemented to protect the sensitive life stages/processes of migratory and resident fish.
Constraints and Opportunities	Channelized watercourse from C10-A-2 to the culvert inlet at C10-A-4. Recommend the channel be naturalized from C10-A-2 to the culvert inlet at C10-A-4. Recommend natural channel design tie-ins at the culvert inlet and outlet. Recommend culverts should be sized to bankfull width and to meet hydraulic requirements. Incorporation of design best management practices (BMPs) for culvert works (e.g., refuge pools, low-flow channels, etc.).	Recommend natural channelization, natural channel tie-ins and culverts sized to bankfull be carried forward to Detail Design.
Other considerations	Stream bed protection will consist of native material where possible, and any rock protection below the highwater mark will consist of round riverstone in accordance with OPSS1005 and NSSP008.	Stream bed material shall consist of riverstone in accordance with OPSS 1005 and NSSP 008. See Fluvial Geomorphological

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Preliminary Design
	An earthen berm is proposed to prevent surface flows from the Bradford Bypass/ Highway 400 interchange from directly flowing into WC-1. The berm will direct flows to a SWM pond which, after treatment, will outlet to WC-1 and continue to flow west under Highway 400. This should not disrupt flows downstream.	Assessment Report: Highway 400 – Highway 404 Link (Bradford Bypass) (AECOM, 2022) for more details. Surface runoff from Bradford Bypass will be treated by the SWM pond prior to flowing downstream. Recommend that the berm design plans be carried forward to Detail Design and that any proposed outlet from the SWM pond to WC-1 be designed to minimize impacts to WC-1.

Table 5-4: Design Considerations for Holland River Subwatershed (WC-01b to WC-09 & WC-11 to WC-24)

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Preliminary Design
In-water Works Timing Window	Reported to be a warmwater thermal regime warmwater (MNRF, 2019a). No in-water works are permitted from March 1 – July 15 at WC-07 to WC-09, WC-16, and WC-21 (MNRF, 2019b [Appendix B]). No in-water works are permitted from March 15 – July 15 at WC-01b to WC-06, WC-10 to WC-15, and WC-17 to WC-20 (MNRF, 2019b [Appendix B]).	The construction schedule and in-water work will be planned to comply with the in-water work timing window.
Fish Passage	Maintain fish passage at culvert replacements and new culvert installations. Fish passage obstructions (ex., debris) observed at C18-D-1. Fish passage could potentially be impeded in low flow conditions at C10-C-1 and C10-C-2. At the time that this Report was completed, it is anticipated that if the flow rates remain below the following, there will likely not be issues with fish passage: C10-C-1: 0.75m/s; C10-C-2: 0.7m/s; C11-A-11: 0.81m/s; C12-A-1: 0.71m/s; C13-A-1: 0.37m/s; C16-A-4: 0.6m/s; C16-A-1: 0.88m/s; C18-F-1: 0.49m/s; C18-G-1: 0.49m/s; C18-H-1: 0.76m/s.	Timing restrictions for in-water works shall be implemented to protect the sensitive life stages/processes of migratory and resident fish. Fish screens shall be used to avoid the entrainment of fish in pumps or hoses. Culverts will be countersunk a minimum of 10% to maintain fish passage. Culvert debris shall be removed following the Culvert Maintenance BMP. Recommend culvert design in future stages aim to meet

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Preliminary Design
		the velocities listed in the previous column.
Significant Fish Habitat	C16-A-1 (WC-09): Mapped Northern Pike spawning habitat. The crossings C10-C-1, C10-C-2, C11-A-1, C13-A-1, C16-A-1, C18-F-1, C18-G-1, and C18-H-1 are significant fish habitat and provide habitat for migration, spawning, feeding, and/or rearing, and are generally non-limiting throughout. No habitat classified as critical by the Species at Risk Act (SARA) was identified.	Timing restrictions for in-water works shall be implemented to protect the sensitive life stages/processes of migratory and resident fish.
Constraints and Opportunities	Obstructions to fish passage at C10-C-1 and C10-C-2. - Provide low-flow fish passage channels at C10-C-1 and C10-C-2. Lower culvert to eliminate perch and allow upstream fish passage at C18-A-1. Unstable banks at C10-C-1, C10-C-2, C11-A-1, C18-A-1 – Recommend the banks at C10-C-1, C10-C-2, C11-A-1, C18-A-1 be stabilized Limited riparian vegetation at C10-A-5. Culvert bottom failing at C10-A-6. Natural channel design tie-ins at culvert inlet and outlet. Culverts sized to bankfull width and to meet hydraulic requirements. Incorporate best management practices (BMPs) for culvert works into the design (e.g., refuge pools, low-flow channels, etc.). Invasive species management, including invasive species removal, should be considered.	Recommend natural channelization, natural channel tie-ins, bank stabilization, and culverts sized to bankfull be carried forward to Detail Design.
Other considerations	Should stream bed protection be proposed in Detail Design, it should consist of native material where possible, and any rock protection below the highwater mark should be round riverstone in accordance with OPSS1005 and NSSP008.	Stream bed material shall consist of riverstone in accordance with OPSS 1005 and NSSP 008. See Fluvial Geomorphological Assessment Report: Highway 400 – Highway 404 Link (Bradford Bypass) (AECOM, 2022) for more details.

Table 5-5: Design Considerations for the Holland River Bridge (WC-10/ C17-A-1)

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Preliminary Design
In-water Works Timing Window	Reported to be a warmwater thermal regime (MNRF, 2019a). No in-water works are permitted from March 1 – July 15 (MNRF, 2019b [Appendix B]).	The construction schedule and in-water work will be planned to comply with the in-water work timing window.
Fish Passage	Currently, no fish impediments are present within the assessed crossing. Cofferdams and work isolation measures will be limited to the smallest necessary footprint to maintain fish passage during construction.	Timing restrictions for in-water works shall be implemented to protect the sensitive life stages/processes of migratory and resident fish. Fish screens shall be used to avoid the entrainment of fish in pumps or hoses. It is not feasible nor necessary to isolate the entire river for pier construction. A small section surrounding the pier will be isolated to facilitate the construction and provide ESC measures which will be subject to conditions provided by the various permits that will be applied for.
Significant Fish Habitat	C17-A-1 (WC 10) Acts as a migratory corridor for fish to reach upstream spawning habitat and specialized habitats that fish use for spawning and nursery (e.g., slower-moving areas with instream cover). Confirmed spawning habitat for muskellunge species (MNRF, 2019b [Appendix B]). C17-A-1 is significant fish habitat and provides habitat for migration, spawning, feeding, and/or rearing, and is generally non-limiting throughout. No habitat classified as critical by the *Species at Risk Act* (SARA) was identified. American Eel (END: *ESA*; NAR*: *SARA*) has the potential to be present in the West Holland River (WC-10)	Timing restrictions for in-water works shall be implemented to protect the sensitive life stages/processes of migratory and resident fish. Works may be subject to approvals under the *Endangered Species Act*. This shall be confirmed during the Detail Design stage. Further discussions with MNRF and MECP are recommended.
Constraints and Opportunities	Temporary in-water work for pier installation will be confirmed during Detail Design. Invasive species management, including invasive species removal, should be considered. Incorporate best management practices (BMPs) for bridge works into the design (e.g., implement ESC measures, restore riparian zone after construction, isolate work area, etc.)	A site-specific Erosion and sediment control (ESC) plan, which includes measures such as the installation, monitoring, maintenance, and removal of temporary ESC measures, will be completed according to OPSS.PROV 182 and

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Preliminary Design
		OPSS.PROV 805 shall be developed and implemented. All other applicable BMPs to the bridge construction shall be implemented.
Other considerations	Riverbed protection will consist of native material where possible, and any rock protection below the highwater mark will consist of round riverstone in accordance with OPSS1005 and NSSP008.	Stream bed material shall consist of riverstone in accordance with OPSS 1005 and NSSP 008. See *Fluvial Geomorphological Assessment Report: Highway 400 – Highway 404 Link (Bradford Bypass)* (AECOM, 2022) for more details. SAR mitigation and registration with all applicable agencies will be completed if any aquatic SAR are identified.

* Under Consideration for Status Change

Table 5-6: Design Considerations for Holland River East Branch Subwatershed (WC-26 to WC-31)

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Preliminary Design
In-water Works Timing Window	Reported to be a warmwater thermal regime warmwater (MNRF, 2019a). No in-water works are permitted from March 1 – July 15 at WC-26 and WC-31 (MNRF, 2019b [Appendix B]). No in-water works are permitted from March 15 – July 15 at WC-27 to WC-30 (MNRF, 2019b [Appendix B]).	The construction schedule and in-water work will be planned to comply with the in-water work timing window.
Fish Passage	Maintain fish passage at culvert replacements and new culvert installations. The earthen berm at the northwest end of the online pond at C25-C-1 creates a fish passage barrier. A submerged culvert or pipe allowed for some water to continue to flow downstream at the time of inspection. At the time that this Report was completed, it is anticipated that if the flow rates remain below the following, there will likely not be issues with fish passage: C22-A-1: 0.47m/s; C25-A-1: 0.72m/s; C25-C-1: 0.39m/s.	Timing restrictions for in-water works shall be implemented to protect the sensitive life stages/processes of migratory and resident fish. Fish screens shall be used to avoid the entrainment of fish in pumps or hoses. Culverts shall be countersunk a minimum of 10% to maintain fish passage. Recommend culvert design in future stages aim to meet the velocities listed in the previous column.
Significant Fish Habitat	The crossings C22-A-1 and C25-C-1 are significant fish habitat and provide habitat for migration, spawning, feeding, and/or rearing, and are generally non-limiting throughout. No habitat classified as critical by the *Species at Risk Act* (SARA) was identified.	Timing restrictions for in-water works shall be implemented to protect the sensitive life stages/processes of migratory and resident fish.
Constraints and Opportunities	Unstable banks at C25-C-1. Recommend the channel be stabilized and naturalized. Earthen berm at the northwest end of the anthropogenic online pond at C25-C-1 inhibits fish passage, disrupts the flow, and may introduce species downstream during high-flow washouts. Recommend removal of pond and naturalization of the channel. Recommend natural channel design tie-ins at the culvert inlet and outlet. Invasive species management, including invasive species removal, should be considered.	Recommend natural channelization, natural channel tie-ins and culverts sized to bankfull be carried forward to Detail Design. See *Fluvial Geomorphological Assessment Report: Highway 400 – Highway 404 Link (Bradford Bypass)* (AECOM, 2022) for more details. Recommend removal of the pond be carried forward to Detail Design.

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Preliminary Design
	Recommend culverts should be sized to bankfull width and to meet hydraulic requirements. Incorporation of design best management practices (BMPs) for culvert works (e.g., refuge pools, low-flow channels, etc.).	
Other considerations	Should stream bed protection be proposed in Detail Design, it should consist of native material where possible, and any rock protection below the highwater mark should be round riverstone in accordance with OPSS1005 and NSSP008.	The planting plan will revegetate exposed soils and areas cleared to facilitate the replacement culvert installation within the ROW. Stream bed material shall consist of riverstone in accordance with OPSS 1005 and NSSP 008.

Table 5-7: Design Considerations for the Holland River East Branch Bridge (WC-25/ C20-A-1)

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Preliminary Design
In-water Works Timing Window	Reported to be a warmwater thermal regime (MNRF, 2019a). No in-water works are permitted from March 1 – July 15 at WC-25 (MNRF, 2019b [Appendix B]).	The construction schedule and in-water work will be planned to comply with the in-water work timing window.
Fish Passage	Currently, no fish impediments are present within the assessed crossing. Cofferdams and work isolation measures will be limited to the smallest necessary footprint to maintain fish passage during construction.	Timing restrictions for in-water works shall be implemented to protect the sensitive life stages/processes of migratory and resident fish. Fish screens shall be used to avoid the entrainment of fish in pumps or hoses. It is not feasible nor necessary to isolate the entire river for pier construction. A small section surrounding the pier will be isolated to facilitate the construction and provide ESC measures which shall be subject to the conditions provided by the various permits that will be applied for.
Significant Fish Habitat	C20-A-1 (WC-25) acts as a migratory corridor for fish to reach upstream spawning habitat and specialized habitats that fish use for spawning and nursery (e.g., slower moving areas with instream cover). Confirmed spawning habitat for muskellunge species (MNRF, 2019b [Appendix B]). C20-A-1 is significant fish habitat and provides habitat for migration, spawning, feeding, and/or rearing, and is generally non-limiting throughout. No habitat classified as critical by the *Species at Risk Act* (SARA) was identified. American Eel (END: *ESA*; NAR*: *SARA*) has the potential to be present in the East Holland River (WC-25)	Timing restrictions for in-water works shall be implemented to protect the sensitive life stages/processes of migratory and resident fish. Works may be subject to approvals under the *Endangered Species Act*. This shall be confirmed during the Detail Design stage. Further discussions with MNRF and MECP are recommended.
Constraints and Opportunities	Temporary in-water work for pier installation will be confirmed during Detail Design. Invasive species management, including invasive species removal, should be considered. Incorporate best management practices (BMPs) for bridge works into the design (e.g., implement ESC measures, restore riparian zone after construction, isolate work area, etc.)	A site-specific Erosion and sediment control (ESC) plan, which includes measures such as the installation, monitoring, maintenance, and removal of temporary ESC measures, will be completed according to OPSS.PROV 182 and OPSS.PROV 805 shall be developed and implemented. All other applicable BMPs to the bridge construction shall be implemented.

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Preliminary Design
Other considerations	Stream bed protection will consist of native material where possible, and any rock protection below the highwater mark will consist of round riverstone in accordance with OPSS1005 and NSSP008. At this time, there are no known aquatic Species at Risk in the Study Area. If it is determined that there is an aquatic Species at Risk at any of the watercourse crossings, the impact assessment will need to include SAR mitigation, and a Notice of Activity registration of the work with MECP will need to be completed.	Stream bed material shall consist of riverstone in accordance with OPSS 1005 and NSSP 008. SAR mitigation and registration with all applicable agencies will be completed if any aquatic SAR are identified.

Table 5-8: Design Considerations for Maskinonge River Subwatershed (WC-32 to WC-34)

Factors to Consider	Design Considerations Provided by the Fisheries Assessment Specialist	Describe How Each Factor Was Addressed Through Preliminary Design
In-water Works Timing Window	Reported to be a warmwater thermal regime warmwater (MNRF, 2019a). No in-water works are permitted from March 15 – July 15 (MNRF, 2019b [Appendix B]).	The construction schedule and in-water work will be planned to comply with the in-water work timing window.
Fish Passage	Currently, no fish impediments are present within the Unnamed Stream. At the time that this Report was completed, it is anticipated that if the flow rates remain below the following, there will likely not be issues with fish passage: C25-A-2: 0.75m/s; C26-A-1: 0.6m/s; C27-A-1: 0.49m/s Incorporate best management practices (BMPs) for culvert works into the design (e.g., refuge pools, low-flow channels, etc.).	Timing restrictions for in-water works shall be implemented to protect the sensitive life stages/processes of migratory and resident fish. Fish screens shall be used to avoid the entrainment of fish in pumps or hoses. Recommend culvert design in future stages aim to meet the velocities listed in the previous column.
Significant Fish Habitat	C27-A-1 is significant fish habitat and provides habitat for migration, spawning, feeding, and/or rearing, and is generally non-limiting throughout. No habitat classified as critical by the *Species at Risk Act* (SARA) was identified.	Timing restrictions for in-water works shall be implemented to protect the sensitive life stages/processes of migratory and resident fish.
Constraints and Opportunities	Recommend natural channel design tie-ins at the culvert inlet and outlet. Recommend culverts should be sized to bankfull width and to meet hydraulic requirements. Incorporation of design best management practices (BMPs) for culvert works (e.g., refuge pools, low-flow channels, etc.).	Recommend natural channelization, natural channel tie-ins and culverts sized to bankfull be carried forward to Detail Design.
Other considerations	Stream bed protection will consist of native material where possible, and any rock protection below the highwater mark will consist of round riverstone in accordance with OPSS1005 and NSSP008.	The planting plan will revegetate exposed soils and areas cleared to facilitate the replacement culvert installation within the ROW. Stream bed material shall consist of riverstone in accordance with OPSS 1005 and NSSP 008. See *Fluvial Geomorphological Assessment Report: Highway 400 – Highway 404 Link (Bradford Bypass)* (AECOM, 2022) for more details.

5.7 Determination of HADD

Following the completion of the impact assessment (including the identification of environmental protection and mitigation measures), it was determined that many of the potential negative effects of the proposed works could be avoided or mitigated at many locations. However, due to the number and size of some of the required new crossings it is anticipated that not all negative effects can be avoided or mitigated entirely. **Table 5-9** provides a summary of the works that may result in a HADD and future recommendations. Due to the permanent alterations of fish habitat described below, at this time, it is assumed that a Request for Review (RfR) will need to be submitted to DFO during the Detail Design phase / prior to construction.

Table 5-9: Summary of HADD

Activity	Location	Associated BMP	Step 4 Assessment	Will the Work Result in a HADD?	Recommendations
Vegetation removal within both the existing and new road ROW to accommodate the road widening and culvert replacements	All watercourse crossings.	Maintenance of Riparian Vegetation in Existing Right-of-Way BMP	N/A	Provided the clearing of riparian vegetation follows the associated BMP, it is anticipated that the HADD of fish habitat is unlikely.	The required clearing of riparian vegetation should be re-assessed during the Detail Design phase. If the BMP is no longer applicable, then riparian vegetation removal should be assessed under Step 4 of the Protocol.
Culvert like-for-like replacement	C10-A-1, C10-A-4	Like-For-Like Culvert Replacement BMP	N/A	Provided the like-for-like culvert replacement can follow the associated BMP, it is anticipated that a HADD of fish habitat is unlikely.	The like-for-like culvert replacement should be re-assessed during the Detail Design phase. If the BMP is no longer applicable, then the culvert work should be assessed under Step 4 of the Protocol.
Culvert removal and replacement with extension	C16-A-1	None	Carried to Step 4 (Section 5.4)	The culvert replacement with extension will result in a permanent alteration to fish habitat and a temporary disruption of fish habitat associated with the construction activities.	Submit a Request for Review (RfR) to DFO during the Detail Design phase for the culvert replacement with extensions.
Culvert clean-out	C18-D-1	Culvert Maintenance BMP	N/A	Provided the culvert clean-out can follow the associated BMP, it is anticipated that the HADD of fish habitat is unlikely.	The culvert cleanout works should be re-assessed during the Detail Design phase. If the BMP is no longer applicable, then the culvert cleanout should be assessed under Step 4 of the Protocol.
Channel realignment	C10-C-1, C10-C-2, C11-A-1, C12-A-1, C13-A-1, C16-A-4, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-A-1, C25-C-1, C25-A-2, C27-A-1	None	Carried to Step 4 (Section 5.4)	The channel realignment will result in a permanent loss of habitat with the infilling of the existing channel and a temporary disruption of fish habitat associated with the construction activities.	The channel should be designed following Natural Channel Design Principals and be at least the same length as the existing channel. Submit a Request for Review (RfR) to DFO during the Detail Design phase for the channel realignments.
Berm construction	C10-A-3	None	Carried to Step 4 (Section 5.4)	An earthen berm is proposed at the Highway 400/ Bradford Bypass interchange to prevent surface flows from directly entering WC-1. The berm will direct flows to a SWM pond which, after treatment, will outlet to WC-1 and continue to flow west under Highway 400. This should not disrupt flows downstream. It is anticipated that a HADD of fish habitat is unlikely.	The berm should be designed to not encroach on the existing watercourse. The SWM pond will treat the surface water from the Bradford Bypass interchange before it rejoins the watercourse and continues to flow downstream and out of the Study Area. It is anticipated that there will be minimal impacts to downstream flows and surface water quality should improve. Submit a Request for Review (RfR) to DFO during the Detail Design phase for the new SWM pond outlet to WC-1.
New culvert installation	C10-C-1, C10-C-2, C11-A-1, C12-A-1, C13-A-1, C16-A-4, C18-C-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-A-1, C25-C-1, C27-A-1	None	Carried to Step 4 (Section 5.4)	Culvert installations at new locations will result in a permanent alteration of habitat as a result of the enclosure of a portion of the watercourse and will result in a temporary disruption of fish habitat associated with the construction activities.	New culverts at watercourse crossings that provide fish habitat should consist of open-footed culverts. Submit a Request for Review (RfR) to DFO during the Detail Design phase for the new culverts.
New bridge construction	C17-A-1, C20-A-1,	None	Carried to Step 4 (Section 5.4)	It is assumed that there will be no permanent footprint within the typical wetted portion of the Holland River and Holland River East Branch, but a temporary footprint and bank stabilization post construction on both rivers will be required	Piers will be located below the HWM (2-year return event), but above the typical wetted portion of the River. To protect fish and fish habitat, a small section surrounding the pier will be isolated to facilitate the construction and provide erosion and sediment control (ESC) measures which will be subject to conditions provided by the various permits and approvals.

Activity	Location	Associated BMP	Step 4 Assessment	Will the Work Result in a HADD?	Recommendations
					Submit a Request for Review (RfR) to DFO during the Detail Design phase for the new bridges

At this time, insufficient data is available to determine if the proposed culverts will cause any disruptions to fish passage, these details are to be confirmed during Detail Design. The Swim Distance and Water Velocity Tool (SPOT) (Di Rocco & Gercais, 2021) was consulted, and the maximum velocities for each culvert that will still allow passage for the average White Sucker (*Catostomus commersonii*) and Northern Pike are available in **Tables 7-12**. White Sucker and Northern Pike were chosen as indicator species for fish passage as they are poorer swimmers than some other species that have been recorded in this watercourse (e.g., Brook Trout, Brown Trout etc.). It is assumed that if White Sucker and Northern Pike can pass through the culverts at the proposed velocity, then these other species would also be able to swim through the culvert. It is recommended that the fish passage assessment should be deferred and assessed as part of Detail Design.

Due to design and construction challenges, the bridges over the Holland River and Holland River East Branch cannot completely span the River outside the HWM (2-year return event) on each side of the bank. A pier is required below the HWM, but outside the active wetted portion of the channel. As a result, a small portion of the river will be isolated using cofferdams to facilitate the pier work and protect fish and fish habitat.

It is proposed that the banks may be hardened along portions of both the Holland River East Branch and the Holland River watercourses to provide erosion protection around the piers. At this stage of design, it is also proposed that footings for the Holland River East Branch bridge will be located under the riverbed. Final design of the pier placement, scour protection requirements, and additional design details for the Holland River watercourses will be more closely investigated during the Detail Design stage.
However, a small loss of riparian habitat on the bank and a temporary in-water footprint will be required. The temporary footprint is to be confirmed during Detail Design as the design is refined and construction staging/access requirements are established.

At the time of writing this Impact Assessment, the Preliminary Design for the project was approximately 60% complete. Some design details are still outstanding or may need to be updated as the Preliminary Design progresses to 100%. It is recommended that these details be carried over to Detail Design for assessment.

5.8 ESA and SARA Approvals and/or Permits

No records of aquatic SAR that are afforded protection under the *Species at Risk Act* (SARA) or *Endangered Species Act* (ESA) are known to occur in the watercourses where culverts are anticipated to be installed; however, there are historical records of Aquatic SAR in the Holland River and Holland River East Branch. Records of American Eel (*Anguilla rostrata*) (Endangered [ESA], No status [SARA]) were returned. It is possible that permits under ESA may be required for the proposed works in the Holland River and Holland River East Branch. Consultation with MECP should start early in the Detail Design phase to confirm ESA permitting requirements.

5.9 Potential Fish Habitat Enhancement or Offsetting Opportunities

MNRF Midhurst and Aurora Districts did not provide any potential fish habitat enhancement or offsetting opportunities during correspondence in 2019. They did provide some input into potential offsetting opportunities during correspondence in 2022, which have been included where in-water works are proposed. For a review of proposed works, the design considerations for the watercourses are outlined in **Table 5-3** to **Table 5-8**.

6. Summary of Environmental Commitments

6.1 2002 Approved Environmental Assessment Commitments

The 2002 Approved Environmental Assessment identified several proposed mitigation and commitments to future work for the project. **Table 6-1** below identifies the fish and fish habitat commitments carried forward through to Preliminary Design and describes any applicable changes to the 2002 Approved Environmental Assessment commitment. Commitments identified in the 2002 Approved Environmental Assessment are to be carried forward to Detail Design phase unless otherwise stated in **Table 6-1** below.

Table 6-1: 2002 Approved Environmental Assessment Commitments

Factor / Criterion	Issue	Concerned Group / Agency	Potential Net Environmental Effect (as taken from 2002 Approved Environmental Report)	Proposed Mitigation / Commitments to Future Work (as taken from 2002 Approved Environmental Report)	Changes to Mitigation/ Protection/ Monitoring (Yes/No/NA)	Description of Commitment Carried Forward through Preliminary Design for Mitigation, Protection and Monitoring
Surface Water Systems	▪ Minimize potential adverse impacts to surface water systems (physical characteristics, water quality and quantity)	▪ Ministry of Transportation, Ministry of Natural Resources and Forestry, Ministry of the Environment, Conservation and Parks, Fisheries and Oceans Canada, Lake Simcoe Region Conservation Authority, interest groups, general public	▪ Long-span bridges will carry the proposed 400-404 Link across both branches of the Holland River. Other stream crossings will use appropriately designed culverts. ▪ The continuity of the surface water system will be maintained.	▪ Where appropriate: – Design bridges and culverts that: ▪ maintain the existing channel form or include a low flow channel where appropriate ▪ do not impede fish movement ▪ do not place piers within the channel as defined by bankfull flow conditions, or are oriented in the direction of water flow to maximize hydraulic efficiency during high flow conditions ▪ minimize erosion and flood risk upstream and downstream of structure ▪ utilize open bottomed culverts in upwelling areas. – develop plans that minimize the disruption to natural systems and maintain slope stability when developing access roads for construction, including re-establishment or stabilization after construction.	▪ No	▪ Bridge and culvert designs are taking into consideration current information related to fish and fish habitat, fluvial geomorphology, hydrogeology, and surface water drainage studies. ▪ Project-specific assessment of environmental impacts are providing recommendations to the design to avoid, minimize or mitigate potential impacts resulting from new or modified watercourse crossings and structures. ▪ Where appropriate, environmental approvals will be sought under the Fisheries Act, Endangered Species Act, Ontario regulation 387/04, etc. ▪ In addition, the Ministry has completed a Stormwater Management Plan and Groundwater Protection and Well Monitoring Plan per the Regulation.
Fisheries and Aquatic Habitat	▪ Protect fish habitat during and following construction, including no net loss of habitat	▪ Ministry of Transportation, Ministry of Natural Resources and Forestry, Fisheries and Oceans Canada, Lake Simcoe Region Conservation Authority, interest groups, general public	▪ The 400-404 Link extends east-west and will cross coolwater and warmwater streams, including two branches of the Holland River, where there is the potential for a small loss of wetland area that may currently provide spawning habitat. Within the three affected watersheds (Innisfil Creek, Holland River, and Maskinonge River), a number of smaller streams and agricultural drains that provide or may provide habitat for migratory warmwater species and or resident baitfish populations will be affected. ▪ Key concerns during construction are the introduction of sediment, habitat disturbance and alteration of the stream banks and bed during structure placement.	▪ Where appropriate: ▪ develop a fish management plan that maintains or enhances fish habitat ▪ plans that maximize the riparian vegetation protection and the re-establishment as soon as possible after disturbance ▪ plans that provide for watercourse realignments in dry ▪ timing constraints to restrict construction activities immediately adjacent to or within watercourses to low flow months and that avoid sensitive spawning periods ▪ plans that minimize the disruption to natural systems and maintain slope stability when developing access roads for construction, including re-establishment or stabilization after construction.	▪ No	▪ The project is being assessed in accordance with the Interim Environmental Guide for Fisheries (Ministry of Transportation, 2020) and the Pilot Ministry of Transportation / Fisheries and Oceans Canada / Ministry of Natural Resources and Forestry Protocol for Protecting Fish and Fish Habitat on Provincial Transportation Undertakings, Version 4 (2020). ▪ Environmental management plans related to fish and fish habitat will be developed as required in accordance with the Fisheries Act.

6.2 Preliminary Design Commitments

Impacts to fish and fish habitat and proposed mitigation measures, monitoring activities and commitments identified during this fish and fish habitat impact assessment are summarized in **Table 6-2** below.

Table 6-2: Summary of Environmental Concerns and Commitments

ID	Issues / Concerns / Potential Effects	Concerned Agencies	ID	Mitigation, Protection, Monitoring, and Commitments
Fish and Fish Habitat				
FISH-1.0	Near and in-water work	DFO, MNRF, MECP, LSRCA, NVCA	FISH-1.01	▪ An Access Management Plan shall be created to prohibit or limit access to banks or areas adjacent to waterbodies to the extent required to protect the structural integrity of banks or shorelines. Where applicable, the plan shall include: ▪ Limit machinery fording of the watercourse to a one-time event (i.e., over, and back), and only if no alternative crossing method is available. ▪ If repeated crossings of the watercourse are required, construct a temporary crossing structure. ▪ Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. ▪ For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording.
			FISH-1.02	▪ Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project.
			FISH-1.03	▪ Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin, and runoff water is clear. Where applicable, the plan may include: ▪ Installation of effective erosion and sediment control measures before work starts to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction ▪ Strategies to repair erosion and sediment control measures and structures, if damage occurs, and ▪ Strategies for the removal of non-biodegradable erosion and sediment control materials once the site is stabilized.
			FISH-1.04	▪ Environmental Protection during work in watercourses and on watercourse banks shall be conducted in accordance with OPSS 182.
			FISH-1.05	▪ Timing of in-water work in accordance with OPSS 802.07.08.01 ▪ In-water work below the high-water mark (HWM) and work on watercourse banks shall be carried out during the appropriate timing window: ▪ Permitted in-water warmwater/ coolwater timing window of July 16 – March 14 (i.e., no in-water work is permitted from March 15 – July 15); or ▪ Permitted in-water timing window of July 16 – February 28 for areas with sensitive (e.g., spawning or nursery) habitat (i.e., no in-water work is permitted from March 1 – July 15).
			FISH-1.06	▪ An in-water work isolation plan should be designed and implemented to maintain clean flow around the work area(s), including the following considerations: ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc., such as sediment is filtered out prior to the water entering a waterbody ▪ Use of energy dissipation measures to prevent bank or bed erosion ▪ Erosion and Sediment control shall be monitored in accordance with OPSS 805.
			FISH-1.07	▪ Isolated in-water work areas must be cleared of fish prior to the commencement of work. Fish must be released unharmed downstream. Intakes of pumps and hoses for de-watering of in-water work areas shall be screened to avoid impingement and/or entrainment of fish (as per OPSS 182). A License to Collect Fish for Scientific Purposes (LCFSP) shall be obtained prior to the start of any fish relocation works.
			FISH-1.08	▪ Whenever possible, operate machinery on land above the high-water level, on ice, or from a floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody.
			FISH-1.09	▪ Operate, store and maintain (e.g., refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the water (refueling and other such tasks should be completed at least 30 m away from a watercourse).
			FISH-1.10	▪ Any part of equipment entering the water or operating on the bank shall be free of fluid leaks, invasive species and noxious weeds. The equipment shall be externally cleaned/degreased to prevent any deleterious substance from entering the water.
			FISH-1.11	▪ Ensure work zones are stabilized against high flows at the end of each workday.
			FISH-1.12	▪ In-water and near-water work shall be monitored to ensure mitigation measures are properly implemented, functioning, maintained and repaired as needed, and removed following construction (as per OPSS 182).
			FISH-1.13	▪ Use only specified amounts and types of fertilizer in areas draining to waterbodies ▪ Avoid the use of chemical dust suppressants, pesticides, and herbicides in areas near or draining waterbodies ▪ Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish.
			FISH -1.14	▪ Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless the structure is provided to take drainage into the valley without erosion and risk of sedimentation.
			FISH-1.15	▪ Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level ▪ Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction

ID	Issues / Concerns / Potential Effects	Concerned Agencies	ID	Mitigation, Protection, Monitoring, and Commitments
				▪ This may include salvage and reinstatement of existing in-stream structures such as large woody debris, boulders, or in-stream aquatic vegetation.
			FISH-1.16	▪ Design and implement vegetation rehabilitation plan following construction to replant riparian vegetation to pre-construction or better condition (e.g., trees for shade to cool water and provide overhead cover) ▪ Considerations: ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank and bed profile ▪ Usually includes reinstatement of native soils or replacement with topsoil/suitable planting medium ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g., live stakes, cuttings) techniques ▪ Use native species compatible with site conditions ▪ Integrate provision o fish cover where feasible ▪ Integrate appropriate techniques for interim stabilization measures, such as a biodegradable blanket and tackifier, to maintain soil stability until vegetation becomes established.
			FISH-1.17	▪ Temporarily store, handle and dispose of all materials used or generated (e.g. organics, soils, uprooted or cut aquatic plants, woody debris, dredging spoils, commercial logging waste, temporary stockpiles, construction waste and materials such as concrete, sheet pile, wood forms etc.) during site preparation, construction and clean-up in a manner that prevents their entry to the waterbody, including temporarily storing and stockpiling materials a safe distance from the waterbody and stabilizing/ containing them.
			FISH-1.18	▪ Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not across watershed boundaries) ▪ Design stormwater management (SWM) measures to manage runoff to waterbody considering discharge (e.g., velocities to avoid erosion) as well as quality (e.g., formal SWM ponds, enhanced ditches, and filtration)
FISH-2.00	The potential presence of aquatic Species at Risk	MECP, MNRF	FISH-2.01	▪ Historical records of American Eel (listed as Endangered under the Provincial Endangered Species Act but not currently on Schedule 1 of the federal Species at Risk Act) were identified in the West Holland River (WC-25). ▪ Works may be subject to approvals under the Endangered Species Act and shall be confirmed during the Detail Design. ▪ Further discussions with MECP are recommended during Detail Design regarding the presence of aquatic Species at Risk and approvals under the Endangered Species Act.
			FISH-2.02	▪ Should a permit under the Endangered Species Act and/or Authorization under the Fisheries Act be required, the construction and post-construction monitoring shall incorporate all requirements of these approvals.
FISH-3.00	Temporary Alteration, Disruption, or Destruction of fish habitat	DFO, MECP, MNRF, LSRCA, NVCA	FISH-3.01	▪ As the fish and fish habitat assessment was completed for the Preliminary Design, consultation and review of the works by Fisheries and Oceans Canada – Fish and Fish Habitat Protection Program will be required to confirm the approval requirements under the Fisheries Act.
			FISH-3.02	▪ Stream bed protection will consist of native material, where possible, and any rock protection below the highwater mark will consist of round riverstone in accordance with OPSS.PROV 1005 and NSSP008.
			FISH-3.03	▪ Re-stabilize any portion of the bed of a waterbody disturbed during construction to pre-construction (or better) conditions. This shall include substrates as per OPSS 182 and OPSS.PROV 1005.
			FISH-3.04	▪ Re-stabilize the banks of a waterbody that have been disturbed during construction to pre-construction (or better) conditions (as per OPSS 182 and OPSS 804). This shall include riparian vegetation or stone material, temporary measures and the avoidance of hard engineering (where applicable)
			FISH-3.05	▪ Stabilize and re-vegetate soils exposed or disturbed during construction, including new or cleaned-out ditches (as per OPSS 182).
			FISH-3.06	▪ Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody ▪ Stabilize and reinforce banks of waterbodies to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders) ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankful channel profile ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established.
FISH-4.00	The in-water works timing window for warmwater systems with significant fish habitat	DFO, MNRF, MECP, LSRCA,	FISH-4.01	▪ The construction schedule and in-water work will be planned in order to comply with the in-water work timing window (no in-water works are permitted from March 1 – July 15 at WC-07 to WC-09, WC-16, and WC-21).
			FISH-4.02	▪ Minimize the duration of in-water work ▪ Conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ Schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter.
			FISH-4.03	▪ The construction schedule and in-water work will be planned in order to comply with the in-water work timing window (no in-water works are permitted from March 15 – July 15).
FISH- 5.0	Fish Passage	DFO, MNRF, MECP,	FISH-5.01	▪ Design and install new culverts, extensions, and replacements to prevent the creation of barriers to fish movement and to maintain bankfull channel functions and habitat functions to the extent possible.

ID	Issues / Concerns / Potential Effects	Concerned Agencies	ID	Mitigation, Protection, Monitoring, and Commitments
		LSRCA, NVCA		▪ Where permanent in-water structures are placed in fish habitat, naturalize these areas by placing river stone below the 2-year high water mark (as per OPSS 825 and 1005). ▪ Design and install in-stream cover to replace or reinstate fish cover removed, altered or disturbed during construction. ▪ Design of culverts should be countersunk a minimum of 10% to maintain fish passage.
			FISH-5.02	▪ Watercourses requiring realignment shall be designed using Natural Channel Design principles as discussed in the Fluvial Geomorphological Assessment Report: Highway 400 – Highway 404 Link (Bradford Bypass) (AECOM, 2022).
			FISH-5.03	▪ Timing restrictions for in-water works shall be implemented to protect the sensitive life stages/ processes of migratory and resident fish.
			FISH-5.04	▪ Culvert debris shall be removed, where applicable.
			FISH-5.05	▪ Fish screens shall be used to avoid the entrainment of fish in pumps and hoses as per the DFO Code of Practice for end-of-pipe fish protection screens.
			FISH-5.06	▪ It is recommended that culvert design in future stages aim to meet the velocities provided in Section 5.6.
FISH-6.00	Impacts to fish associated with dewatering during construction	DFO, MNRF, MECP, LSRCA, NVCA	FISH-6.01	▪ As per OPSS 182, any fish isolated in the work area should be transferred (using appropriate capture, handling and release techniques to prevent harm and minimize stress) downstream or away from the construction area ▪ Fish screens shall be used to avoid entrainment of fish in pumps or hoses ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. shall be used, so sediment is filtered out prior to the water entering a waterbody (as per OPSS 182) ▪ Use of energy dissipation measures to prevent bank or bed erosion.
			FISH-6.02	▪ Isolated in-water work areas must be cleared of fish prior to the commencement of work ▪ Fish shall be released unharmed downstream ▪ Intakes of pumps and hoses for de-watering of in-water work areas shall be screened to avoid impingement and/or entrainment of fish (as per OPSS 182) ▪ A License to Collect Fish for Scientific Purposes (LCFSP) shall be obtained prior to the start of any fish relocation works.
			FISH-6.03	▪ Construction Specifications for Dewatering in accordance with OPSS 517 shall be followed. This includes the general provisions provided for temporary flow passage systems, both outside and within a waterbody, how to properly discharge of the water, and the minimum monitoring requirements.
FISH-7.00	Potential for oil, gasoline, grease and other deleterious substances from construction equipment, material storage and handling to enter adjacent watercourses.	DFO, MNRF, MECP, LSRCA, NVCA	FISH-7.01	▪ A Spills Management Plan should be prepared and include materials, instructions, education and emergency numbers. The plan shall be kept onsite at all times, communicated to work crews and be properly implemented in the event of accidental spills (OC – Spill Prevent and Response Contingency Plan as per OPSS 182).
			FISH-7.02	▪ The Contractor shall be in compliance with the requirements of all of the applicable environmental legislation as stated in the Environmental Incident Management Under Legislation Protecting the Environment and Natural Resources in accordance with OPSS 100.
			FISH-7.03	▪ Operate, store and maintain (e.g. refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the waterbody (as per OPSS 182) ▪ Any part of equipment entering the waterbody or operating from the bank shall be cleaned, free of fluid leaks and in good working condition.
FISH-8.00	Potential for the spread of invasive species	DFO, MNRF, MECP, LSRCA, NVCA	FISH-8.01	▪ The contractor shall implement best management practices to prevent the introduction/spread of invasive plants, including proper soil management and equipment cleaning protocols ▪ The contractor shall follow the guidelines outlined in the Ontario Ministry of Natural Resources, Invasive Phragmites – Best Management Practices, Ontario Ministry of Natural Resources, Peterborough, Ontario. Version 2011. 15p.
			FISH-8.02	▪ The Contractor shall remove and dispose of excess soil from areas identified as containing invasive species as per WEMM 3.06. no invasive plants prior to every time leaving the construction site as per WEMM 3.06.
			FISH-8.03	▪ The Contractor shall be required to clean all vehicles and equipment exposed to invasive species prior to every time leaving the construction site as per WEMM 3.06.

7. Conclusion

Fifty-one (51) crossings were assessed across thirty-four (34) watercourses, as part of this preliminary impact assessment. All the crossings that contain fish habitat in the East Holland River Subwatershed, West Holland River Subwatershed and the Maskinonge Subwatershed support warmwater fish communities. Only the crossings in the Innisfil Creek Subwatershed support coolwater fish communities. The East and West Holland River crossings (20-A-1 and 17-A-1, respectively), as well as C16-A-1, are known spawning habitat for muskellunge species.

In total, 31 proposed culverts across 23 of the assessed fisheries crossings have been identified that may require in-water works such as a like-for-like culvert replacement, grading, culvert extension, new culvert installation, watercourse realignment, and new bridge construction in either direct or indirect fish habitat.

No records of aquatic SAR were found at any culverts within the Study Area. Records of American Eel were found in the Holland River and Holland River East Branch where the associated bridge works are located.

The proposed in-water works described in **Table 5-1** cannot be completed under the MTO Routine Works. Riparian vegetation removal, like-for-like culvert replacements, and culvert cleanout work can likely follow existing BMPs. All other proposed works were carried to Step 4 of the Fisheries Assessment Process. AECOM Fisheries Biologists certified in the MTO Registry, Appraisal and Qualification System (RAQS) as Fisheries Assessment Specialists have assessed the potential negative impacts of the proposed work and recommended appropriate mitigation measures to avoid or negate these impacts. Although a permanent alteration of direct and indirect fish habitat is anticipated from the proposed works, mitigation and environmental provisions have been described to reduce the impacts to fish habitat and facilitate the restoration and/or improvement of habitat at each proposed crossing. Proposed works that should be submitted to DFO for review are outlined in **Table 5-9**. The Fish and Fish Habitat Impact Documentation (Template D4) is provided in **Appendix F**.

At the time of writing this Report, some of the design details are still in preliminary stages (i.e. the finalized velocity data required to complete the impact assessment for fish passage and the temporary footprints needed to determine whether or not the Clear Span Bridge BMP could be used) and will be carried out in detail in subsequent design phases. It is recommended that these details be carried over to the Detail Design phase for assessment.

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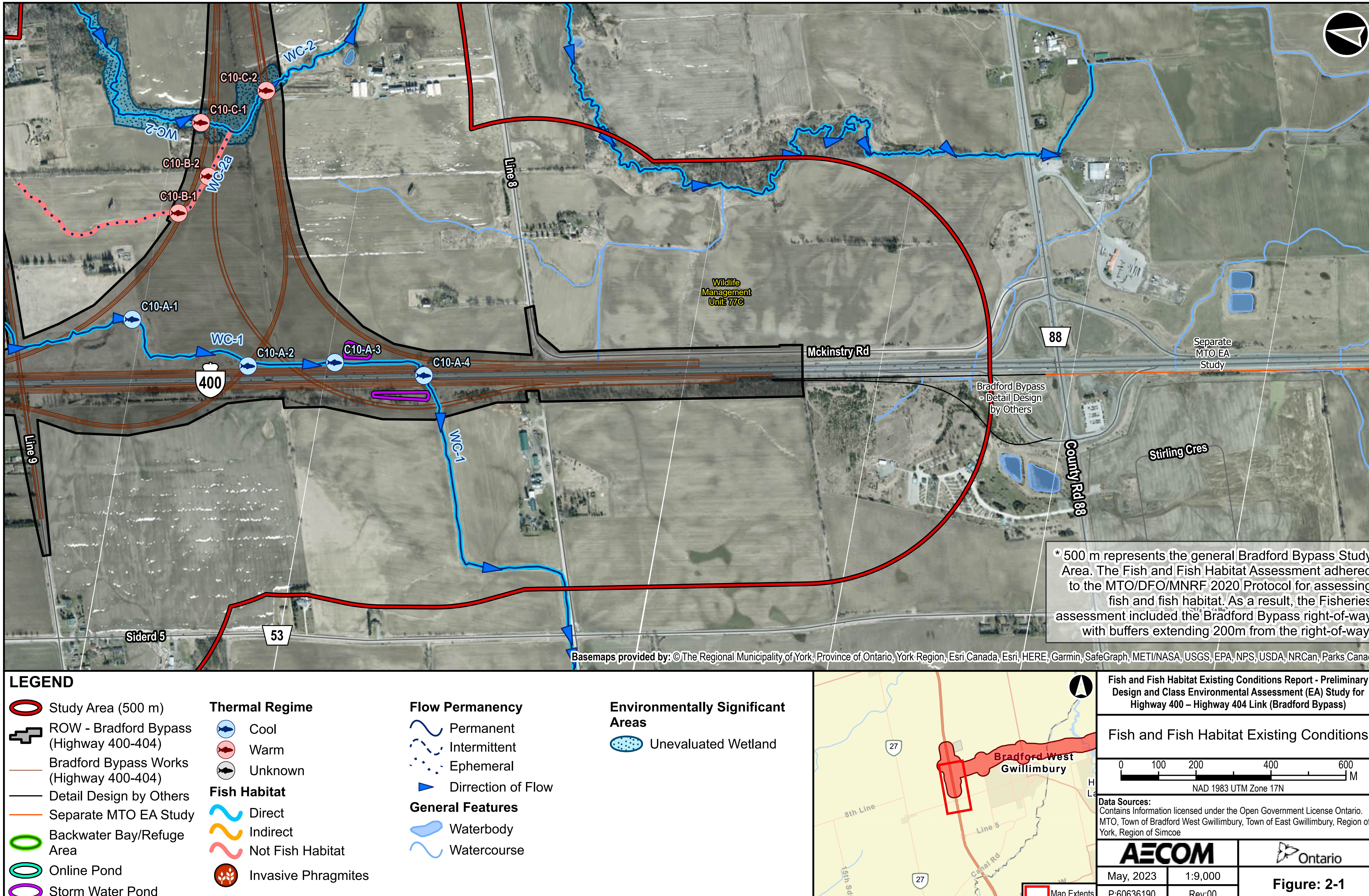
Appendix A

Fish and Fish Habitat Existing Conditions Mapping


WC-2
C10-C-2
C10-C-1
WC-2
C10-B-2
WC-2a
C10-B-1
Line 8
Wildlife Management Unit: 77C
C10-A-1
WC-1
C10-A-2
C10-A-3
C10-A-4
400
Mckinstry Rd
88
Separate MTO EA Study
Bradford Bypass - Detail Design by Others
Line 9
WC-1
County Rd 88
Stirling Cres
Siderd 5
53
* 500 m represents the general Bradford Bypass Study Area. The Fish and Fish Habitat Assessment adhered to the MTO/DFO/MNRF 2020 Protocol for assessing fish and fish habitat. As a result, the Fisheries assessment included the Bradford Bypass right-of-way with buffers extending 200m from the right-of-way.
Basemaps provided by: © The Regional Municipality of York, Province of Ontario, York Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, NRCan, Parks Canada
LEGEND
Study Area (500 m)
ROW - Bradford Bypass (Highway 400-404)
Bradford Bypass Works (Highway 400-404)
Detail Design by Others
Separate MTO EA Study
Backwater Bay/Refuge Area
Online Pond
Storm Water Pond
Thermal Regime
Cool
Warm
Unknown
Fish Habitat
Direct
Indirect
Not Fish Habitat
Invasive Phragmites
Flow Permanency
Permanent
Intermittent
Ephemeral
Direction of Flow
General Features
Waterbody
Watercourse
Environmentally Significant Areas
Unevaluated Wetland
27
Bradford West Gwillimbury
8th Line
Line 5
Canal Rd
15th Sdrd
27
Map Extents
Fish and Fish Habitat Existing Conditions Report - Preliminary Design and Class Environmental Assessment (EA) Study for Highway 400 – Highway 404 Link (Bradford Bypass)
Fish and Fish Habitat Existing Conditions
0 100 200 400 600 M
NAD 1983 UTM Zone 17N
Data Sources:
Contains Information licensed under the Open Government License Ontario. MTO, Town of Bradford West Gwillimbury, Town of East Gwillimbury, Region of York, Region of Simcoe
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Ontario
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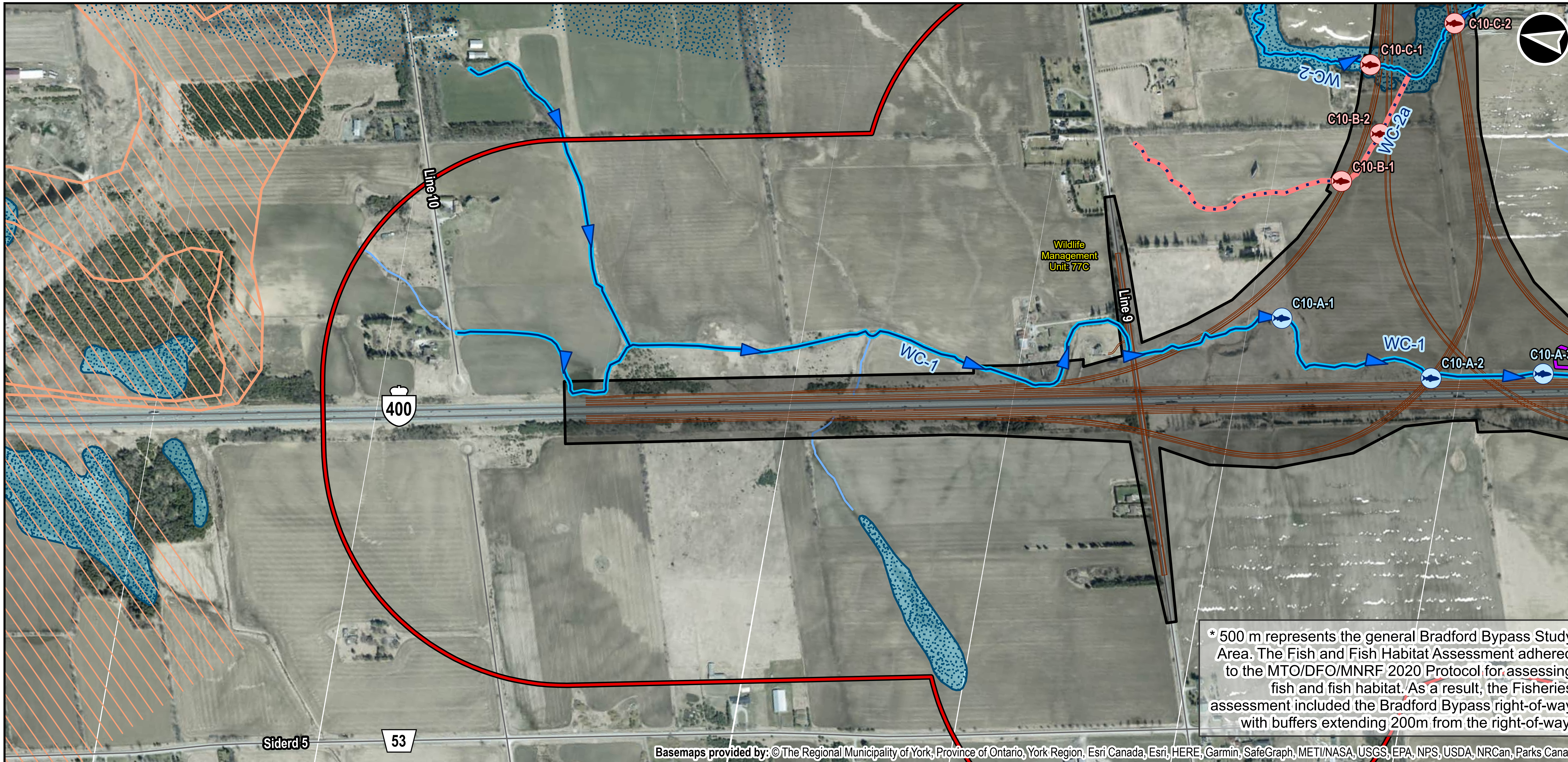
Figure: 2-1



LEGEND

- Study Area (500 m)
- ROW - Bradford Bypass (Highway 400-404)
- Bradford Bypass Works (Highway 400-404)
- Detail Design by Others
- Separate MTO EA Study
- Backwater Bay/Refuge Area
- Online Pond
- Storm Water Pond

Thermal Regime

- Cool
- Warm
- Unknown

Fish Habitat

- Direct
- Indirect
- Not Fish Habitat
- Invasive Phragmites

Flow Permanency

- Permanent
- Intermittent
- Ephemeral
- Direction of Flow

General Features

- Waterbody
- Watercourse

Environmentally Significant Areas

- Unevaluated Wetland
- Deer Wintering Areas - Stratum 2

Fish and Fish Habitat Existing Conditions Report - Preliminary Design and Class Environmental Assessment (EA) Study for Highway 400 – Highway 404 Link (Bradford Bypass)

Fish and Fish Habitat Existing Conditions

0 100 200 400 600 M

NAD 1983 UTM Zone 17N

Data Sources:
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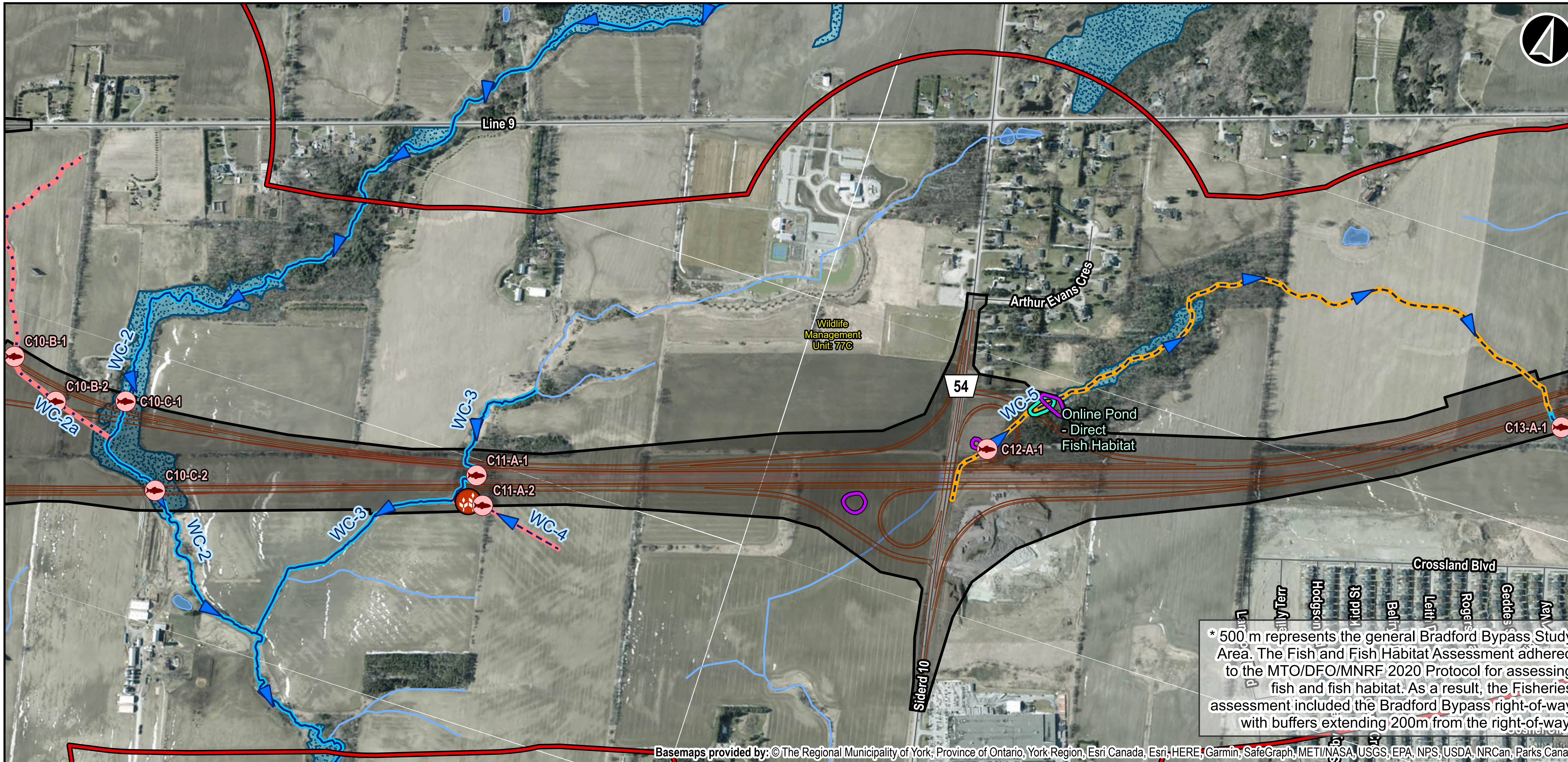

LEGEND

- Study Area (500 m)
- ROW - Bradford Bypass (Highway 400-404)
- Bradford Bypass Works (Highway 400-404)
- Detail Design by Others
- Separate MTO EA Study
- Backwater Bay/Refuge Area
- Online Pond
- Storm Water Pond

Thermal Regime
- Cool
- Warm
- Unknown

Fish Habitat
- Direct
- Indirect
- Not Fish Habitat
- Invasive Phragmites

Flow Permanency
- Permanent
- Intermittent
- Ephemeral
- Direction of Flow

General Features
- Waterbody
- Watercourse

Environmentally Significant Areas
- Unevaluated Wetland

Fish and Fish Habitat Existing Conditions Report - Preliminary Design and Class Environmental Assessment (EA) Study for Highway 400 – Highway 404 Link (Bradford Bypass)

Fish and Fish Habitat Existing Conditions

0 100 200 400 600 M
NAD 1983 UTM Zone 17N

Data Sources:
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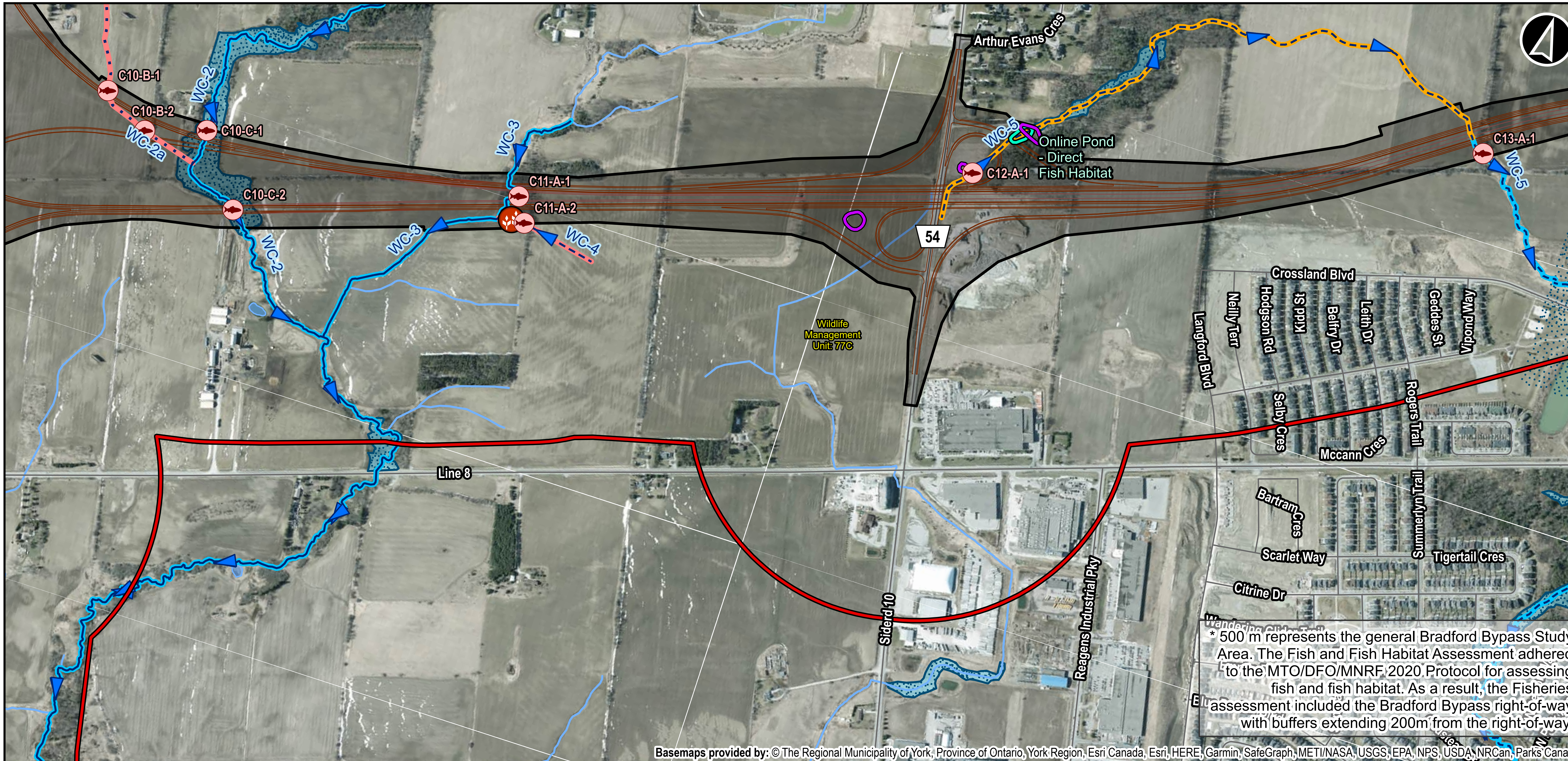
May, 2023	1:8,000	Figure: 2-3
P:60636190	Rev:00	



LEGEND

- Study Area (500 m)
- ROW - Bradford Bypass (Highway 400-404)
- Bradford Bypass Works (Highway 400-404)
- Detail Design by Others
- Separate MTO EA Study
- Backwater Bay/Refuge Area
- Online Pond
- Storm Water Pond

Thermal Regime

- Cool
- Warm
- Unknown

Fish Habitat

- Direct
- Indirect
- Not Fish Habitat
- Invasive Phragmites

Flow Permanency

- Permanent
- Intermittent
- Ephemeral
- Direction of Flow

General Features

- Waterbody
- Watercourse

Environmentally Significant Areas

- Unevaluated Wetland

Fish and Fish Habitat Existing Conditions Report - Preliminary Design and Class Environmental Assessment (EA) Study for Highway 400 – Highway 404 Link (Bradford Bypass)

Fish and Fish Habitat Existing Conditions

0 100 200 400 600 M

NAD 1983 UTM Zone 17N

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P:60636190	Rev:00

Figure: 2-4

LEGEND

- Study Area (500 m)
- ROW - Bradford Bypass (Highway 400-404)
- Bradford Bypass Works (Highway 400-404)
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- Separate MTO EA Study
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Thermal Regime
- Cool
- Warm
- Unknown

Fish Habitat
- Direct
- Indirect
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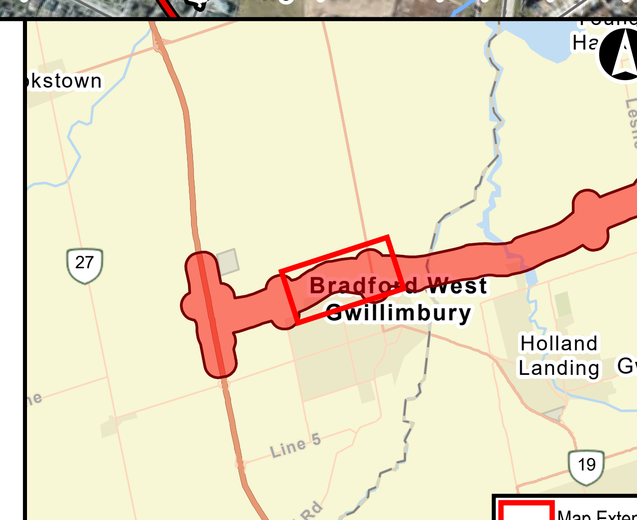
Flow Permanency
- Permanent
- Intermittent
- Ephemeral
- Direction of Flow

General Features
- Waterbody
- Watercourse

Environmentally Significant Areas
- Unevaluated Wetland



Fish and Fish Habitat Existing Conditions Report - Preliminary Design and Class Environmental Assessment (EA) Study for Highway 400 – Highway 404 Link (Bradford Bypass)

Fish and Fish Habitat Existing Conditions

0 100 200 400 600 M

NAD 1983 UTM Zone 17N

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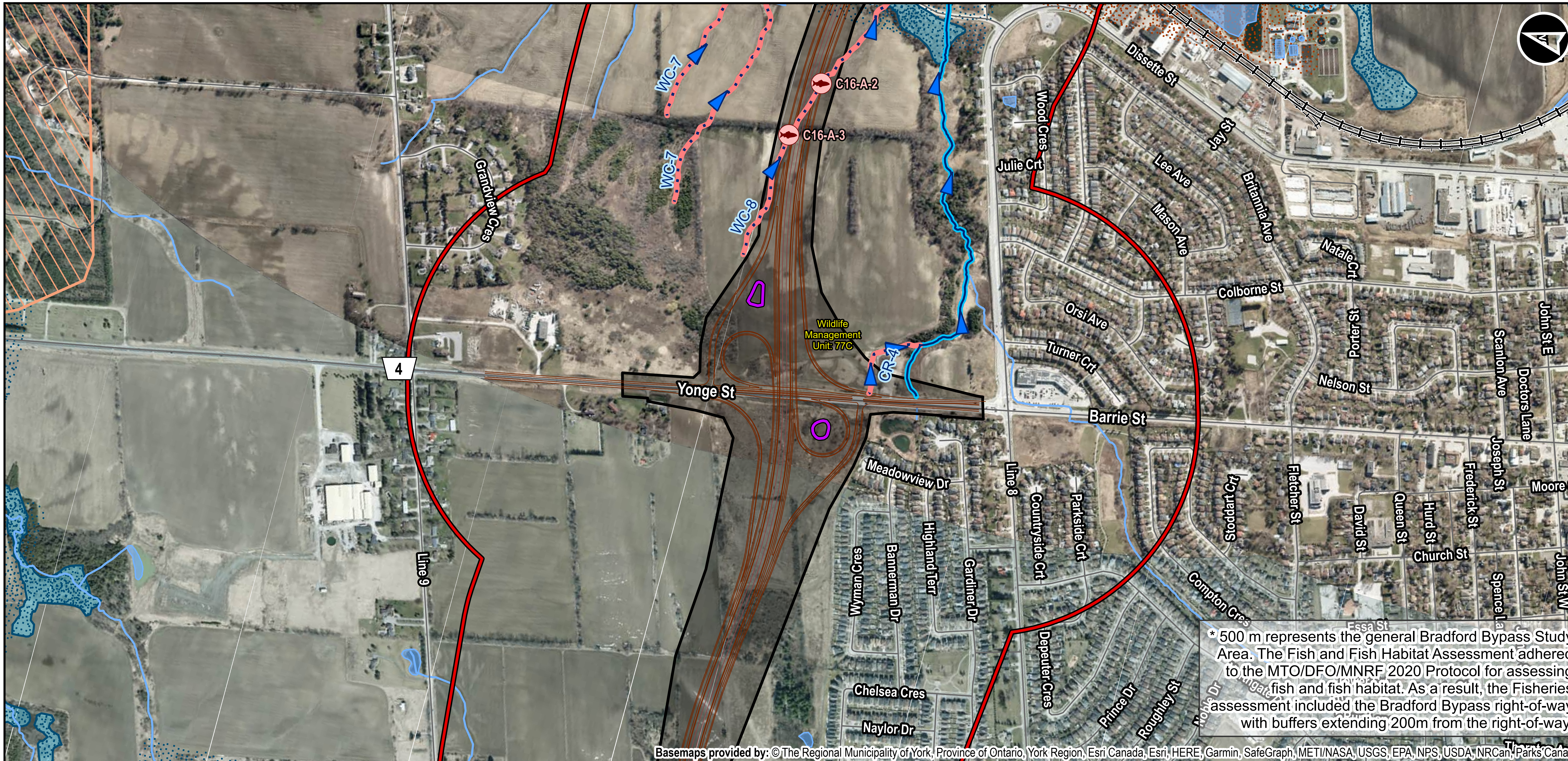
P:60636190	Rev:00

Figure: 2-5



LEGEND

- Study Area (500 m)
- ROW - Bradford Bypass (Highway 400-404)
- Bradford Bypass Works (Highway 400-404)
- Detail Design by Others
- Separate MTO EA Study
- Backwater Bay/Refuge Area
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Thermal Regime
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- Warm
- Unknown

Fish Habitat
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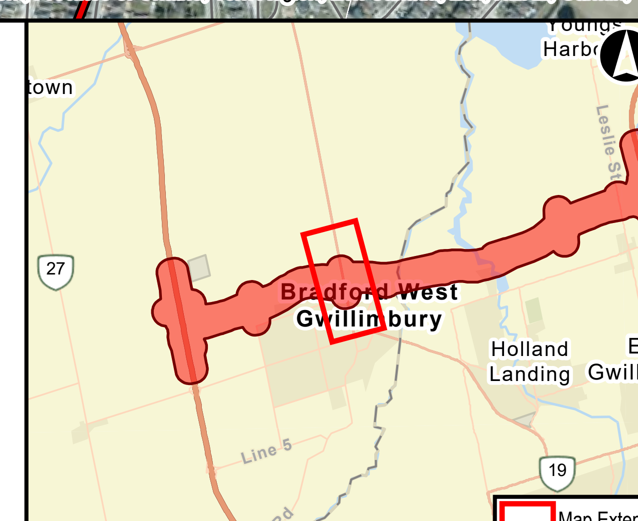
- Indirect
- Not Fish Habitat
- Invasive Phragmites

Flow Permanency
- Permanent
- Intermittent
- Ephemeral
- Direction of Flow

General Features
- Waterbody
- Watercourse



Fish and Fish Habitat Existing Conditions Report - Preliminary Design and Class Environmental Assessment (EA) Study for Highway 400 – Highway 404 Link (Bradford Bypass)

Fish and Fish Habitat Existing Conditions

0 100 200 400 600 M

NAD 1983 UTM Zone 17N

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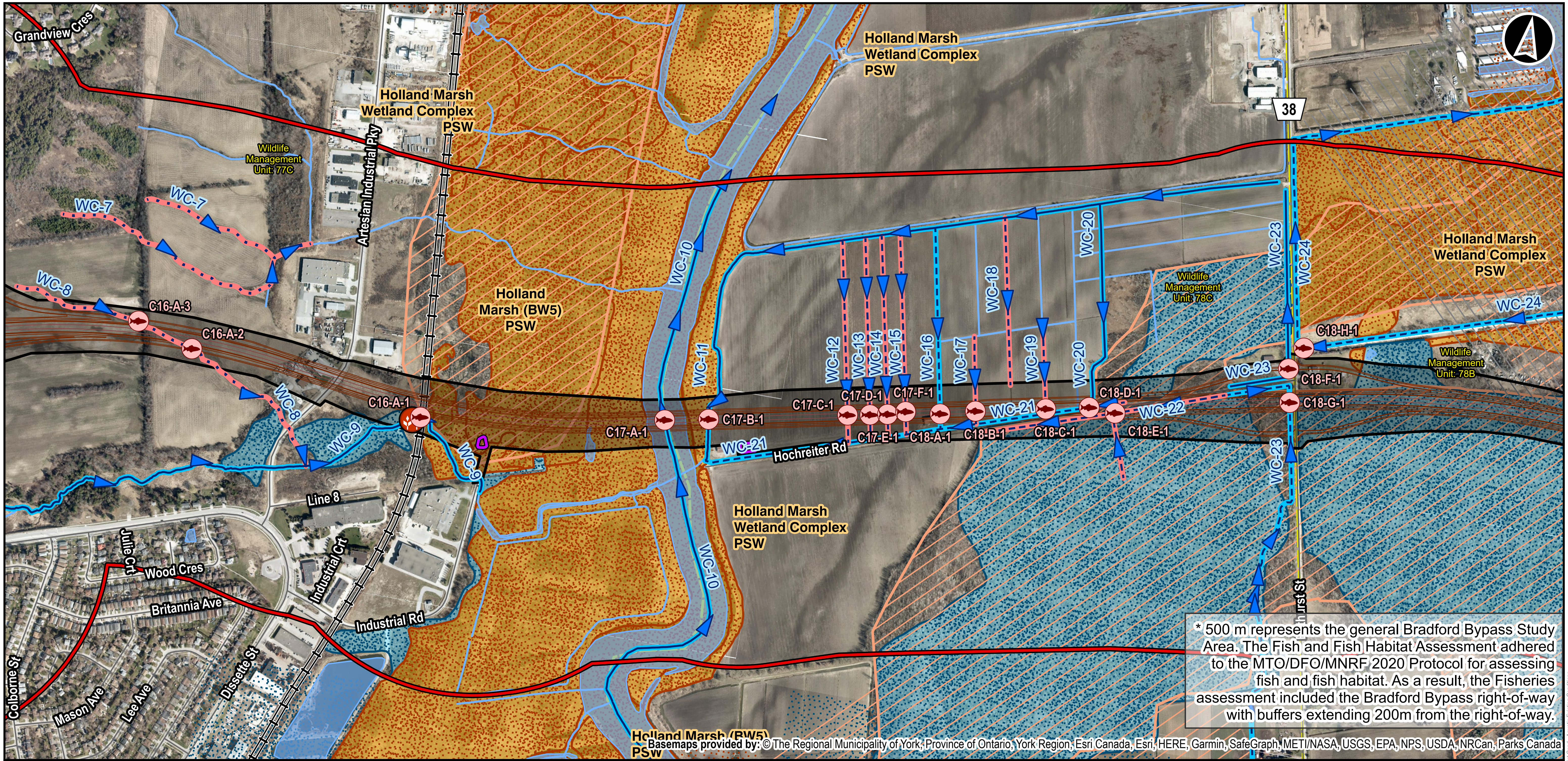
May, 2023	1:9,000	Figure: 2-6
P:60636190	Rev:00	



LEGEND

- Study Area (500 m)
- ROW - Bradford Bypass (Highway 400-404)
- Bradford Bypass Works (Highway 400-404)
- Detail Design by Others
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Thermal Regime

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- Warm
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Fish Habitat

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- Indirect
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Flow Permanency

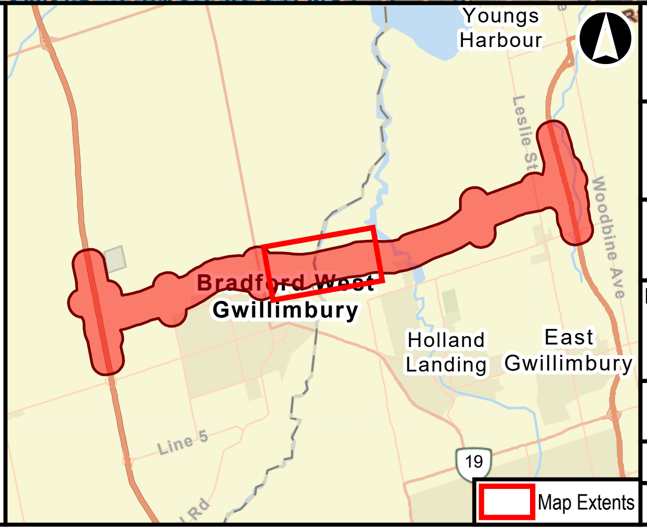
- Permanent
- Intermittent
- Ephemeral
- Direction of Flow

General Features

- Waterbody
- Watercourse

Environmentally Significant Areas

- Provincially Significant Wetland (PSW)
- Unevaluated Wetland
- Deer Wintering Areas - Stratum 2



Fish and Fish Habitat Existing Conditions Report - Preliminary Design and Class Environmental Assessment (EA) Study for Highway 400 – Highway 404 Link (Bradford Bypass)

Fish and Fish Habitat Existing Conditions

0 100 200 400 600 M
NAD 1983 UTM Zone 17N

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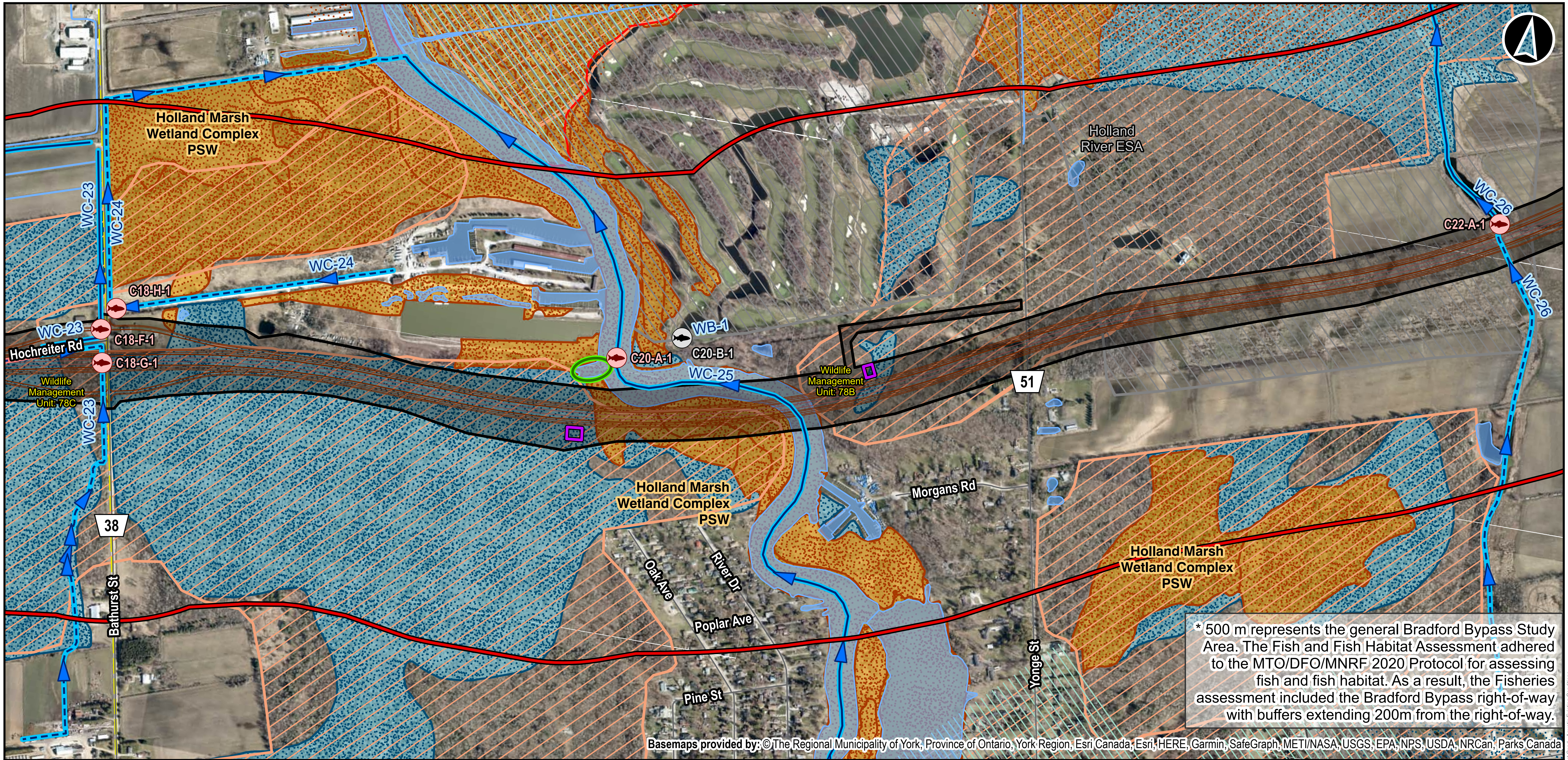
Jul, 2023	1:9,000	Figure: 2-7
P:60636190	Rev:00	



LEGEND

- Study Area (500 m)
- ROW - Bradford Bypass (Highway 400-404)
- Bradford Bypass Works (Highway 400-404)
- Detail Design by Others
- Separate MTO EA Study
- Backwater Bay/Refuge Area
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Thermal Regime

- Cool
- Warm
- Unknown

Fish Habitat

- Direct
- Indirect
- Not Fish Habitat
- Invasive Phragmites

Flow Permanency

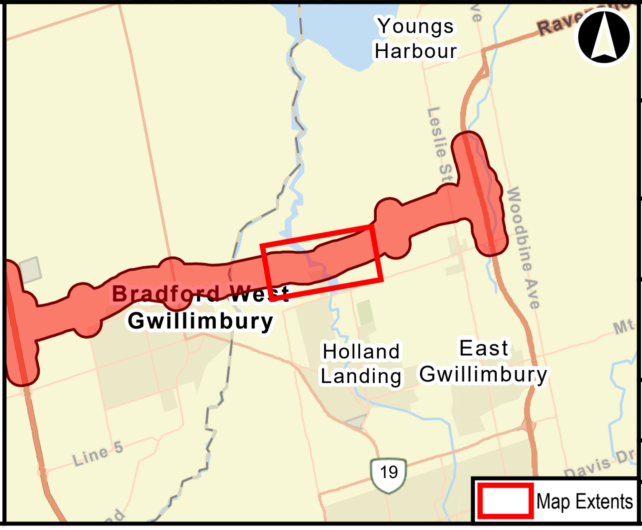
- Permanent
- Intermittent
- Ephemeral
- Direction of Flow

General Features

- Waterbody
- Watercourse

Environmentally Significant Areas

- Provincially Significant Wetland (PSW)
- Unevaluated Wetland
- Lake Simcoe Region Conservation Authority - Environmentally Significant Area
- Deer Wintering Areas - Stratum 2



Fish and Fish Habitat Existing Conditions Report - Preliminary Design and Class Environmental Assessment (EA) Study for Highway 400 – Highway 404 Link (Bradford Bypass)

Fish and Fish Habitat Existing Conditions

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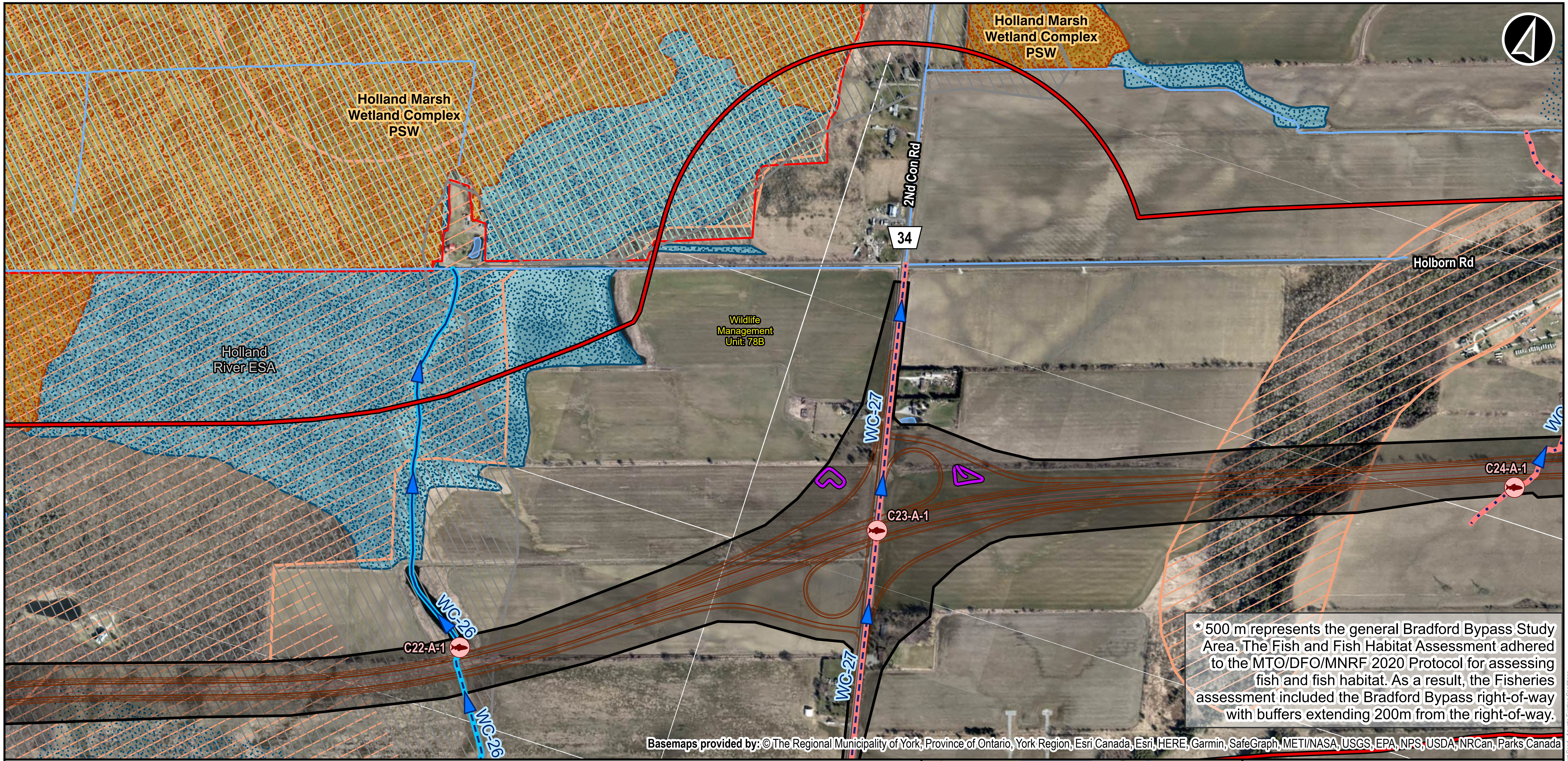
May, 2023	1:9,000	**Figure: 2-8**
P:60636190	Rev:00	



LEGEND

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- ROW - Bradford Bypass (Highway 400-404)
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Thermal Regime

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- Unknown

Fish Habitat

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Flow Permanency

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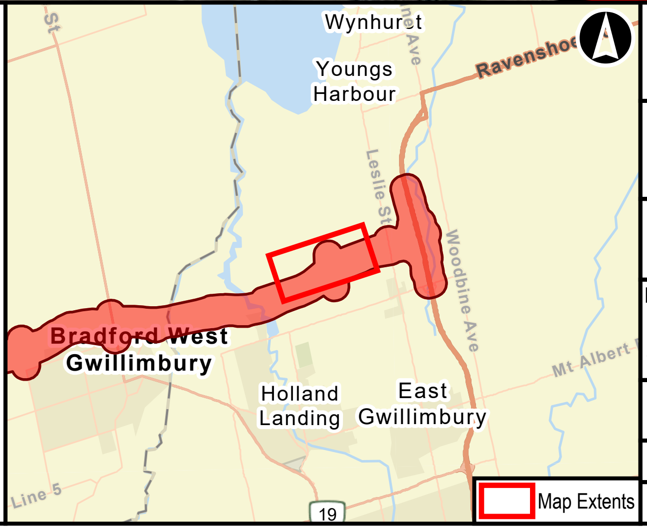
- Ephemeral
- Direction of Flow

General Features

- Waterbody
- Watercourse

Environmentally Significant Areas

- Provincially Significant Wetland (PSW)
- Unevaluated Wetland
- Provincial ANSI - Life Science
- Lake Simcoe Region Conservation Authority - Environmentally Significant Area
- Deer Wintering Areas - Stratum 2



Fish and Fish Habitat Existing Conditions Report - Preliminary Design and Class Environmental Assessment (EA) Study for Highway 400 – Highway 404 Link (Bradford Bypass)

Fish and Fish Habitat Existing Conditions

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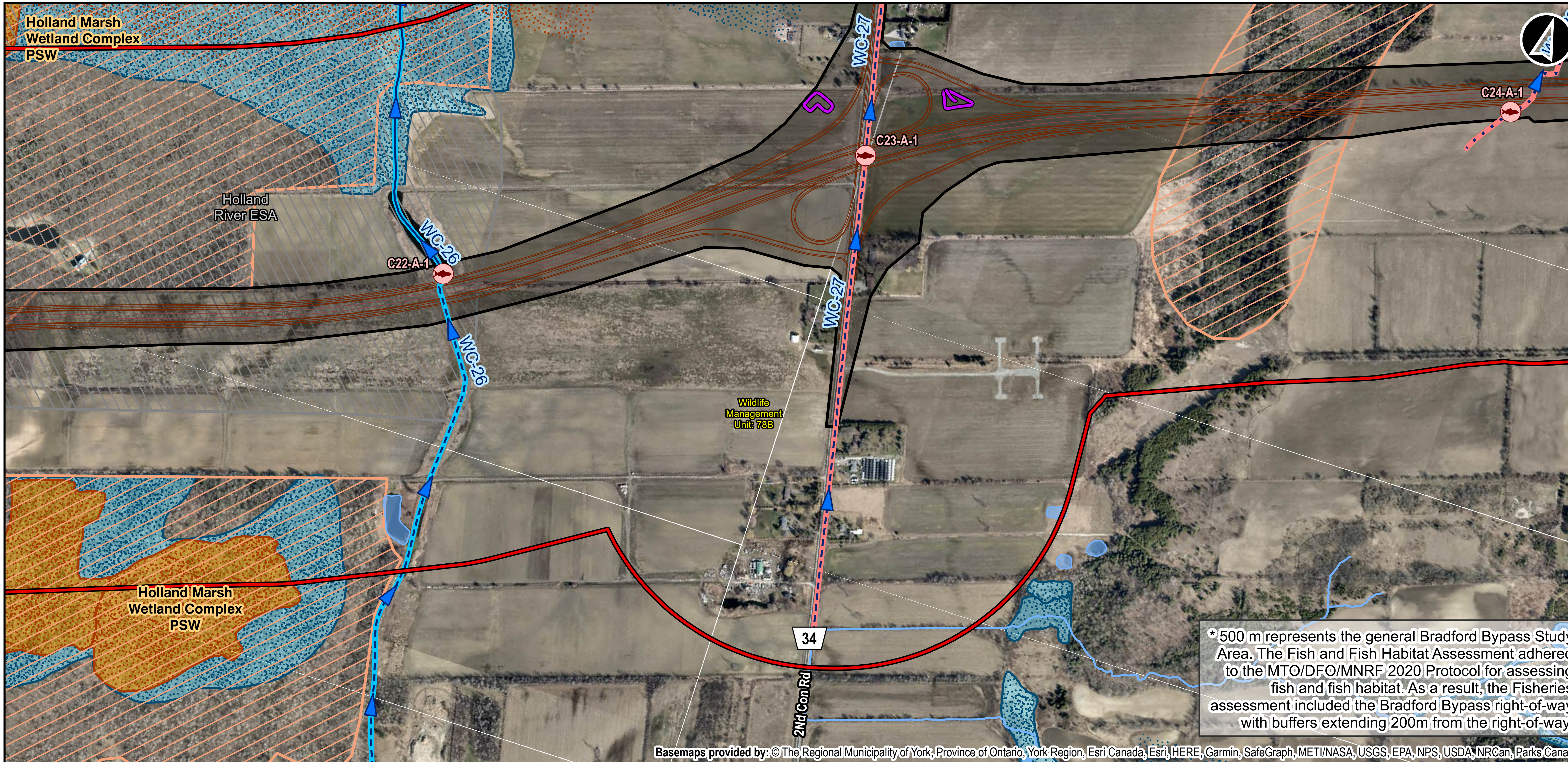
May, 2023	1:8,000	Figure: 2-9
P:60636190	Rev:00	



LEGEND

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General Features

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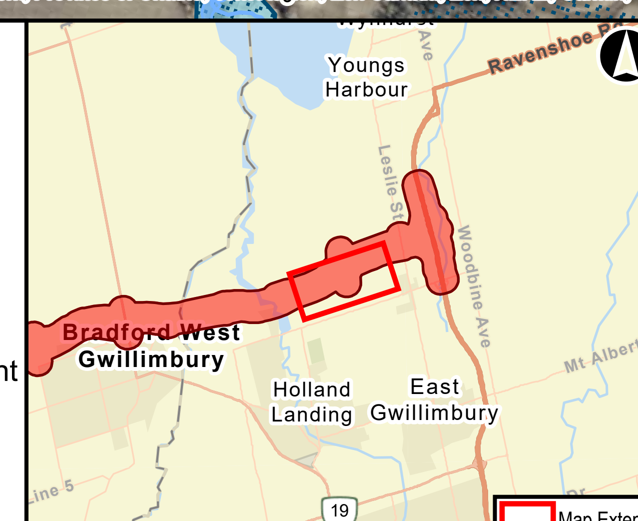
- Watercourse

Environmentally Significant Areas

- Provincially Significant Wetland (PSW)
- Unevaluated Wetland
- Lake Simcoe Region Conservation Authority - Environmentally Significant Area
- Deer Wintering Areas - Stratum 2



Fish and Fish Habitat Existing Conditions Report - Preliminary Design and Class Environmental Assessment (EA) Study for Highway 400 – Highway 404 Link (Bradford Bypass)

Fish and Fish Habitat Existing Conditions

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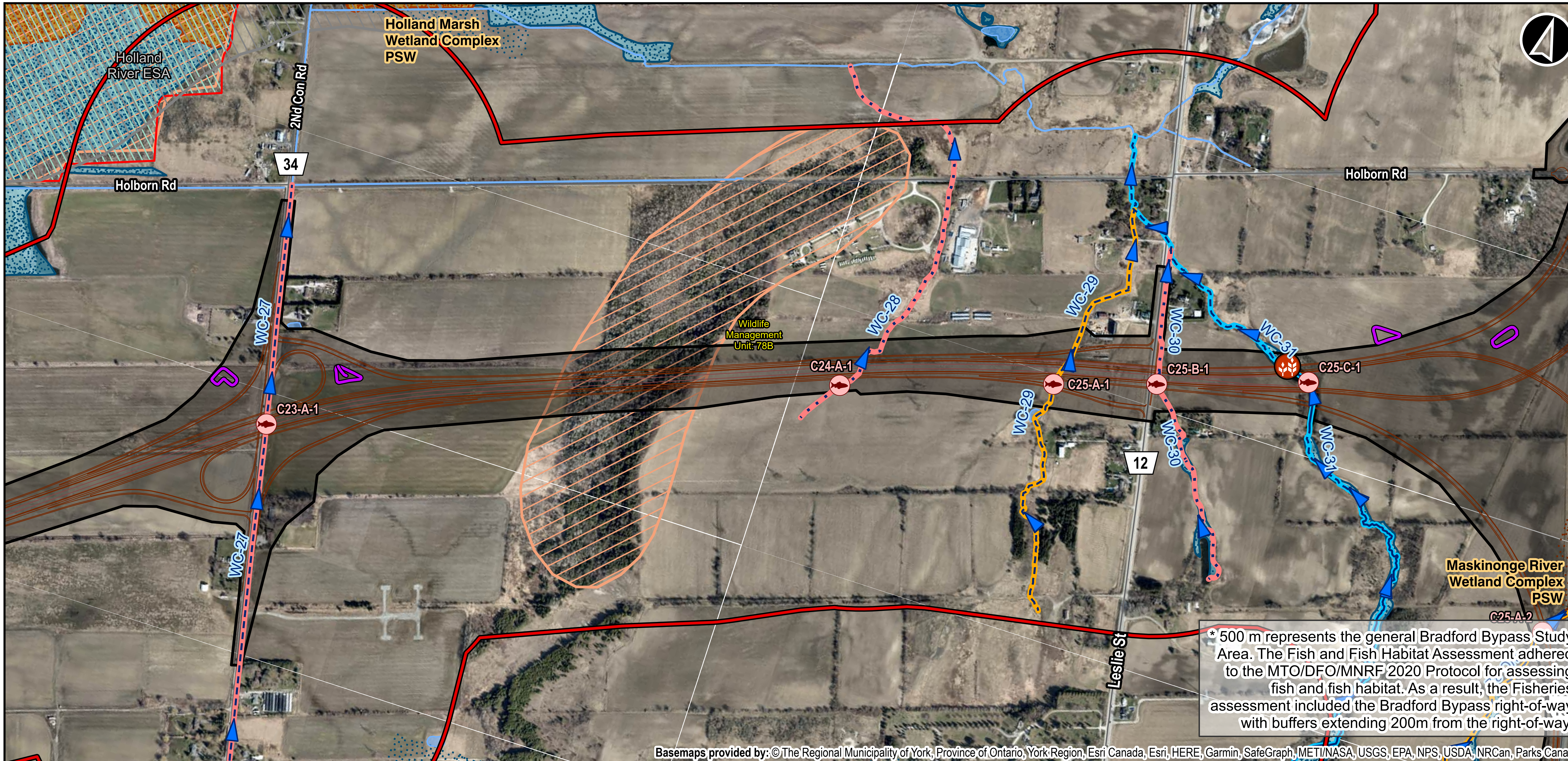
May, 2023	1:8,000
P:60636190	Rev:00

Figure: 2-10



* 500 m represents the general Bradford Bypass Study Area. The Fish and Fish Habitat Assessment adhered to the MTO/DFO/MNRF 2020 Protocol for assessing fish and fish habitat. As a result, the Fisheries assessment included the Bradford Bypass right-of-way with buffers extending 200m from the right-of-way.

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LEGEND

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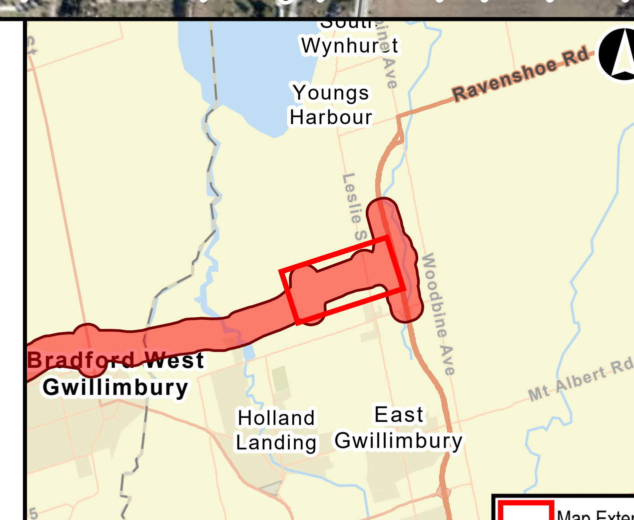
General Features
- Waterbody
- Watercourse

Environmentally Significant Areas
- Unevaluated Wetland
- Deer Wintering Areas - Stratum 2



Fish and Fish Habitat Existing Conditions Report - Preliminary Design and Class Environmental Assessment (EA) Study for Highway 400 – Highway 404 Link (Bradford Bypass)

Fish and Fish Habitat Existing Conditions

0 100 200 400 600 M

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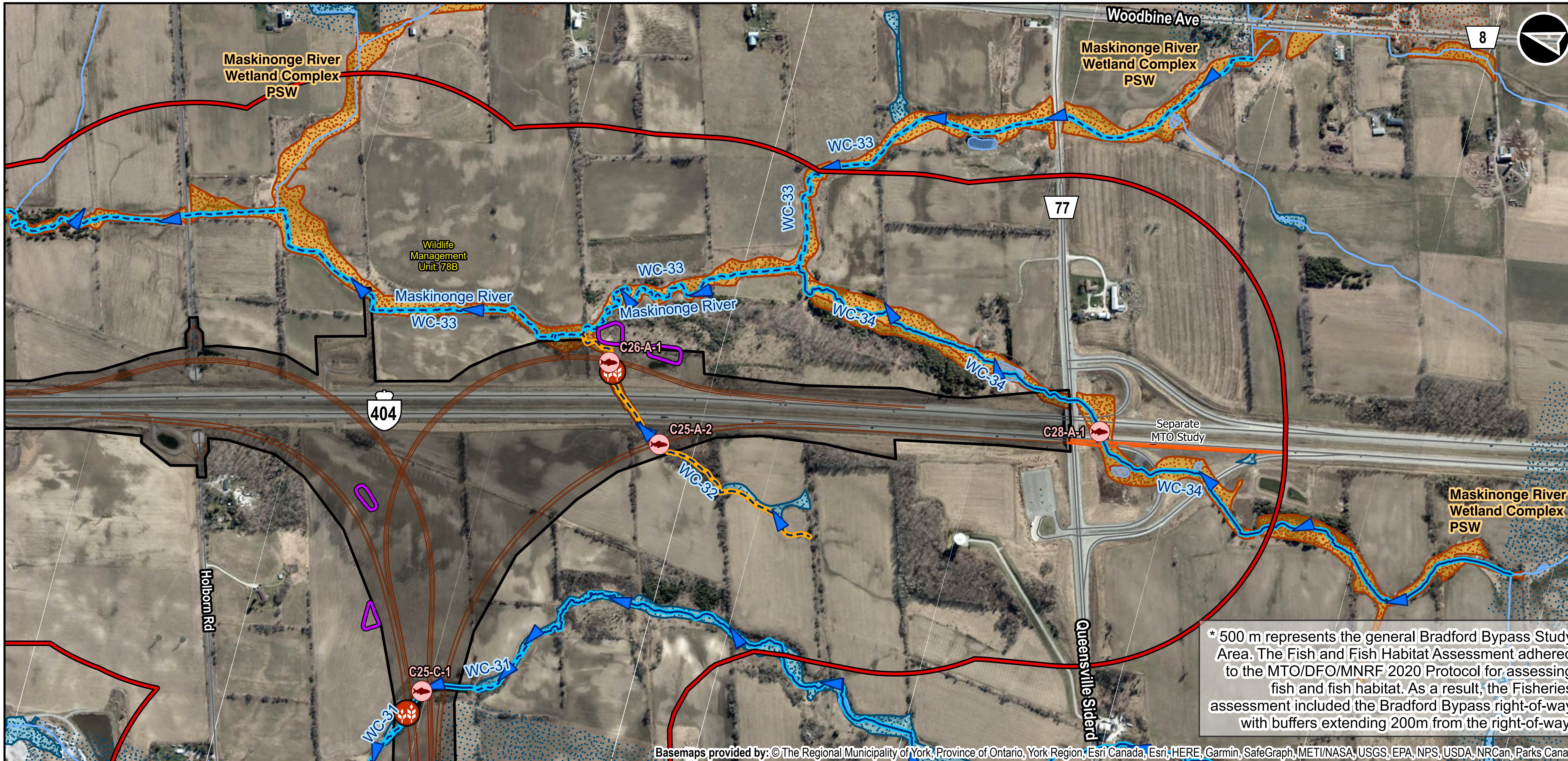
May, 2023	1:9,000	**Figure: 2-11**
P:60636190	Rev:00	



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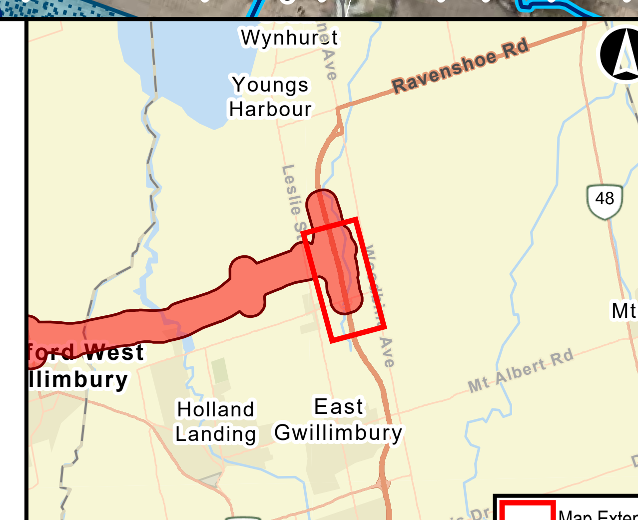
- Direction of Flow

General Features

- Waterbody
- Watercourse

Environmentally Significant Areas

- Provincially Significant Wetland (PSW)
- Unevaluated Wetland



Fish and Fish Habitat Existing Conditions Report - Preliminary Design and Class Environmental Assessment (EA) Study for Highway 400 – Highway 404 Link (Bradford Bypass)

Fish and Fish Habitat Existing Conditions

0 100 200 400 600 M

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May, 2023	1:9,000	Figure: 2-12
P:60636190	Rev:00	

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Date Saved: 5/6/2023 2:12 PM **User:** MarincS

LEGEND

- Study Area (500 m)
- ROW - Bradford Bypass (Highway 400-404)
- Bradford Bypass Works (Highway 400-404)
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General Features
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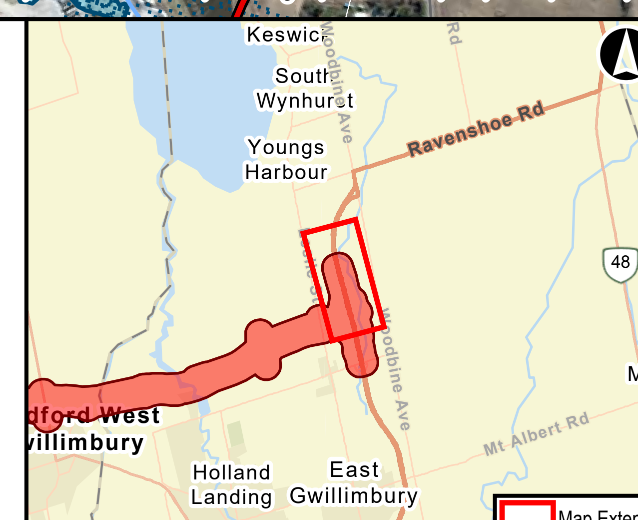

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May, 2023	1:9,000
P:60636190	Rev:00

Figure: 2-13

Appendix B

Agency Correspondence

Minielly, Andrew

From:	Kate Lillie <K.Lillie@lsrca.on.ca>
Sent:	Tuesday, December 10, 2019 11:01 AM
To:	Minielly, Andrew
Cc:	Shawn Filson; Darren Campbell
Subject:	RE: LSRCA - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request
Attachments:	BradfordBypass_DeerWintering.pdf

Hi Andrew,

Thanks for your email. Shawn forwarded your request for natural heritage information over to me to facilitate. In addition to the information you have acquired already, we would be able to provide the following:

Landcover mapping
This mapping includes ELC to the community series, but, as this mapping was largely completed via air photo interpretation, it would need to be ground-truthed.
We would be able to provide .pdf maps at no cost, but since it is such a large study area, you may want to have this information in GIS format. If .pdfs are acceptable, please let me know and I'll prepare those for you. But, if you require this in GIS format, please submit a request directly to our GIS Coordinator, Darren Campbell (d.campbell@lsrca.on.ca).

Aquatic monitoring data
There are several LSRCA monitoring stations within the study area. I've placed a request with our Aquatic Ecologist to review the fisheries data you've gathered so far. Any additional fisheries data will be provided once it has been compiled. We appreciate your patience as it can sometimes take several weeks to pull this information together depending on the volume of requests we receive.

Deer wintering areas
Please find attached a .pdf map that shows deer wintering areas. This data is owned and managed by MNRF. If you require it in GIS format, please request it directly from MNRF.

Natural Heritage System mapping
LSRCA recently completed natural heritage system mapping for the Lake Simcoe watershed as part of the Natural Heritage System & Restoration Strategy. The Strategy may contain information relevant to your project and can be accessed online here: https://www.lsrca.on.ca/Shared%20Documents/reports/Natural-Heritage-Systems-Restoration-Strategy.pdf
In particular, Fig. 4.15 is a map of the entire natural heritage system (last page of the strategy). Section 4.0 describes the various types of core features (wetland, woodland, etc.) and targeted areas that were mapped as part of the system. If you require this mapping in GIS format, please request this through our GIS Coordinator.

Subwatershed Plans
The study area spans three subwatersheds: West Holland, East Holland and Maskinonge. The Subwatershed Plans for each area may contain information relevant to your project.
West Holland River Subwatershed Plan: https://www.lsrca.on.ca/Shared%20Documents/reports/west-holland-subwatershed-plan.pdf
East Holland River Subwatershed Plan: https://www.lsrca.on.ca/Shared%20Documents/reports/east-holland-subwatershed-plan.pdf
Maskinonge River Subwatershed Plan:
https://www.lsrca.on.ca/Shared%20Documents/reports/maskinonge_subwatershed_2010.pdf

Please let me know if we can be of further assistance at this point.

Kind regards,

Kate Lillie, HBSc, EP, ISA
Natural Heritage Ecologist
Lake Simcoe Region Conservation Authority
120 Bayview Parkway,
Newmarket, Ontario L3Y 3W3
905-895-1281, ext. 286 | 1-800-465-0437
k.lillie@LSRCA.on.ca | www.LSRCA.on.ca

Twitter: @LSRCA
Facebook: LakeSimcoeConservation

From: Minielly, Andrew [mailto:Andrew.Minielly@aecom.com]
Sent: December 4, 2019 11:37 AM
To: Shawn Filson
Cc: Piette, Jessica; Lohnes, Shelley; Ellis, Julie; Fowler, Devon; Easterling, Katie; Rankin, Sonia; Fleming, Braden; larry.sarris@ontario.ca; Rhonda.Gribbon@ontario.ca
Subject: LSRCA - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request

Good morning Mr. Filson,

AECOM has been retained by the Ministry of Transpiration to undertake preparatory work for the re-initiation of the Bradford Bypass, which will be completed to a Preliminary Design level of detail. At this time, the preparatory work will include a desktop and secondary source data review. A request for information letter is attached. Figure 1 is attached and provides an overview of the Background Data Request Study Area.

AECOM would kindly like to request that the LSRCA review the list of Natural Heritage, SOCC, SAR and aquatic resource records identified for the Study Area (Provided in Attachment 1) and confirm if there are any other records that should be considered for this project. Any data received by December 18th can be included in the first draft of our report, however data received after this date will be included in final drafts of the reports to be issued by February 1, 2020.

Thank you and please do not hesitate to contact me if you have any questions or concerns,

Andrew Minielly, (Hons) B.ES
Terrestrial Ecologist, Water & Natural Resources, Environment
D +1-519-650-8634
M +1-519-571-4109
andrew.minielly@aecom.com

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50 Sportsworld Crossing Rd.
Kitchener, Ontario, N2P 0A4, Canada
T +1-519-650-5313
aecom.com

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Fowler, Devon

From:	Minielly, Andrew
Sent:	December-12-19 3:04 PM
To:	Fowler, Devon
Cc:	Easterling, Katie; Lohnes, Shelley; Ellis, Julie; Piette, Jessica; Fleming, Braden
Subject:	FW: LSRCA - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request
Attachments:	EH35.xlsx; WH05.xlsx; WH07.xlsx; 2019-12-12.Bradford Bypass Map.jpg; EH32.xlsx

Hey Devon,

I just received the attached fish data from the LSRCA.

Cheers,

Andrew

From: Kate Lillie <K.Lillie@lsrca.on.ca>
Sent: Thursday, December 12, 2019 2:57 PM
To: Minielly, Andrew <Andrew.Minielly@aecom.com>
Cc: Shawn Filson <S.Filson@lsrca.on.ca>
Subject: RE: LSRCA - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request

Hi Andrew,

Please find attached fish data from LSRCA monitoring stations within the study area.

Kind regards,

Kate Lillie, HBSc, EP, ISA
Natural Heritage Ecologist
Lake Simcoe Region Conservation Authority
120 Bayview Parkway,
Newmarket, Ontario L3Y 3W3
905-895-1281, ext. 286 | 1-800-465-0437
k.lillie@LSRCA.on.ca | www.LSRCA.on.ca

Twitter: @LSRCA
Facebook: LakeSimcoeConservation

From: Kate Lillie
Sent: December 10, 2019 11:01 AM
To: Andrew.Minielly@aecom.com

From:	Shirley, Brent (MNRF) <brent.shirley@ontario.ca>
Sent:	Wednesday, December 11, 2019 9:41 AM
To:	Minielly, Andrew
Cc:	Piette, Jessica; Lohnes, Shelley; Ellis, Julie; Fowler, Devon; Easterling, Katie; Rankin, Sonia; Fleming, Braden; Sarris, Larry (MTO); Gribbon, Rhonda (MTO)
Subject:	RE: MNRF Midhurst District - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request

Hi Andrew,

As stated in my earlier email my comments with pertain to the Simcoe County portion of the study area for your project.

The in-water timing window for water crossings 1-8 is no in-water work between March 15-July 15.

All **known** natural heritage features are mapped in LIO and are available. Just because natural heritage features and / or significant wildlife habitat is not identified that doesn't mean that it doesn't exist. Evaluating for other natural heritage values for example candidate significant wildlife habitats (SWH) will be informed by direction in the Natural Heritage Reference Manual, the Significant Wildlife Habitat Technical Guide and SWH Criteria Schedule for Ecoregion 6E. Your field work will inform your review of the study area for natural heritage features and functions.

If you have any questions or concerns please feel free to call or email me at any time.

Best Regards,

Brent Shirley

A/ Management Biologist I Midhurst District Ministry of Natural Resources & Forestry I 2284 Nursery Rd I Midhurst, ON I L9X 1N8 I Phone 705-725-7547 I Fax- 705-725-7584

Please Note: As of July 2, 2019, I will no longer have voicemail services with my office phoneline. My phone line has been re-directed to Shannon Lawless for messaging; however should I miss your call you can email me directly or send your questions ot request to midhurstinfo@ontario.ca where your inquiry will be forwarded back to me or re-directed towards another staff member.

From: Minielly, Andrew <Andrew.Minielly@aecom.com>
Sent: December-06-19 9:21 AM
To: MIDHURSTINFO (MNRF) <MIDHURSTINFO@ontario.ca>
Cc: Piette, Jessica <Jessica.Piette@aecom.com>; Lohnes, Shelley <Shelley.Lohnes@aecom.com>; Ellis, Julie <Julie.Ellis@aecom.com>; Fowler, Devon <Devon.Fowler@aecom.com>; Easterling, Katie <katie.easterling@aecom.com>; Rankin, Sonia <sonia.rankin@aecom.com>; Fleming, Braden <Braden.Fleming@aecom.com>; Sarris, Larry (MTO) <Larry.Sarris@ontario.ca>; Gribbon, Rhonda (MTO) <Rhonda.Gribbon@ontario.ca>

Subject: MNRF Midhurst District - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request

CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Good morning,

AECOM has been retained by the Ministry of Transpiration to undertake preparatory work for the re-initiation of the Bradford Bypass, which will be completed to a Preliminary Design level of detail. At this time, the preparatory work will include a desktop and secondary source data review. A request for information letter is attached. Figure 1 is attached and provides an overview of the Background Data Request Study Area.

AECOM would kindly like to request that the MNRF review the list of Natural Heritage, SOCC and aquatic resource records identified for the Study Area (Provided in Attachment 1) and confirm if there are any other records that should be considered for this project. Any data received by December 18th can be included in the first draft of our report, however data received after this date will be included in final drafts of the reports to be issued by February 1, 2020.

Thank you and please do not hesitate to contact me if you have any questions or concerns,

Andrew Minielly, (Hons) B.ES
Terrestrial Ecologist, Water & Natural Resources, Environment
D +1-519-650-8634
M +1-519-571-4109
andrew.minielly@aecom.com

AECOM
50 Sportsworld Crossing Rd.
Kitchener, Ontario, N2P 0A4, Canada
T +1-519-650-5313
aecom.com

Minielly, Andrew

From:	Brothers, Brianne (MNRF) <Brianne.Brothers@ontario.ca>
Sent:	Monday, December 16, 2019 4:16 PM
To:	Minielly, Andrew
Subject:	RE: MNRF Aurora District - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request
Attachments:	MTO_BradfordBackgroundReview.pdf

Hello Andrew,

Please find the attached comments regarding the Bradford Bypass project.

Thank you,

Brianne

Brianne Brothers
IRM Technical Specialist | Aurora District
Ministry of Natural Resources and Forestry
50 Bloomington Road, 4th Floor, Aurora, ON | L4G 0L8
☎ 905-713-7390 | brianne.brothers@ontario.ca

Ontario

From: Scientific Collection Permits Aurora (MNRF) <scp.aurora@ontario.ca>
Sent: December 10, 2019 2:29 PM
To: Bobak, Eva (MNRF) <Eva.Bobak@ontario.ca>; Brothers, Brianne (MNRF) <Brianne.Brothers@ontario.ca>
Subject: FW: MNRF Aurora District - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request

Hi Eva and Brianne,

As per Joad's direction, I am forwarding you both a natural heritage information request regarding an MTO project. The consultants are looking for fish collection records and other natural heritage information. Varga has also been forwarded this email to provide natural heritage features, such as wetlands, etc. I do not know how you two want to divide this up, but the consultants have multiple sites and are requesting information for each one. You may want to work will Varga to provide one email response with MNRF's comments.

Thank you,

Tessa

From: ESA Aurora (MNRF) <ESA.Aurora@ontario.ca>
Sent: December 4, 2019 12:19 PM
To: Scientific Collection Permits Aurora (MNRF) <scp.aurora@ontario.ca>

Subject: FW: MNRF Aurora District - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request

---

From: Minielly, Andrew <Andrew.Minielly@aecom.com>
Sent: December 4, 2019 11:38 AM
To: ESA Aurora (MNRF) <ESA.Aurora@ontario.ca>
Cc: Piette, Jessica <Jessica.Piette@aecom.com>; Lohnes, Shelley <Shelley.Lohnes@aecom.com>; Ellis, Julie <Julie.Ellis@aecom.com>; Fowler, Devon <Devon.Fowler@aecom.com>; Easterling, Katie <katie.easterling@aecom.com>; Rankin, Sonia <sonia.rankin@aecom.com>; Fleming, Braden <Braden.Fleming@aecom.com>; Sarris, Larry (MTO) <Larry.Sarris@ontario.ca>; Gribbon, Rhonda (MTO) <Rhonda.Gribbon@ontario.ca>
Subject: MNRF Aurora District - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request

Good morning,

AECOM has been retained by the Ministry of Transpiration to undertake preparatory work for the re-initiation of the Bradford Bypass, which will be completed to a Preliminary Design level of detail. At this time, the preparatory work will include a desktop and secondary source data review. A request for information letter is attached. Figure 1 is attached and provides an overview of the Background Data Request Study Area.

AECOM would kindly like to request that the MNRF review the list of Natural Heritage, SOCC and aquatic resource records identified for the Study Area (Provided in Attachment 1) and confirm if there are any other records that should be considered for this project. Any data received by December 18th can be included in the first draft of our report, however data received after this date will be included in final drafts of the reports to be issued by February 1, 2020.

Thank you and please do not hesitate to contact me if you have any questions or concerns,

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Terrestrial Ecologist, Water & Natural Resources, Environment
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Attachment 1

The tables below summarize all available Natural Heritage, Species of Conservation Concern (SOCC) and aquatic resource records identified within the Background Data Request Study Area. All natural heritage features identified in the Study Area are presented in **Table 1**.

Table 1. Natural Heritage Features Identified Within the Study Area

Feature Name	Feature Significance
Holland Marsh (BW5)	Provincially Significant Wetland
Holland Marsh Wetland Complex	Provincially Significant Wetland
Maskinonge River Wetland Complex	Provincially Significant Wetland
Holland River Marsh	Provincially Significant ANSI
Holland Marsh Environmentally Significant Area (ESA)	Lake Simcoe Region Conservation Authority (LSRCA) ESA

Several unevaluated wetlands exist within the study area and should be considered for impacts as well (may become significant upon evaluation)

A total of 18 SOCC have been identified within the vicinity of the proposed work area. These species are listed in **Table 2** below.

Table 2. Species of SOCC Identified through NHIC.

Common Name	Scientific Name	S-Rank[1]	*ESA* Status[2]	COSEWIC Status[3]	Source of Record	Year of Observation
Black Tern	*Chlidonias niger*	S3B	SC	NAR	NHIC, OBBA	2001-2005
Canada Warbler	*Cardellina canadensis*	S4B	SC	THR	EA, OBBA	2001-2005
Common Nighthawk	*Chordeiles minor*	S4B	SC	SC	EA, OBBA	2001-2005
Eastern Wood-Pewee	*Contopus virens*	S4B	SC	SC	EA, OBBA	2001-2005
Golden-winged Warbler	*Vermivora chrysoptera*	S4B	SC	THR	EA, OBBA	2001-2005
Grasshopper Sparrow	*Ammodramus savannarum*	S4B	SC	SC	OBBA	2001-2005
Red-headed Woodpecker	*Melanerpes erythrocephalus*	S4B	SC	END	NHIC, OBBA	2003
Wood Thrush	*Hylocichla mustelina*	S4B	SC	THR	EA, NHIC, OBBA	2001-2005
Yellow Rail	*Coturnicops noveboracensis*	S4B	SC	SC	NHIC	1985
Western Chorus Frog (Great Lakes/St. Lawrence – Canadian Shield population)	*Pseudacris maculata*	S3	NAR	THR	ORAA	2017

Common Name	Scientific Name	S-Rank[1]	*ESA* Status[2]	COSEWIC Status[3]	Source of Record	Year of Observation
Northern Map Turtle	*Graptemys geographica*	S3	SC	SC	ORAA	1993
Snapping Turtle	*Chelydra serpentina*	S3	SC	SC	ORAA	2019
Green-striped Darner	*Aeshna verticalis*	S3	No Status	No Status	NHIC	1941
Monarch	*Danaus plexippus*	S2N, S4B	SC	END	OBA	2018
Black Ash	*Fraxinus nigra*	S3	No Status	THR	EA	1995
Early-branching Panicgrass	*Dichanthelium praecocius*	S3	No Status	No Status	NHIC	1977
Houghton's Flatsedge	*Cyperus houghtonii*	S3	No Status	No Status	NHIC	1976
Bristly Buttercup	Ranunculus hispidus	S3	No Status	No Status	EA	1995

With respect to aquatic Species at Risk, both DFO SAR Mapping and MNRF's NHIC were reviewed and no aquatic SAR were identified within the Study Area.

The 1997 Environmental Assessment (EA) report, MNRF's LIO database and Fish ON-Line web resource were reviewed to glean a better understanding of the aquatic features within the Study Area (**Figure 1**). **Table 3** below includes the available data regarding fish communities and habitat that may occur within the watercourses that have been identified within the Study Area.

Table 3. Watercourses Identified Within the Study Area

Crossing Number	**Structure/ work location/ (UTM Coordinates)**	**Watercourse Name**	**Watercourse classification**	**Habitat information/ locations**	**Historical data on fish species present, including whether the subject waterbody(s) are considered to support any vulnerable aquatic species**	**MNRF fisheries management objectives, if applicable**	**In-water timing windows for construction**
Crossing Number	Structure/ work location/ (UTM Coordinates)	Watercourse Name	Watercourse classification	Habitat information/ locations	Historical data on fish species present, including whether the subject waterbody(s) are considered to support any vulnerable aquatic species	MNRF fisheries management objectives, if applicable	In-water timing windows for construction
1	609218.449, 4885909.654	Tributary to Pennville Creek	Unknown	Intermittent flow, no known barriers in the vicinity, contains habitat for warmwater species (1997, EA).	Blacknose Dace, Blacknose Shiner, Bluntnose Minnow, Brassy Minnow, Brook Stickleback, Brown Bullhead, Common Shiner, Creek Chub, Fathead Minnow, Finescale Dace, Johnny Darter, Largemouth Bass, Longnose Dace, Mottled Sculpin, Northern Redbelly Dace, Pumpkinseed, Rainbow Darter, Rainbow Trout, Rock Bass, White Crappie and White Sucker.	Lake Simcoe Fisheries Community Objectives	Unknown
2	609930.3209, 4886069.943	Tributary to Holland River	Coolwater	Unknown	Black Crappie, Blacknose Dace, Bluegill, Bluntnose Minnow, Bowfin, Brook Stickleback, Brown Bullhead, Central Mudminnow, Common Carp, Common Shiner, Creek Chub, Fathead Minnow, Golden Shiner, Goldfish, Hornyhead Chub, Johnny Darter, Largemouth Bass, Lepomis sp., Northern Pike, Pumpkinseed, Rock Bass, Smallmouth Bass, White Sucker and Yellow Perch.	Lake Simcoe Fisheries Community Objectives	June 1 to March 15 March 15-July 15 (no works)
3	610547.9048, 4886272.661	Tributary to Holland River	Unknown	Unknown	Blacknose Dace, Bluntnose Minnow, Brook Stickleback, Central Mudminnow, Common Shiner, Creek Chub, Fathead Minnow, Johnny Darter, Largemouth Bass, Lepomis sp.,	Lake Simcoe Fisheries Community Objectives	Unknown

Crossing Number	Structure/ work location/ (UTM Coordinates)	Watercourse Name	Watercourse classification	Habitat information/ locations	Historical data on fish species present, including whether the subject waterbody(s) are considered to support any vulnerable aquatic species	MNRF fisheries management objectives, if applicable	In-water timing windows for construction
					Longnose Dace, Northern Pike, Northern Redbelly Dace, Pumpkinseed and White Sucker.		
4	612791.95, 4886960.961	Tributary to Holland River	Unknown	Unknown	Blacknose Dace, Bluntnose Minnow, Brook Stickleback, Central Mudminnow, Common Shiner, Creek Chub, Fathead Minnow, Johnny Darter, Largemouth Bass, Lepomis sp., Longnose Dace, Northern Pike, Northern Redbelly Dace, Pumpkinseed and White Sucker.	Lake Simcoe Fisheries Community Objectives	Unknown
5	613197.386, 4887078.821	Tributary to Holland River	Unknown	Unknown	Blacknose Dace, Bluntnose Minnow, Brook Stickleback, Central Mudminnow, Common Shiner, Creek Chub, Fathead Minnow, Johnny Darter, Largemouth Bass, Lepomis sp., Longnose Dace, Northern Pike, Northern Redbelly Dace, Pumpkinseed and White Sucker.	Lake Simcoe Fisheries Community Objectives	Unknown
6	615116.8616, 4887564.306	Tributary to Holland River	Unknown	Unknown	Blacknose Dace, Bluntnose Minnow, Bowfin, Brook Stickleback, Brown Bullhead, Carps and Minnows, Central Mudminnow, Common Shiner, Creek Chub, Emerald Shiner, Fathead Minnow, Golden Shiner, Johnny Darter, Largemouth Bass, Northern Pike, Northern Redbelly Dace, Pumpkinseed, Rock Bass, White Sucker and Yellow Perch.	Lake Simcoe Fisheries Community Objectives	Unknown
7	615762.6669, 4887454.459	Tributary to Holland River	Warmwater	Unknown	See Fish Community Above Significant muskie/pike spawning	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 1-July 15 (no works)

Crossing Number	Structure/ work location/ (UTM Coordinates)	Watercourse Name	Watercourse classification	Habitat information/ locations	Historical data on fish species present, including whether the subject waterbody(s) are considered to support any vulnerable aquatic species	MNRF fisheries management objectives, if applicable	In-water timing windows for construction
8	616323.0212, 4887569.116	Holland River	Warmwater	Permanent flow, no known barriers; supports a diverse assemblage of many warmwater species, contains spawning habitat for muskellunge and warmwater species, likely contains nursery habitat for Northern Pike.	Rock Bass, Brook Stickleback, Northern Pike, Johnny Darter/ Tesselated Darter, Pumpkinseed, Largemouth Bass, Emerald Shiner, Yellow Perch, Black Crappie, Walleye, Common Carp, Golden Shiner, Bluntnose Minnow and Spottail Shiner.	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 1-July 15 (for pike and muskie, as identified)
9	616421.4807, 4887579.872	Tributary to Holland River	Warmwater	Unknown	Black Crappie, Bluntnose Minnow, Bowfin, Brook Stickleback, Brown Bullhead, Common Carp, Creek Chub, Emerald Shiner, Fathead Minnow, Golden Shiner, Goldfish, Johnny Darter, Johnny Darter/ Tesselated Darter, Largemouth Bass, Lepomis sp., Northern Pike, Pumpkinseed, Rock Bass, Spottail Shiner, Walleye, White Sucker, Yellow Perch	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 1-July 15 (for pike and muskie, as identified)
10	616752.5582, 4887653.739	Unnamed Drain	Warmwater	Unknown	See Fish Community Above	Lake Simcoe Fisheries	June 1 to March 31

March 15-July 15 (no works)

Crossing Number	Structure/ work location/ (UTM Coordinates)	Watercourse Name	Watercourse classification	Habitat information/ locations	Historical data on fish species present, including whether the subject waterbody(s) are considered to support any vulnerable aquatic species	MNRF fisheries management objectives, if applicable	In-water timing windows for construction
						Community Objectives	
11	616797.5375, 4887641.833	Unnamed Drain	Warmwater	Unknown	See Fish Community Above	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)
12	616827.9646, 4887700.041	Unnamed Drain	Warmwater	Unknown	See Fish Community Above	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)
13	616879.5585, 4887657.708	Unnamed Drain	Warmwater	Unknown	See Fish Community Above	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)
14	616949.6732, 4887722.531	Unnamed Drain	Warmwater	Unknown	See Fish Community Above	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)
15	617035.663, 4887719.885	Unnamed Drain	Warmwater	Unknown	See Fish Community Above	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)
16	617100.486, 4887710.625	Unnamed Drain	Warmwater	Unknown	See Fish Community Above	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 1-July 15 (for pike and muskie, as identified)
17	617195.7362, 4887766.187	Unnamed Drain	Warmwater	Unknown	See Fish Community Above	Lake Simcoe Fisheries	June 1 to March 31 March 15-July 15 (no works)

Crossing Number	Structure/ work location/ (UTM Coordinates)	Watercourse Name	Watercourse classification	Habitat information/ locations	Historical data on fish species present, including whether the subject waterbody(s) are considered to support any vulnerable aquatic species	MNRF fisheries management objectives, if applicable	In-water timing windows for construction
						Community Objectives	
18	617263.3369, 4887804.193	Unnamed Drain	Warmwater	Unknown	See Fish Community Above	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)
19	617304.1845, 4887800.38	Unnamed Drain	Warmwater	Unknown	See Fish Community Above	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)
20	617654.7892, 4887836.302	Unnamed Drain	Unknown	Unknown	Unknown	Lake Simcoe Fisheries Community Objectives	Unknown March 15-July 15 (no works)
21	618939.5026, 4888106.556	Holland River East Branch	Warmwater	Permanent flow, no known barriers; supports a diverse assemblage of many warmwater species, contains spawning habitat for muskellunge and warmwater species, likely	Brown Bullhead, Bowfin, Common Carp, Northern Pike, Pumpkinseed, Largemouth Bass, Golden Shiner, Spottail Shiner, Black Crappie, Rock Bass, Yellow Perch and Fathead Minnow	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 1-July 15 (for pike and muskie, as identified)

Crossing Number	Structure/ work location/ (UTM Coordinates)	Watercourse Name	Watercourse classification	Habitat information/ locations	Historical data on fish species present, including whether the subject waterbody(s) are considered to support any vulnerable aquatic species	MNRF fisheries management objectives, if applicable	In-water timing windows for construction
				contains nursery habitat for Northern Pike (1997, EA).			
22	620961.9719, 4888719.425	Tributary to Holland River East Branch	Warmwater	Unknown	Brown Bullhead, Carps and Minnows, Central Mudminnow, Creek Chub, Fathead Minnow, Golden Shiner, Largemouth Bass, Northern Pike, Pumpkinseed, Smallmouth Bass and White Sucker	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)
23	621711.5585, 4889266.293	Unnamed Drain	Warmwater	Unknown	Brown Bullhead, Carps and Minnows, Central Mudminnow, Creek Chub, Fathead Minnow, Golden Shiner, Largemouth Bass, Northern Pike, Pumpkinseed, Smallmouth Bass and White Sucker.	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)
24	622946.7263, 4889756.589	Unnamed Tributary	Warmwater	Unknown	Brown Bullhead, Carps and Minnows, Central Mudminnow, Creek Chub, Fathead Minnow, Golden Shiner, Largemouth Bass, Northern Pike, Pumpkinseed, Smallmouth Bass and White Sucker.	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)
25	623418.1643, 4889926.307	Unnamed Tributary	Warmwater	Unknown	Brown Bullhead, Carps and Minnows, Central Mudminnow, Creek Chub, Fathead Minnow, Golden Shiner, Largemouth Bass, Northern Pike, Pumpkinseed, Smallmouth Bass and White Sucker.	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)
26	623672.7409, 4889997.022	Unnamed Tributary	Warmwater	Unknown	Brown Bullhead, Carps and Minnows, Central Mudminnow, Creek Chub, Fathead Minnow, Golden Shiner, Largemouth Bass, Northern Pike, Pumpkinseed, Smallmouth Bass and White Sucker.	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)

Crossing Number	Structure/ work location/ (UTM Coordinates)	Watercourse Name	Watercourse classification	Habitat information/ locations	Historical data on fish species present, including whether the subject waterbody(s) are considered to support any vulnerable aquatic species	MNRF fisheries management objectives, if applicable	In-water timing windows for construction
27	623941.4606, 4890096.024	Unnamed Tributary	Warmwater	Unknown	Brown Bullhead, Carps and Minnows, Central Mudminnow, Creek Chub, Fathead Minnow, Golden Shiner, Largemouth Bass, Northern Pike, Pumpkinseed, Smallmouth Bass and White Sucker.	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)
28	624846.6217, 4890350.601	Maskinonge (Jersey) River	Warmwater	Permanent flow, no known barriers, lower reaches, near Lake Simcoe, may support muskellunge and warmwater species such as Largemouth Bass and Northern Pike. Upper reaches may support a warmwater community (1997, EA).	Black Crappie, Blacknose Dace, Bluegill, Bluntnose Minnow, Bowfin, Brook Stickleback, Brown Bullhead, Central Mudminnow, Common Carp, Common Shiner, Creek Chub, Emerald Shiner, Etheostoma sp., Fathead Minnow, Golden Shiner, Hornyhead Chub, Johnny Darter, Johnny Darter/ Tesselated Darter, Largemouth Bass, Mimic Shiner, Mottled Sculpin, Northern Pike, Northern Redbelly Dace, Pumpkinseed, Redfin Shiner, White Sucker and Yellow Perch.	Lake Simcoe Fisheries Community Objectives	June 1 to March 31 March 15-July 15 (no works)

Fowler, Devon

From:	Shirley, Brent (MNRF) <brent.shirley@ontario.ca>
Sent:	December-11-19 10:47 AM
To:	Fowler, Devon
Subject:	RE: MNRF Midhurst District - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request

Hi Devon,

The first water crossing has rainbow trout and mottled scuplin listed in the fish community assemblage. Those species are indicative of cool / coldwater thermal regimes. Based on the fish community listed for the other crossings (2-8) I would assume that those waterbodies are more likely a warmwater thermal regime. When thermal regimes are determined by water temperature data rather than based on fish community assemblages they are much more accurate.

Hope this information is helpful.

Best Regards,
Brent

From: Fowler, Devon <Devon.Fowler@aecom.com>
Sent: December-11-19 10:27 AM
To: Shirley, Brent (MNRF) <brent.shirley@ontario.ca>
Subject: RE: MNRF Midhurst District - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request

CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

I obviously meant Hi Brent…

From: Fowler, Devon
Sent: December-11-19 10:21 AM
To: Shirley, Brent (MNRF) <brent.shirley@ontario.ca>
Subject: RE: MNRF Midhurst District - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request

Hi Shirley,

I was hoping you could confirm the thermal regimes of WC-01 to WC-08 as LIO shows many of them as Unknown. Based on your recommended timing window I would assume warmwater possibly coolwater habitat, however want to make sure we are on the same page. No worries if they are truly unknown!

GWP or Project Name	Waterbody	Work Location (UTM Coordinates)	Flow	Thermal Regime	Fish Habitat*
Bradford Bypass Retainer - Assignment #: 2018-E-0028 – Work Item 001	WC-01: Tributary to Pennville Creek	609218.449, 4885909.654	EA (1997) and NVCA (2013): Permanent	LIO (2019): Unknown	LIO (2019) and EA (1997): Direct

GWP or Project Name	Waterbody	Work Location (UTM Coordinates)	Flow	Thermal Regime	Fish Habitat*
				NVCA (2013): Coolwater	
Bradford Bypass Retainer - Assignment #: 2018-E-0028 – Work Item 001	WC-02: Tributary to Holland River (Fraser Creek)	609930.3209, 4886069.943	EA (1997): Permanent	LIO (2019): Coolwater	LIO (2019) and EA (1997): Direct
Bradford Bypass Retainer - Assignment #: 2018-E-0028 – Work Item 001	WC-03: Tributary to Holland River (Tributary to Fraser Creek)	610547.9048, 4886272.661	EA (1997): Intermittent	LIO (2019): Unknown	LIO (2019): Direct
Bradford Bypass Retainer - Assignment #: 2018-E-0028 – Work Item 001	WC-04: Holland River Tributary (White Cedar Swamp)	612791.95, 4886960.961	EA (1997): Intermittent	LIO (2019): Unknown	LIO (2019): Direct
Bradford Bypass Retainer - Assignment #: 2018-E-0028 – Work Item 001	WC-05: Holland River Tributary (White Cedar Swamp)	613197.386, 4887078.821	EA (1997): Intermittent	LIO (2019): Unknown	LIO (2019): Direct
Bradford Bypass Retainer - Assignment #: 2018-E-0028 – Work Item 001	WC-06: Holland River Tributary (Cultivated Waterways)	615116.8616, 4887564.306	EA (1997): Intermittent	LIO (2019): Unknown	LIO (2019): Direct
Bradford Bypass Retainer - Assignment #: 2018-E-0028 – Work Item 001	WC-07: Holland River Tributary (Cultivated Waterway)	615762.6669, 4887454.459	EA (1997): Intermittent	LIO (2019): Warmwater	LIO (2019): Direct
Bradford Bypass Retainer - Assignment #: 2018-E-0028 – Work Item 001	WC-08: West Holland River (Holland River West Branch)	616323.0212, 4887569.116	EA (1997) and LSRCA (2010): Permanent	LIO (2019) and LSRCA (2010): Warmwater	LIO (2019) and LSRCA (2010): Direct

Thanks!

Devon Fowler, Hon. B.Sc.
Aqautic Ecologist, Water & Natural Resources, Environment
Office: 705-797-3293
Cell: 226-820-6156

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From: Shirley, Brent (MNRF) <brent.shirley@ontario.ca>
Sent: December-11-19 9:41 AM
To: Minielly, Andrew <Andrew.Minielly@aecom.com>
Cc: Piette, Jessica <Jessica.Piette@aecom.com>; Lohnes, Shelley <Shelley.Lohnes@aecom.com>; Ellis, Julie <Julie.Ellis@aecom.com>; Fowler, Devon <Devon.Fowler@aecom.com>; Easterling, Katie <katie.easterling@aecom.com>; Rankin, Sonia <sonia.rankin@aecom.com>; Fleming, Braden

<Braden.Fleming@aecom.com>; Sarris, Larry (MTO) <Larry.Sarris@ontario.ca>; Gribbon, Rhonda (MTO) <Rhonda.Gribbon@ontario.ca>
Subject: RE: MNRF Midhurst District - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request

Hi Andrew,

As stated in my earlier email my comments with pertain to the Simcoe County portion of the study area for your project.

The in-water timing window for water crossings 1-8 is no in-water work between March 15-July 15.

All **known** natural heritage features are mapped in LIO and are available. Just because natural heritage features and / or significant wildlife habitat is not identified that doesn't mean that it doesn't exist. Evaluating for other natural heritage values for example candidate significant wildlife habitats (SWH) will be informed by direction in the Natural Heritage Reference Manual, the Significant Wildlife Habitat Technical Guide and SWH Criteria Schedule for Ecoregion 6E. Your field work will inform your review of the study area for natural heritage features and functions.

If you have any questions or concerns please feel free to call or email me at any time.

Best Regards,

Brent Shirley

A/ Management Biologist I Midhurst District Ministry of Natural Resources & Forestry I 2284 Nursery Rd I Midhurst, ON I L9X 1N8 I Phone 705-725-7547 I Fax- 705-725-7584

Please Note: As of July 2, 2019, I will no longer have voicemail services with my office phoneline. My phone line has been re-directed to Shannon Lawless for messaging; however should I miss your call you can email me directly or send your questions ot request to midhurstinfo@ontario.ca where your inquiry will be forwarded back to me or re-directed towards another staff member.

From: Minielly, Andrew <Andrew.Minielly@aecom.com>
Sent: December-06-19 9:21 AM
To: MIDHURSTINFO (MNRF) <MIDHURSTINFO@ontario.ca>
Cc: Piette, Jessica <Jessica.Piette@aecom.com>; Lohnes, Shelley <Shelley.Lohnes@aecom.com>; Ellis, Julie <Julie.Ellis@aecom.com>; Fowler, Devon <Devon.Fowler@aecom.com>; Easterling, Katie <katie.easterling@aecom.com>; Rankin, Sonia <sonia.rankin@aecom.com>; Fleming, Braden <Braden.Fleming@aecom.com>; Sarris, Larry (MTO) <Larry.Sarris@ontario.ca>; Gribbon, Rhonda (MTO) <Rhonda.Gribbon@ontario.ca>
Subject: MNRF Midhurst District - Ministry of Transportation - Bradford Bypass (Highway 400 - 404 Link)- Background Information Request

Good morning,

AECOM has been retained by the Ministry of Transpiration to undertake preparatory work for the re-initiation of the Bradford Bypass, which will be completed to a Preliminary Design level of detail. At this time, the preparatory work will include a desktop and secondary source data review. A request for information letter is attached. Figure 1 is attached and provides an overview of the Background Data Request Study Area.

AECOM would kindly like to request that the MNRF review the list of Natural Heritage, SOCC and aquatic resource records identified for the Study Area (Provided in Attachment 1) and confirm if there are any other records that should be considered for this project. Any data received by December 18th can be included in the first draft of our report, however data received after this date will be included in final drafts of the reports to be issued by February 1, 2020.

Thank you and please do not hesitate to contact me if you have any questions or concerns,

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Appendix C

Photolog

Photograph 1. ↑
C10-A-A, June 2022. Mapped feature within highway 400 RoW – dense phragmites along ditch.

Photograph 2. ↑
C10-A-A, June 2022. Mapped feature within highway 400 RoW – dense phragmites.

Photograph 3. ↑
C10-A-B, June 2022. Looking downstream (east) from the culvert outlet.

Photograph 4. ↑
C10-A-B, June 2022. Looking upstream (west) towards the culvert outlet. Clean gravel and pebbles were observed in the riffle section.

Photograph 5.
C10-A-B, June 2022. Looking downstream (east) from the highway ROW. ~~Vulnerable banks and some~~ Some evidence of erosion was observed at the time of inspection.

Photograph 6.
C10-A-B, June 2022. Looking upstream (west) from the highway ROW. ~~Vulnerable banks and some~~ Some evidence of erosion was observed at the time of inspection.

Photograph 7.
C10-A-C, June 2022. Run feature looking upstream at upstream end of reach.

Photograph 8.
C10-A-C, June 2022. Riffle feature looking upstream at downstream end of reach.

Photograph 9.
C10-A-1, June 2021. Looking upstream (north) at upstream ZDA. Meandering channel through grassed meadow.

Photograph 10.
C10-A-1, June 2021. Looking downstream (south) at downstream ZDA. Meandering channel through grassed meadow.

Photograph 11.
C10-A-1, June 2021. Looking east from channel at riparian grasses. Agricultural fields further east 30+ m from channel.

Photograph 12.
C10-A-1, June 2021. Typical cross-section of run feature through upstream ZDA. Narrow channel with riparian grasses.

Photograph 13.
C10-A-2, June 2021. Typical riffle feature in upstream ZDA.

Photograph 14.
C10-A-2, June 2021. Typical pool feature in downstream ZDA.

Photograph 15.
C10-A-2, June 2021. Looking upstream (north) at upstream ZDA. Highway slope on the right (west) side of the photograph, agricultural lands to the east.

Photograph 16.
C10-A-2, June 2021. Looking downstream (south) from upstream ZDA. Highway slope on the left (west) side of the photograph, agricultural lands to the east.

Photograph 17.
C10-A-3, June 2021. Looking upstream (north) at upstream ZDA. Straight channel along highway that functions as highway ditch.

Photograph 18.
C10-A-3, June 2021. Looking downstream (south) at downstream ZDA. Straight channel along highway that functions as highway ditch.

Photograph 19.
C10-A-3, June 2021. Typical run feature throughout upstream ZDA and downstream ZDA.

Photograph 20.
C10-A-4, June 2021. Culvert inlet on east side of Highway 400, looking west.

Photograph 21. ↑
C10-A-4, June 2021. Inside culvert looking west from inlet, east side of Highway 400.

Photograph 22. ↑
C10-A-4, June 2021. Looking upstream at upstream ZDA near culvert inlet.

Photograph 23. ↑
C10-A-4, June 2021. Pool at culvert inlet in upstream ZDA.

Photograph 24. ↑
C10-A-4, June 2021. Culvert outlet on west side of Highway 400, looking east.

Photograph 25. ↑
C10-A-4, June 2021. Looking downstream at downstream ZDA from culvert outlet.

Photograph 26. ↑
C10-A-4, June 2021. Looking upstream (east) at downstream ZDA from edge of highway ROW.

Photograph 27. ↑
C10-A-5, June 2022. Culvert outlet at McKinstry Road, looking upstream.

Photograph 28. ↑
C10-A-5, June 2022. Looking downstream (east) at channel feature.

Photograph 29.
C10-A-6, June 2022. Mapped feature within highway 400 RoW – looking downstream on east side of highway.

Photograph 30.
C10-A-6, June 2022. Mapped feature within highway 400 RoW – looking at culvert inlet on west side of highway.

Photograph 31.
C10-A-6, June 2022. Looking downstream (east) at Hwy 400 Culvert inlet. The concrete bottom of the culvert appears to have been eroded away.

Photograph 32.
C10-A-6, June 2022. Looking upstream (north) at the highway drainage channel. Terrestrial grasses and some cattails grew throughout the channel.

Photograph 33.
C10-A-6, June 2022. Looking upstream (west) at runoff channel from field west of the highway. Large riverstone has been used to stabilize the bank/ runoff channel.

Photograph 34.
C10-A-6, June 2022. Water present in the runoff channel. It had rained approximately 34mm in the 72hrs prior to the survey.

Photograph 35.
C10-B-1, June 2021. Looking upstream (north) at upstream ZDA. Dry agricultural field.

Photograph 36.
C10-B-1, June 2021. Looking downstream (south) at downstream ZDA. Dry agricultural field.

Photograph 37. ↑
C10-B-2, June 2021. Looking upstream (northwest) at upstream ZDA. Dry agricultural field.

Photograph 38. ↑
C10-B-2, June 2021. Looking downstream (east) at downstream ZDA. Grass field with no defined feature.

Photograph 39. ↑
C10-C-1, June 2021. Looking downstream (south) at upstream ZDA.

Photograph 40. ↑
C10-C-1, June 2021. Looking upstream (north) at upstream ZDA.

Photograph 41.
C10-C-1, June 2021. Looking upstream (north) at downstream ZDA.

Photograph 42.
C10-C-1, June 2021. Looking downstream (south) at downstream ZDA.

Photograph 43.
C10-C-1, June 2021. Typical channel cross section in downstream ZDA.

Photograph 44.
C10-C-2, June 2021. Looking upstream (north) at upstream ZDA.

Photograph 45. ↑
C10-C-2, June 2021. Looking downstream (south) at upstream ZDA.

Photograph 46. ↑
C10-C-2, June 2021. Algae and scum on top of water at downstream ZDA, stagnant water.

Photograph 47. ↑
C10-C-2, June 2021. Looking upstream (north) at downstream ZDA.

Photograph 48. ↑
C10-C-2, June 2021. Looking downstream (south) at downstream ZDA.

Photograph 49. ↑
C11-A-1, June 2021. Looking upstream (north) at upstream ZGA.

Photograph 50. ↑
C11-A-1, June 2021. Looking downstream (south) at upstream ZDA.

Photograph 51. ↑
C11-A-1, June 2021. Typical riffle cross section in upstream ZDA. .

Photograph 52. ↑
C11-A-1, June 2021. Looking downstream (south) at upstream ZDA.

Photograph 53. ↑
C11-A-1, June 2021. Looking upstream (north) from downstream ZDA.

Photograph 54. ↑
C11-A-1, June 2021. Undercut bank in downstream ZDA.

Photograph 55. ↑
C11-A-1, June 2021. Clay substrate in downstream ZDA.

Photograph 56. ↑
C11-A-1, June 2021. Looking downstream at downstream ZGA. Grass swale between two agricultural fields.

Photograph 57. ↑
C11-A-2, June 2021. Looking upstream (east) at ZGA.

Photograph 58. ↑
C11-A-2, June 2021. Looking downstream (west) at upstream ZDA.

Photograph 59. ↑
C11-A-2, June 2021. Looking downstream (west) at downstream ZDA. Dry swale in forested lands.

Photograph 60. ↑
C11-A-2, June 2021. Outlet point of C11-A-2 into C11-A-1.

	
Photograph 61. C12-A-1, June 2021. Looking upstream (south) at upstream ZDA. Road ditch with wet soils. .	**Photograph 62.** C12-A-1, June 2021. Looking downstream (north) at upstream ZDA.
	
Photograph 63. C12-A-1, June 2021. Looking downstream (northeast) at downstream ZDA.	**Photograph 64.** C12-A-1, June 2021. Small wetland feature in downstream ZDA. No flowing water or defined inlet/outlet feature observed.

Photograph 65. ↑
C12-A-1, June 2021. Looking downstream (northeast) at upstream ZDA.

Photograph 66. ↑
C12-A-1, June 2021. Agricultural field on the west side of Sideroad 10. No defined feature or connection to east side of Sideroad 10.

Photograph 67. ↑
C13-A-1, June 2021. Looking upstream (north) at upstream ZDA.

Photograph 68. ↑
C13-A-1, June 2021. Looking upstream (north) at upstream ZDA.

Photograph 69. ↑
C13-A-1, June 2021. Typical run feature in upstream and downstream ZDA.

Photograph 70. ↑
C13-A-1, June 2021. Looking downstream (southeast) at downstream ZDA.

Photograph 71. ↑
C13-A-1, June 2021. Looking downstream (southeast) at downstream ZGA.

Photograph 72. ↑
C13-A-1, June 2021. Looking upstream (northwest) at downstream ZDA.

Photograph 73. ↑
C14-A-1, June 2021. Dry, poorly defined swale in downstream ZGA.

Photograph 74. ↑
C14-A-1, June 2021. Looking downstream (south) at downstream ZDA, dry forested lands.

Photograph 75. ↑
C14-A-1, June 2021. Looking downstream (south) at upstream ZDA, dry forested lands.

Photograph 76. ↑
C14-A-1, June 2021. Looking upstream (north) at upstream ZDA, dry forested lands.

Photograph 77. ↑
C16-A-1, August 2021. Looking downstream (east) in upstream ZGA.

Photograph 78. ↑
C16-A-1, August 2021. Typical cross section in upstream ZGA.

Photograph 79. ↑
C16-A-1, August 2021. Looking upstream (west) at upstream ZDA.

Photograph 80. ↑
C16-A-1, August 2021. Looking upstream (northwest) at dense phragmites patch adjacent to creek.

Photograph 81. ↑
C16-A-1, August 2021. Looking downstream (east) at downstream ZDA.

Photograph 82. ↑
C16-A-1, August 2021. Dense submerged aquatic vegetation in downstream ZDA.

Photograph 83. ↑
C16-A-1, August 2021. Riparian wetland along downstream ZDA.

Photograph 84. ↑
C16-A-2, June 2021. Looking downslope (eat) at dry drainage swale from upslope hedgerow.

Photograph 85. ↑
C16-A-2, June 2021. Dense hedgerow between C16-A-3 and C16-A-2, dry drainage swale.

Photograph 86. ↑
C16-A-3, June 2021. Downslope portion of drainage channel in hedgerow.

Photograph 87. ↑
C16-A-3, June 2021. Looking upslope (west) at dry drainage swale.

Photograph 88. ↑
C17-A-1, June 2021. Looking east at active farmland adjacent to river.

Photograph 89. ↑
C16-A-4/ CR-4, June 2021. SWMP forebay, looking north.

Photograph 90. ↑
C16-A-4/ CR-4, June 2021. SWMP inlet at southwest corner of pond forebay.

Photograph 91. ↑
C16-A-4/ CR-4, June 2021. SWMP forebay and detention pond, looking south from earth berm.

Photograph 92. ↑
C16-A-4/ CR-4, June 2021. SWMP looking west. Dense cattails and pond lilies.

Photograph 93. ↑
C16-A-4/ CR-4, June 2021. SWMP outlet structure. Overgrown vegetation at overflow feature.

Photograph 94. ↑
C16-A-4/ CR-4, June 2021. SWMP outlet structure discharging into channel feature, west side of County Road 4.

Photograph 95. ↑
C16-A-4/ CR-4, June 2021. County Road 4 culvert inlet on west side, dense vegetation growth around inlet.

Photograph 96. ↑
C16-A-4/ CR-4, June 2021. County Road 4 culvert inlet, laminar flow across concrete bottom.

	
Photograph 97. ↑ C16-A-4/ CR-4, June 2021. SWMP outlet structure. Looking west from County Road for at channel section between culvert inlet and SWMP outlet.	**Photograph 98.** ↑ C16-A-4/ CR-4, June 2021. Looking east from east side of County Road 4 above culvert outlet. Large invasive phragmites patch.
	
Photograph 99. ↑ C16-A-4/ CR-4, June 2021. County Road 4 culvert outlet looking west. Dense phragmites immediately downstream.	**Photograph 100.** ↑ C16-A-4/ CR-4, June 2021. County Road 4 culvert outlet.

Photograph 101. ↑
C16-A-4/ CR-4, June 2021. Approximately 150 m downstream of culvert inlet. Dense phragmites still present along Unnamed Tributary.

Photograph 102. ↑
C16-A-4/ CR-4, June 2021. Approximately 150 m downstream of culvert inlet. Dense phragmites still present along Unnamed Tributary, water present in channel.

Photograph 103. ↑
C17-A-1, June 2021. Riparian wetland area along east side of river, looking downstream (north).

Photograph 104. ↑
C17-A-1, June 2021. Looking west across river from east bank in downstream ZDA.

Photograph 105.
C17-A-1, June 2021. Looking downstream (north) at ZGA from east bank with water lily and duckweed vegetation common throughout.

Photograph 106.
C17-A-1, June 2021. Looking upstream (south) at ZGA from east bank with water lily and duckweed vegetation common throughout.

Photograph 107.
C17-B-1, June 2021. Looking upstream (north) at upstream ZDA.

Photograph 108.
C17-B-1, June 2021. Typical cross section at upstream ZDA, looking west from east bank.

Photograph 109. ↑
C17-B-1, June 2021. Looking downstream at upstream ZDA from east bank.

Photograph 110. ↑
C17-B-1, June 2021. Typical cross section at downstream ZDA, dense duckweed on water surface.

Photograph 111. ↑
C17-B-1, June 2021. Looking downstream (north) at downstream ZDA from east bank.

Photograph 112. ↑
C17-C-1, June 2021. Looking downstream (south) towards Hochreiter Road.

	
Photograph 113. ↑ C17-C-1, June 2021. Looking upstream (north).	**Photograph 114.** ↑ C17-D-1, June 2021. Looking upstream (north).
	
Photograph 115. ↑ C17-D-1, June 2021. Looking downstream (south) towards Hochreiter Road.	**Photograph 116.** ↑ C17-E-1, June 2021. Looking upstream (north).

	
Photograph 117. ↑ C17-E-1, June 2021. Looking downstream (south) towards Hochreiter Road.	**Photograph 118.** ↑ C17-F-1, June 2021. Looking upstream (north).
	
Photograph 119. ↑ C17-F-1, June 2021. Looking downstream (south) towards Hochreiter Road.	**Photograph 120.** ↑ C18-A-1, June 2021. Looking upstream (north).

Photograph 121. ↑
C18-A-1, June 2021. Looking downstream (south) towards Hochreiter Road.

Photograph 122. ↑
C18-B-1, June 2021. Looking upstream (north).

Photograph 123. ↑
C18-B-1, June 2021. Looking downstream (south) towards Hochreiter Road.

Photograph 124. ↑
C18-C-1, June 2021. Looking upstream (north).

Photograph 125. ↑
C18-D-1, June 2021. Looking downstream (south) towards Hochreiter Road.

Photograph 126. ↑
C18-D-1, June 2021. Looking upstream (north).

Photograph 127. ↑
Hochreiter Road, June 2021. Ditch along north side of road, between C18-C-1 and C18-D-1.

Photograph 128. ↑
Hochreiter Road, June 2021. Ditch along north side of road, between C17-B-1 and C17-C-1.

Photograph 129. ↑
C18-E-1, June 2021. Looking upstream (south) at dry swale in forested area.

Photograph 130. ↑
C18-E-1, June 2021. Looking downstream at dry swale and ditch along south side of Hochreiter Road.

Photograph 131. ↑
C18-F-1, June 2021. Standing water on west side of Bathurst Street, north of Hochreiter Road, looking south.

Photograph 132. ↑
C18-F-1, June 2021. Standing water on east side of Bathurst Street, north of marina entrance, looking north.

Photograph 133. ↑
C18-F-1, June 2021. Standing water on west side of Bathurst Street, north of Hochreiter Road, looking north.

Photograph 134. ↑
C18-G-1, June 2021. Pool feature/standing water north of Bathurst Street along Hochreiter Road, looking west.

Photograph 135. ↑
C18-G-1, June 2021. Standing water in ditch along west side of Bathurst Street, looking south.

Photograph 136. ↑
C18-G-1, June 2021. Pool feature/standing water at southwest corner of Bathurst Street and Hochreiter Road.

Photograph 137. ↑
C18-H-1, June 2021. Standing water on east side of Bathurst Street, south of marina entrance, looking east.

Photograph 138. ↑
C18-H-1, June 2021. Standing water on east side of Bathurst Street, south of marina entrance, looking north.

Photograph 139. ↑
C20-A-1, June 2021. Looking upstream at upstream ZDA from west bank.

Photograph 140. ↑
C20-A-1, June 2021. Looking upstream at backwater location along west bank. Dense aquatic vegetation.

Photograph 141. ↑
C20-A-1, June 2021. Looking upstream at downstream ZDA from west bank.

Photograph 142. ↑
C20-A-1, June 2021. Looking across the river from the downstream ZDA from west bank.

Photograph 143. ↑
C20-A-1, June 2021. Looking downstream from downstream ZDA on west bank.

Photograph 144. ↑
C20-A-1, June 2021. Marina entrance on west bank in downstream ZDA.

Photograph 145. ↑
C20-B-1, June 2021. Offline pond at golf course.

Photograph 146. ↑
C20-B-1, June 2021. Offline pond at golf course.

Photograph 147. ↑
C22-A-1, June 2021. Looking upstream from north side of pond, looking south.

Photograph 148. ↑
C22-A-1, June 2021. Looking downstream at downstream ZGA, pond on north side of access road.

	
Photograph 149. ↑ C22-A-1, June 2021. Looking upstream (south) of pond at upstream ZDA, dry drainage ditch south of pond.	**Photograph 150.** ↑ C22-A-1, June 2021. Looking downstream (north) at pond from upstream ZDA.
	
Photograph 151. ↑ C23-A-1, June 2021. Dry roadside ditch along 2nd Concession Road, looking north.	**Photograph 152.** ↑ C23-A-1, June 2021. Dry roadside ditch along 2nd Concession Road, looking south.

Photograph 153. ↑
C24-A-1, June 2021. Dry agricultural swale looking upslope (southwest).

Photograph 154. ↑
C24-A-1, June 2021. Dry agricultural swale looking downslope (northeast).

Photograph 155. ↑
C25-A-1, June 2021. Looking upstream at upstream ZDA, dry grassland are.

Photograph 156. ↑
C25-A-1, June 2021. Looking upstream at ponded area in upstream ZDA.

Photograph 157. ↑
C25-A-1, June 2021. Looking at downstream ZDA, grass swale between agricultural fields.

Photograph 158. ↑
C25-A-1, June 2021. Looking downstream at downstream ZGA in farm area.

Photograph 159. ↑
C25-B-1, June 2021. Dry agricultural field with poorly define swale, looking upslope (south).

Photograph 160. ↑
C25-B-1, June 2021. Dry agricultural field with poorly define swale, looking downslope (north).

Photograph 161. ↑
C25-C-1, August 2021. Looking upstream (south) of pond at upstream ZDA.

Photograph 162. ↑
C25-C-1, August 2021. Looking upstream (south) of pond at upstream ZGA.

Photograph 163. ↑
C25-C-1, August 2021. Looking upstream (south) at south end of pond in upstream ZDA.

Photograph 164. ↑
C25-C-1, August 2021. Looking downstream (north) at north end of pond in downstream ZDA.

	
Photograph 165. ↑ C25-C-1, August 2021. Looking west at north end of pond in downstream ZDA.	**Photograph 166.** ↑ C25-C-1, August 2021. Looking downstream of pond at outlet pool, phragmites patch along channel.
	
Photograph 167. ↑ C25-C-1, August 2021. Looking downstream (northwest) of pond at channel in downstream ZGA.	**Photograph 168.** ↑ C25-C-1, August 2021. Dry channel downstream (northwest) of pond in channel.

	
Photograph 169. ↑ C25-A-2, June 2021. Looking upstream (southwest) from culvert inlet on west side of Highway 404.	**Photograph 170.** ↑ C25-A-2, June 2021. Culvert inlet on west side of Highway 404.
	
Photograph 171. ↑ C25-A-2, June 2021. Standing water upstream of culvert inlet in ZDA.	**Photograph 172.** ↑ C26-A-1, June 2021. Looking downstream (northeast) from culvert outlet on east side of Highway 404.

Photograph 173.
C26-A-1, June 2021. Culvert outlet on east side of Highway 404.

Photograph 174.
C26-A-1, June 2021. Standing water in culvert on west side of Highway 404.

Photograph 175.
C27-A-1, May 2022. Upstream reach facing upstream. Banks lined with dense riparian vegetation including buttercup species, honeysuckle species, and goldenrod species.

Photograph 176.
C27-A-1, May 2022. Submerged blue water-speedwell in upstream reach.

Photograph 177. ↑
C27-A-1, May 2022. Downstream reach with riparian cattails.

Photograph 178. ↑
C27-A-1, May 2022. Downstream reach bank with rip-rap and surrounding agricultural land use.

Photograph 179. ↑
C28-A-1, May 2022. Upstream reach facing upstream southwest.

Photograph 180. ↑
C28-A-1, May 2022. Downstream reach facing upstream at culvert outlet.

Photograph 181. ↑
C28-A-1, May 2022. Downstream reach facing left bank with active erosion.

Photograph 182. ↑
C28-A-1, May 2022. Downstream reach pool showing algae and emergent cattails.

Photograph 183. ↑
C28-A-1, May 2022. Downstream reach facing downstream from culvert outlet.

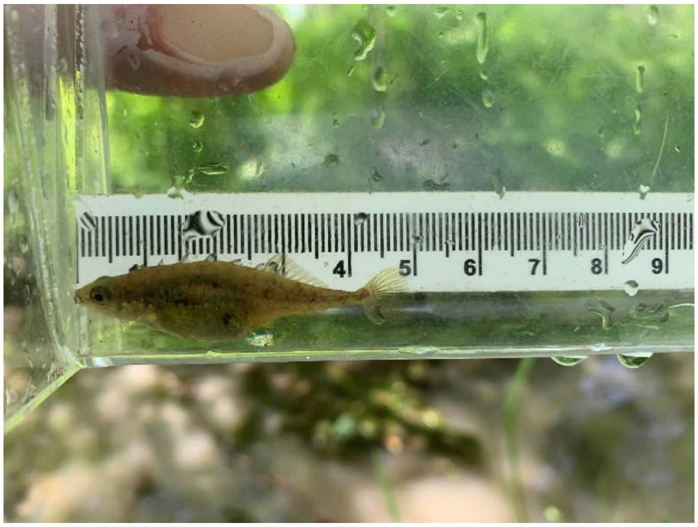
Photograph 184. ↑
C28-A-1, May 2022. Downstream reach left bank with phragmites.

Photograph 185. ↑
C10-A-1, June 2021. Creek Chub captured in downstream ZDA.

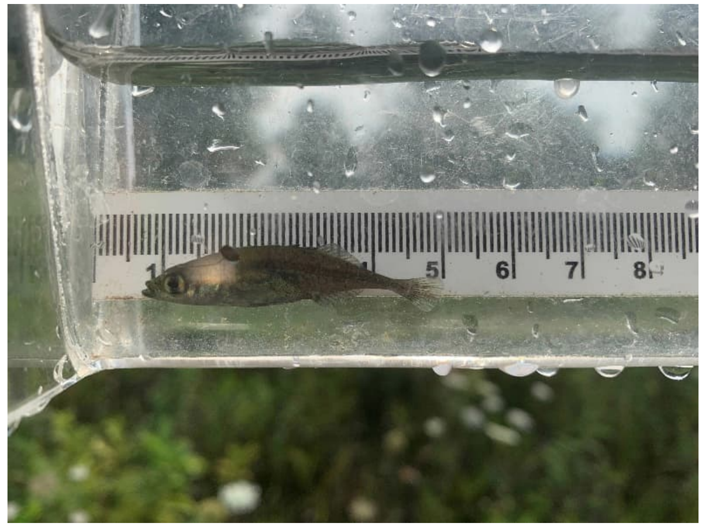
Photograph 186. ↑
C10-A-4, June 2021. Blacknose Dace captured in upstream ZDA.

Photograph 187. ↑
C10-A-4, June 2021. Creek Chub captured in upstream ZDA.

Photograph 188. ↑
C11-A-1, June 2021. Northern Redbelly Dace and Creek Chub captured in upstream ZDA.



Photograph 189. ↑
C11-A-1, June 2021. Brook Stickleback captured in upstream ZDA.



Photograph 190. ↑
C25-C-1, August 2021. Brook Stickleback captured in upstream (south) end of pond.

Photograph 191. ↑
C25-C-1, August 2021. Creek Chub captured in upstream (south) end of pond.

Photograph 192. ↑
C28-A-1, May 2022. Northern Redbelly Dace captured in downstream (northeast) reach.

Photograph 193. 🡑
C10-A-C, June 2022. Brook Stickleback captured in downstream (north) reach.

Photograph 194. 🡑
C10-A-C, June 2022. Blacknose Dace captured in downstream (north) reach.

Photograph 195. 🡑
Pond 1, June 2022. Fathead Minnows captured in western side of the pond.

Appendix D

Field Notes

2020 Watercourse survey field data

Project Number:	Project Description:	Date:	Is stream realignment required	Collectors:	Time Started:	Weather Conditions	Air Temperature (°C):	Water Temperature (°C):	Conductivity (µS/cm):	Velocity:	Name of Waterbody:	Drainage System:	Crossing ID:	Station ID:	Location of Crossing:	Latitude	Longitude	MTO Chainage:	Township:	MNRF District:	Surrounding Land Use:	Pollution Sources:	Existing Structure Type:	UpstDwnStRep_End_count	Additional Comments:	Append additional notes?	CreationDate	Creator
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	No	DF, KC	2020-09-15 16:59	Sunny, slightly winc	10			Slow	Unnamed Drain		C18-A-1			44.1329243	-79.5379217		TOWNSHIP OF KING	Aurora	Agricultural field	Runoff from agricultural fields	N/A	2	Agricultural drain with no water in the upstream section and very little in the downstream section. Surrounding land use includes a squash and corn field. Drain has been channalized and is very straight	Yes	2020-09-15 17:05	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	No	DF, KC	2020-09-15 17:17	Sunny, slightly winc	15				Unnamed Drain		C17-F-1			44.1330643	-79.5390088		TOWNSHIP OF KING	Aurora	Agricultural field	Runoff from agricultural field	N/A	2	This channel was dry upon inspection. It is a straight channel uniform in depth that is in between 2 corn fields. The ground is soft and while the channel has no water in it the substrate is still damp indicating that it could be have dried up recently, or that the area retains water for a while after rain events.	Yes	2020-09-15 17:25	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	No	DF, KC	2020-09-15 17:30	Sunny	15				Unnamed Drain		C18-B-1			44.1331357	-79.5369034		TOWNSHIP OF KING	Aurora	Agriculture	Runoff from fields	N/A	2	Channel was dry upon inspection. Bottom of channel was slightly damp. Channel was composed of steep straight banks indicating. Vines from fields beside channel were in the channel at some points which could indicate that while this area is damp it might not hold a lot of water very often (at least during this time of year). Harvest was actively happening during site inspection	Yes	2020-09-15 17:36	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	No	DF, KC	2020-09-15 17:42	Sunny, breezy	15				Unnamed Drain		C18-C-1			44.1335516	-79.5349186		TOWNSHIP OF KING	Aurora				2	Swale in agricultural field. The crossing is at a tiny channel inbetween rows of a field	Yes	2020-09-15 17:45	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	No	DF, KC	2020-09-15 18:19	Sunny, breezy	15				Unnamed Drain		C18-E-1			44.1337209	-79.5329107		TOWNSHIP OF KING	Aurora	Woodlot off of access road to agricultural fields	Runoff from road	N/A	2	This dry channel is off the access road by approximately 10m in a woodlot dominated with deciduous species (aspen, buckthorn, birch etc). Channel seems fairly uniform in size but the bank slope is a wide U shape rather than being overly steep. Woody debris and growth in the channel indicate that this channel has not been dredged recently	Yes	2020-09-15 18:27	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	No	DF, KC	2020-09-15 17:57	Sunny, breezy	15			Slow	Unnamed Drain		C18-D-1			44.1337	-79.5339891		TOWNSHIP OF KING	Aurora	Agricultural fields and access road for fields	Runoff from road and fields	N/A	2	This is a straightened channel that holds water that likely ran off from the field and access road. The water is extremely turbid (chocolate milk colour) and appears to be stagnant	Yes	2020-09-15 18:27	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	No	DF, KC	2020-09-15 18:52		15				Unnamed Drain		C17-E-1			44.1329555	-79.5394824		TOWNSHIP OF KING	Aurora	Farm fields	Runoff from corn fields	N/A	2	Channel is a straightened drain inbetween cornfields. While there is no water in the channel the bottom of it is still damp. The dirt (I don't think it should be referred to as substrate as it is clearly the same material as the corn fields) is composed of fine particles.	Yes	2020-09-15 18:56	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	No	DF, KC	2020-09-15 18:59	Sunny, breezy	15				Unnamed Drain		C17-D-1			44.1328	-79.5399623		TOWNSHIP OF KING	Aurora	Agricultural fields	Runoff from agricultural fields	N/A	2	Straightened channel used as an agricultural drain. No water present at time of inspection, but ground at bottom of channel was still damp. Ground composed of the same fine particles that the ground in the field was composed of.	Yes	2020-09-15 19:03	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	No	DF, KC	2020-09-15 19:08		16				Unnamed Drain		C17-C-1			44.132608	-79.5405		TOWNSHIP OF KING	Aurora	Agricultural field	Runoff from field	N/A	2	Crossing is another straightened channel that is another agricultural drain. No water was present in channel upon inspection. This channel was very overgrown with various grasses, pigweed, and thistle	Yes	2020-09-15 19:12	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	No	DF, KC	2020-09-15 16:30	Sunny, moderate v	18				Holland River		C17-A-1		East bank of Holland River West	44.1312131	-79.5446		TOWNSHIP OF KING	Aurora	PSW and AG	Nutrient loading from AG	N/A	2	Wide, deep and slow moving river bordered by wetalnd on the east and riparian buffer and agriculture on the west. Water is turbid and sediment laden, highly productive vegetation sugests high nutrient loading from surrounding AG practices. Semi natural morphology in this location.	Yes	2020-09-15 19:22	Devon.Fowler@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	No	DF, KC	2020-09-15 19:47	Sunny, breezy	16			Slow	Unnamed Drain		C18-F-1			44.1352855	-79.5280847		TOWNSHIP OF KING	Aurora	Road, woodlot, residential property	Runoff from road	N/A	2	Fairly straight channel approximately 10m off of the road. The water is fairly stagnent and there is thick cover provided by a woodlot that surrounds either side of the channel. 3 larger trees have fallen across channel in the u/s section but neither they, nor the smaller debris downstream appear to completely block of the channel. The channel dries up in the downstream section	Yes	2020-09-15 20:36	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	Unknown	DF, KC	2020-09-15 19:30	Sunny, light wind	15						C18-H-1		Roadside drainage adjacent to bathurst st. (east side)	44.1349303	-79.5281603		TOWN OF EAST GWILLIMBURY	Aurora	Residential	Road runoff	N/A	2	Roadside drainage adjacent to bathurst st	Yes	2020-09-15 20:42	Devon.Fowler@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-16 16:00	No	DF, KC	2020-09-16 15:00	Sunny, breezy	18			Slow	Unnamed Drain		C23-A-1			44.146	-79.4782867		TOWN OF EAST GWILLIMBURY	Aurora	Agricultural fields and road	Runoff from road and agricultural fields	N/A	2	Roadside drainage, looked as if it had been dredged recently (within the past year or so). Water was present upon inspection but due to depth this drain could seasonally impede fish movement.	Yes	2020-09-16 15:26	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-16 16:00	Unknown	KC DF	2020-09-16 15:52	Sunny , breezy	17			Slow	Holland River East Branch - Trib		C22-A-1			44.1413283	-79.4876076		TOWN OF EAST GWILLIMBURY	Aurora	Sod field	Runoff from fields	N/A	2	3m riparian buffer on either side, riparian comprised of marsh species (u/s). Downstream flows into a retention pond surrounded by cattails and goldenrod. With duckweed covering the northeast side of pond. Agricultural Field adjacent to watercouse is wet.	Yes	2020-09-16 16:38	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-16 16:00	Unknown	DF, KC	2020-09-16 17:43	Overcast	22						C18-G-1		Southwest corner of bathurst st and hochrieter	44.1349238	-79.5281144		TOWNSHIP OF KING	Aurora	Ag	Road runoff	N/A	2	Swale through forest seasonally drains into road drainage	No	2020-09-16 18:00	Devon.Fowler@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-16 16:00	No	DF, KC	2020-09-16 18:30	Overcast	22				Holland River East Branch		C20-A-1		Holland River (E) at marina location (ds) and at golf course (us)	44.1370027	-79.5135		TOWN OF EAST GWILLIMBURY	Aurora	Business (marina)	Boating activity, gas sationds	N/A	2	Wide, deep and slow moving river bordered by marina and wetland on the east and riparian buffer and golf course on the west. Water is turbid and sediment laden, highly productive vegetation sugests high nutrient loading from surrounding AG practices. Natural morphology throughout reach.	Yes	2020-09-16 20:02	Devon.Fowler@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	Unknown	DF, KC	2020-09-15 17:35	Sunny, moderate v	18				Holland River - Trib		C17-B-1		Channel runs parelle to holland river (w) on west side of river	44.1314	-79.5437696		TOWNSHIP OF KING	Aurora	River an AG	Nutrient load	N/A	2	Channelized, deep agricultural drainage. Highly productive,evidence of intensive nutrient load. Water in channel obscured with thick layer of duckweed.	Yes	2020-09-17 15:07	Devon.Fowler@aecom.com_aecom

60636190	Bradford Bypass - Preliminary Design	2020-09-17 16:00	Unknown	KC, DF	2020-09-17 16:16	Sunny, breezy	14		Maskinonge (Jersey) River - Trib	C26-A-1		44.1512294	-79.4395883	TOWN OF EAST GWILLIMBURY	Aurora	Adjacent to hwy 404, wetland	Runoff from highway	Box Culvert	2	Refer to crossing number C25-A-2 for upstream info. This downstream section was dry at the culvert at time of inspection and the main part of the crossing looked to be a wetland. There were no defined banks nor channel morphology. Wetland vegetation species were dominated by cattail and phragmities.	Yes	2020-09-17 16:32	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	Unknown	DF, KC	2020-09-15 17:35	Sunny moderate w	18		Holland River - Trib	C17-B-1	Channel runs parelle to Holland River (west) on west bank of river	44.1634827	-79.6433008	TOWNSHIP OF KING	Aurora	Ag, Holland River	Nutrient load	N/A	2	Channelized, deep agricultural drain. Highly productive, evidence of intensive nutrient loading. Water in channel obscured by thick layer of duckweed	Yes	2020-09-17 16:32	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-17 16:00	Unknown	KC, DF	2020-09-17 16:49		14		Maskinonge (Jersey) River - Trib	C25-A-2		44.1504769	-79.4406486	TOWN OF EAST GWILLIMBURY	Aurora	Highway 404, agricultural field	Runoff from hwy and agriculture field	Box Culvert	2	Refer to crossing C26-A-1 for downstream. Crossing was dry upon inspection with the majority of plant species present being drought tolerant terrestrial species. Approximately 40m away from culvert cattails were visible. It appears that the channel may diverge at culvert when it does run. Crossing is in a valley created by hwy 404 and the neighbouring agricultural field.	Yes	2020-09-17 17:32	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-17 16:00	Unknown	KC DF	2020-09-17 17:33	Sunny	15				C25-C-1 taken at Leslie rd	44.155477	-79.4548799						2	Picture taken upstream of C25-C-1 where channel intersects with Leslie st. due to lack of access. From what we can see the channel is quite overgrown with vegetation that tolerates both wet and dry conditions. Golden rod and grass species dominate vegetation. A few cattails close to the road. Likely not representative of what we see upstream	Yes	2020-09-17 17:45	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-17 16:00	Unknown	KC DF	2020-09-17 18:07	Sunny	15		Unnamed Trib	C25-A-1		44.1534863	-79.4566035	TOWN OF EAST GWILLIMBURY	Aurora	Agricultural land	Runoff		2	170m d/s from actual crossing. Channel is overgrown with wet and dry tolerant plant species and a few cattails. There was no water present at time of inspection however there was water present on farm access road at crossing location	Yes	2020-09-17 18:15	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-17 16:00	Unknown	KC DF	2020-09-17 18:29	Sunny	16		Unnamed Trib	C24-A-1	Approx 210m downstream of crossing	44.1524534	-79.4613427	TOWN OF EAST GWILLIMBURY	Aurora	Agriculture fields/farm activities	Runoff	Open Foot Culvert	2	This section of channel approx 200m d/s from actual crossing but we did not have access to proper crossing at time of inspection. Channel was dry upon inspection and the dense vegetation (primarily wet and dry tolerant species (goldenrod, aster, grass, wild grape etc) and lack of defined banks or channel morphology suggests that this part of the channel is dry quite often	Yes	2020-09-17 18:36	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-17 16:00	Unknown	KC, DF	2020-09-17 20:02	Sunny	18			C12-A-1		44.1248863	-79.6053631	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Meadow adjacent to residential properties and 10 sideroad	Runoff from road	N/A	2	Swale that runs through thicket. The ground was soft and muddy throughout but no water nor defined banks/channel morphology were present. Thicket was dominated by willow trees, buckthorn, senesitive fernand, jewlweed other species that prefer wet habitats. Water Body 02 is a cattail depression, water was present but did not flow through "channel"	Yes	2020-09-17 20:19	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-18 16:00	Unknown	DF, KC	2020-09-18 15:46	Sunny, breezy	12		Holland River - Trib	C16-A-2		44.1318778	-79.5598145	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Agricultural field and cement factory	Runoff	N/A	2	Crossing is a swale in an agricultural field. The crop is not planted through crossing which suggests that the area may get some flow during the spring or during significant rain events. Swale meanders slightly, but there is no defined channel.	Yes	2020-09-18 15:52	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-18 16:00		DF, KC		Sunny	11	Moderate	Holland River - Trib	C16-A-1		44.1299516	-79.555944	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Woodlot surrounding stream, industrial park beyond wood lot, there is a culvert upstream at Artisan Industrial parkway		N/A	2	Unable to access d/s due to PTE. Fish observed during observation. Incised channel through clay substrate, natural morphology, very thick thicket coverage in sections and lots of woody debris overhanging channel, and moderate flow. Investigated approximately 50m away from downstream (PTE) but investigated 100m of upstream	Yes	2020-09-18 15:52	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-18 16:00	Unknown	KC, DF	2020-09-18 15:57	Sunny	14		Holland River - Trib	C16-A-3		44.1321989	-79.560505	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Agricultural fields	Runoff	N/A	2	Agricultural swale, approx 15m d/s from crossing due to PTE. Looked the same as C16-A-2. Refer to photolog for photos	No	2020-09-18 16:01	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-18 16:00	Unknown	KC, DF	2020-09-18 16:51	Overcast	12		Holland River - Trib	C14-A-1		44.1283398	-79.5849837	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst				2	Swale/wetland depression within thicket that is dominated by wetland plants such as jewlweed, Joe-Pye weed, horsetail, and a type of grass. There was no standing water present at time of inspection.No defined channel observed.	Yes	2020-09-18 16:58	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-18 16:00	No	KC, DF	2020-09-18 18:12	Sunny	13		Holland River - Trib	C13-A-1		44.1268	-79.5897914	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Meadow and agricultural fields	Runoff	N/A	2	Approx 15m wide swale in a meadow that separates agricultural fields. Mostly wet and dry tolerant vegetation present (aster, grass, jewlweed, phragmities, milkweed, goldenrod). No defined channel nor distinct morphology present	Yes	2020-09-18 18:19	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-21 16:00	Unknown	KC, DF	2020-09-21 15:17	Sunny	14	Moderate		C11-A-1flows		44.1207605	-79.618564	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Agricultural fields	Runoff from fields	N/A	2	D/s is deeper than upstream and looks as though it flows fast in the spring due to how the substrate looks bowl shaped in the steam. Banks are extremely unstable but have a lot of vegetation. This crossing flows westward. U/s is naturalized heavily incised, severely eroded left bank, signs of high flow period and sediment deposistion. No fish present upon inspection. Naturalized diverse channel substrates.	Yes	2020-09-21 16:34	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-21 16:00	No	KC, DF	2020-09-21 15:52					C11-A-2		44.1208107	-79.6186008	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Agricultural field	Runoff	N/A	2	Phragmities lined, channel is approximately 20cm wide. Substrate looks wet, but channel was dry upon inspection	Yes	2020-09-21 16:34	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-21 16:00	Unknown	KC, DF	2020-09-21 17:07	Sunny	17		Holland River - Trib	C10-C-2		44.1193609	-79.6258758	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Approx 250m of Woodlot buffering stream on either side from agricultural fields	Runoff from agriculture fields	N/A	2	D/s and u/s were the same. Exposed bank on the left bank. Water only present in pools. No fish observed at time of inspection. Substrate was consistent throughout reach. Woodlot is dominated by willow trees, apple trees present throughout as well. Fairly steep valley from field off of right bank.Channel itself becomes a soft "U" shape the further downstream you go.	Yes	2020-09-21 18:42	kate.crawford@aecom.com_aecom

60636190	Bradford Bypass - Preliminary Design	2020-09-21 16:00	Unknown	DF, KC	2020-09-21 17:45	Sunny	20	Slow	Penville Creek - Trib	C10-A-3	East side (north bound lanes) HWY 400 adjacent, roadside drain	44.3824299	-79.7112166	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Ag and HWY	Road	N/A	2	Creek reach channelized adjacent to HWY 400, deeply insized (spring flow incision and permanent), watercourse banks densely shaded with hebaceous, cattail and some phragmites, flow was slow to moderate, mostly clay bottom with silt deposition.	Yes	2020-09-21 20:18	Devon.Fowler@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-14 16:00	No	DF, KC	2020-09-14 16:20	Sunny	13		Penville Creek - Trib	C10-A-2		44.1212228	-79.6352673	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Open field, catchment basin from surr	Runoff from highway 400	N/A	2	Heavy silt deposistion. Stream is heavily covered by various wet meadow terrestrial plant species, with thick coverage over stream banks are undercut which provide fish habitat but the banks are not eroded to the point where they are unstable. Crossing was completed slightly upstream due to lack of access (fence).	No	2020-09-14 16:43	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-14 16:00	No	DF, KC	2020-09-14 16:46		13	Moderate	Penville Creek - Trib	C10-A-1		44.1215948	-79.634257	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Meadow, drainage for agricultural field and highway 400	Runoff from agricultural fields and hwy 400	N/A	2	Thick wet meadow vegetation shading 100% of channel. Undercut banksand vegetation provide fish habitat but banks are very stable. Inciseded channel in wide floodplain with pockets of cattail marsh. Gravel bottom with heavy deposits of sediment and silt.	No	2020-09-14 17:00	kate.crawford@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-14 16:00	Unknown	DF, KC	2020-09-14 19:49	Sunny, mild, light w	18	Moderate	Holland River - Trib	C10-C-1	South of 9th Line	44.1207404	-79.6273352	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Forested (5 to 10m, both side), AG		N/A	2		Yes	2020-09-14 20:52	Devon.Fowler@aecom.com aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-14 16:00	Unknown	DF, KC	2020-09-14 15:07	Sunny, mild temp	15		Penville Creek - Trib	C10-A-4	North of Hwy 400 and 8th line	44.1140797	-79.6354	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Ag, HWY	Agriculture nuitrient load, road runoff	Box Culvert	2		Yes	2020-09-14 20:52	Devon.Fowler@aecom.com_aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-14 16:00	No	KC , DF	2020-09-14 20:17		15		Holland River - Trib	C10-B-1	Middle of corn field	44.12197011	-79.63077946	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Farm field		N/A	2	Swale in agricultural field	No	2020-09-14 21:21	kate.crawford@aecom.com aecom
60636190	Bradford Bypass - Preliminary Design	2020-09-14 16:00	No	DF, KC	2020-09-14 19:23	Sunny	15		Holland River - Trib	C10-B-2		44.1203859	-79.6289695	TOWN OF BRADFORD WEST GWILLIMBURY	Midhurst	Farm field		N/A	2	Swale in farm field	No	2020-09-14 21:21	kate.crawford@aecom.com aecom

Crossing ID	Specify if following data is related to upstream or downstream survey?	Section (Reach) Identifier:	Associated Wetland:	Section location:	Section Type:	Section Type Status:	Run:	Pool:	Riffle:	Flats:	Culvert:	Other:	Run - Percentage of area:	Run - Mean wetted depth (m):	Run - Mean wetted width (m):	Run - Mean bankful depth (m):	Run - Mean bankful width (m):	Pool - Percentage of area:	Pool - Mean wetted depth (m):	Pool - Mean wetted width (m):	Pool - Mean bankful depth (m):	Pool - Mean bankful width (m):	Riffle - Percentage of area:	Riffle - Mean wetted depth (m):	Riffle - Mean wetted width (m):	Riffle - Mean bankful depth (m):	Riffle - Mean bankful width (m):	Flats - Percentage of area:	Flats - Mean wetted depth (m):	Flats - Mean wetted width (m):	Flats - Mean bankful depth (m):	Flats - Mean bankful width (m):	Flats - Substrate Percentage:	Culvert - Mean wetted depth (m):	Culvert - Mean wetted width (m):	Culvert - Mean bankful depth (m):	Culvert - Mean bankful width (m):	Other - Percentage of area:	Percent Bedrock Substrate:	Percent Boulder Substrate:
C18-A-1	Downstream				Channelized	Intermittent						Yes																										100		
C18-A-1	Upstream				Channelized	Intermittent																																		
C17-F-1	Upstream				Channelized	Ephemeral																																		
C17-F-1	Downstream				Channelized	Ephemeral																																		
C18-B-1	Upstream				Channelized	Ephemeral																																		
C18-B-1	Downstream				Channelized	Ephemeral																																		
C18-C-1	Upstream				Channelized	Ephemeral																																		
C18-C-1	Downstream				Channelized	Ephemeral																																		
C18-E-1	Upstream				Channelized	Ephemeral																																		
C18-E-1	Upstream				Channelized	Ephemeral																																		
C18-D-1	Upstream				Channelized	Permanent	Yes						100			2																								
C18-D-1	Downstream				Channelized	Permanent	Yes						100			2																								
C17-E-1	Upstream				Channelized	Ephemeral																																		
C17-E-1	Downstream				Channelized	Ephemeral																																		
C17-D-1	Upstream				Channelized	Ephemeral																																		
C17-D-1	Downstream				Channelized	Ephemeral																																		
C17-C-1	Upstream				Channelized	Ephemeral																																		
C17-C-1	Downstream				Channelized	Ephemeral																																		
C17-A-1	Upstream	Upstream	Holland Marsh	Upstream	Steam or River	Permanent				Yes																		100	5		25	1.5								
C17-A-1	Downstream	Downstream	Holland River	Downstream	Steam or River	Permanent				Yes																		100	5	25	1.5	2								
C18-F-1	Upstream				Channelized	Permanent				Yes																		100												
C18-F-1	Downstream				Channelized	Intermittent				Yes																		100												
C18-H-1	Upstream	Us		Us	Channelized	Permanent				Yes																		100	0.2	1	1	1.2								
C18-H-1	Downstream	Ds		Ds	Channelized	Permanent				Yes																		100	0.2	1.5	0.5	1.75								
C23-A-1	Upstream				Channelized	Permanent				Yes																		100	0.1	0.75	1.5	3								
C23-A-1	Downstream				Channelized	Permanent				Yes																		100	0.08	0.5	1.5	3								
C22-A-1	Upstream				Channelized	Permanent				Yes																		100	0.15	1.5	0.5	2								
C22-A-1	Downstream				Channelized	Permanent																																		
C18-G-1	Upstream	Us		No habitat map		Ephemeral																																		
C18-G-1	Downstream																																							
C20-A-1	Downstream	Ds	Holland marsh	Ds	Steam or River	Permanent				Yes																		100	5	40	1	45								
C20-A-1	Upstream	Ds	Holland marsh		Steam or River	Permanent				Yes																		100	5	60	2	70								
C17-B-1	Upstream	Upstream		Upstream	Steam or River	Permanent				Yes																		100	1	2	0.5	2.5								
C26-A-1	Downstream				Steam or River	Intermittent																																		
C26-A-1	Upstream			Refer to C25-a-2 for upstream																																				
C17-B-1	Upstream	Us		Us	Channelized	Permanent				Yes																		100	1	2	0.5	2.5								
C17-B-1	Downstream	Ds			Channelized	Permanent				Yes																		100	1	2	0.5	2.5								
C25-A-2	Upstream				Steam or River	Intermittent																																		
C25-A-2	Downstream			Refer to C26-A-1 for downstream																																				
	Upstream																																							
	Downstream																																							
C25-A-1	Downstream																																							
C24-A-1	Downstream																																							
C12-A-1	Downstream				Steam or River	Intermittent																																		
C12-A-1	Upstream				Steam or River	Intermittent																																		
C16-A-2	Upstream				Steam or River	Ephemeral																																		
C16-A-2	Downstream				Steam or River	Ephemeral																																		
C16-A-1	Upstream				Steam or River	Permanent	Yes	Yes		Yes			20					30		30								50	0.2	1	1.5	4								
C16-A-1	Downstream																																							
C16-A-3	Upstream					Ephemeral																																		
C16-A-3	Downstream					Ephemeral																																		
C14-A-1	Upstream					Ephemeral																																		
C14-A-1	Downstream					Ephemeral																																		
C13-A-1	Upstream					Ephemeral																																		
C13-A-1	Downstream					Ephemeral																																		
C11-A-1flows	Upstream				Steam or River	Permanent		Yes	Yes									60	0.1	1.5	1	4	40	0.05	0.5	1	4													5
C11-A-1flows	Downstream				Channelized	Permanent		Yes		Yes								40	0.4	0.75	1.5	2.5						60	0.35	0.5	1.5	2.5								
C11-A-2	Downstream				Channelized	Intermittent																																		
C10-C-2	Upstream				Steam or River	Intermittent		Yes	Yes	Yes								40	0.05	0.2	1		30	3		1	3	30			1	3							5	
C10-A-3	Upstream	Us			Channelized	Permanent				Yes																		100	0.1	0.5	1	2								
C10-A-2	Upstream				Steam or River	Permanent	Yes		Yes				90										10																	
C10-A-2	Downstream				Steam or River	Permanent	Yes		Yes				90										10																	

C10-A-1	Downstream			Steam or River	Permanent			Yes	Yes												50	0.5			0.75	50	0.75	60
C10-A-1	Upstream			Steam or River	Permanent			Yes	Yes												50					50		60
C10-C-1	Upstream	Upstream	Upstream	River	Permanent	Yes	Yes				80	0.1	2	0.75	4	10	0.3	3	1	5								
C10-C-1	Downstream	Downstream	Downstream	Steam or River	Permanent	Yes	Yes	Yes			40	0.2	2	0.5	2.5	30	0.3	2.5	0.5	3	30	0.1	0.75	0.5	0.25			
C10-A-4	Downstream	Downstream 200m	D/s	Channelized	Permanent	Yes		Yes		Yes	90	0.2	0.75	2	4						10	0.05	0.75	2	4			
C10-A-4	Upstream																											
C10-B-1	Upstream				Ephemeral																							
C10-B-1	Upstream				Ephemeral																							
C10-B-2	Upstream				Ephemeral																							
C10-B-2	Downstream				Ephemeral																							

Percent Cobble Substrate:	Percent Gravel Substrate:	Percent Sand Substrate:	Percent Silt Substrate:	Percent Clay Substrate :	Percent Muck Substrate:	Percent Detritus Substrate:	Left Bank Stability:	Right Bank Stability:	Left Bank Description:	Right Bank Description:	None:	Undercut banks (%):	Boulders (%):	Cobbles (%):	Organic Debris (%):	Vascular Macrophytes Species:	Vascular Macrophytes Total Cover (%):	Vascular Macrophytes Instream Cover (%):	Vascular Macrophytes Overhanging Cover (%):	Woody Debris Description:	Woody Debris Total Cover (%):	Woody Debris Instream Cover (%):	Woody Debris Overhanging Cover (%):	Shore Cover % of steam shaded:	Comments:	No Vegetation:	Submergent Vegetation (%):	Predominant Submergent Species:	Floating Vegetation (%):	Predominant Floating Species:	Emergent Vegetation(%):	Predominant Emergent Species:	No Migratory Obstructions:	Seasonal Obstructions:	CreationDate	Creator	Crossing ID
		20	40	30	10		Stable	Stable																None											2020-09-15 17:05	kate.crawford@aecom.com_aecom	C18-A-1
							Stable	Stable																											2020-09-15 17:05	kate.crawford@aecom.com_aecom	C18-A-1
																																			2020-09-15 17:25	kate.crawford@aecom.com_aecom	C17-F-1
																																			2020-09-15 17:25	kate.crawford@aecom.com_aecom	C17-F-1
																																			2020-09-15 17:36	kate.crawford@aecom.com_aecom	C18-B-1
																																			2020-09-15 17:36	kate.crawford@aecom.com_aecom	C18-B-1
																																			2020-09-15 17:45	kate.crawford@aecom.com_aecom	C18-C-1
																																			2020-09-15 17:45	kate.crawford@aecom.com_aecom	C18-C-1
																																			2020-09-15 18:27	kate.crawford@aecom.com_aecom	C18-E-1
																																			2020-09-15 18:27	kate.crawford@aecom.com_aecom	C18-E-1
			30	60	10		Stable	Stable			Yes													1 - 29%	Few overhanging plants										2020-09-15 18:27	kate.crawford@aecom.com_aecom	C18-D-1
			30	40	10		Stable	Stable								Golden rod, aster, dandelion, pigweed, moss	10		10					1 - 29%	Some overhanging plants, channel has obviously been dredged before										2020-09-15 18:27	kate.crawford@aecom.com_aecom	C18-D-1
																																			2020-09-15 18:56	kate.crawford@aecom.com_aecom	C17-E-1
																																			2020-09-15 18:56	kate.crawford@aecom.com_aecom	C17-E-1
																																			2020-09-15 19:03	kate.crawford@aecom.com_aecom	C17-D-1
																																			2020-09-15 19:03	kate.crawford@aecom.com_aecom	C17-D-1
																																			2020-09-15 19:12	kate.crawford@aecom.com_aecom	C17-C-1
																																			2020-09-15 19:12	kate.crawford@aecom.com_aecom	C17-C-1
			40	30	30		Stable	Stable	Protected Bank	Protected Bank					30	Cattail, duckweed, arrrowhead,sedges, rushes,water lily,	20	10	10		10	5	5	1 - 29%			30		30		40		Yes		2020-09-15 19:22	Devon.Fowler@aecom.com_aecom	C17-A-1
			30	30	40		Stable	Stable	Protected Bank	Protected Bank					30	Same as u/s	20	10	10		10	5	5	1 - 29%			30		30	Duckweed, water lily	40	Cattail	Yes		2020-09-15 19:22	Devon.Fowler@aecom.com_aecom	C17-A-1
			50	30	10	10	Stable	Stable	Protected Bank	Protected Bank					40				30		60	30	30	30 - 59%											2020-09-15 20:36	kate.crawford@aecom.com_aecom	C18-F-1
			50	30	10	10	Stable	Stable	Protected Bank	Protected Bank					15	Asters, goldenrod, ash trees, buckthorn	60		60	A few smaller logs in stream, nothing that would block fish passage	10	5	5	60 - 89%		Yes									2020-09-15 20:36	kate.crawford@aecom.com_aecom	C18-F-1
			30	10	30	30	Slightly Unstable	Stable	Vulnerable Bank	Protected Bank					20		40				10			30 - 59%	Riparian species (dominated herabaceous, shrub a couple trees)		10	10			50	Cattail		Woody debris and vegetation has a seasonal potential to impede access	2020-09-15 20:42	Devon.Fowler@aecom.com_aecom	C18-H-1
			20	10	30	40	Stable	Slightly Unstable	Protected Bank	Vulnerable Bank					20	Cattail, sedges	50	30	20		30	5	25	1 - 29%							20			Vegetation	2020-09-15 20:42	Devon.Fowler@aecom.com_aecom	C18-H-1
	30	30	40				Slightly Unstable	Slightly Unstable	Protected Bank	Vulnerable Bank						Cattails, bullrush, golden rod, grass	70	30	40					1 - 29%	Some grass shading channel but not a lot						75	Cattails			2020-09-16 15:26	kate.crawford@aecom.com_aecom	C23-A-1
	30	30	40				Slightly Unstable	Slightly Unstable	Protected Bank	Vulnerable Bank						Cattails, grass	60	40	20					30 - 59%	Some goldenrod and other roadside plants hanging over stream						40	Cattails			2020-09-16 15:26	kate.crawford@aecom.com_aecom	C23-A-1
			30	30	40		Stable	Stable	Protected Bank	Protected Bank						Cattails, duckweed, grass (possibly quack grass)	95	45	50					90 - 100%					30	Duckweed	65	Cattails, grass (possibly quack grass)			2020-09-16 16:38	kate.crawford@aecom.com_aecom	C22-A-1
			40	30	30		Stable	Stable	Protected Bank	Protected Bank						Cattails,golden rod, asters	20		20					30 - 59%					40	Duckweed	20	Cattail			2020-09-16 16:38	kate.crawford@aecom.com_aecom	C22-A-1
					20	80															50	25	25	90 - 100%		Yes								Swale	2020-09-16 18:00	Devon.Fowler@aecom.com_aecom	C18-G-1
																																			2020-09-16 18:00	Devon.Fowler@aecom.com_aecom	C18-G-1
			30	40	20	10	Stable	Stable	Protected Bank	Protected Bank					5		20	10	10		20	5	15	None					20	Lily pad	50	Cattail	Yes		2020-09-16 20:02	Devon.Fowler@aecom.com_aecom	C20-A-1
			40	40	20		Stable	Stable	Protected Bank	Protected Bank					10		25	20	5		10	5	5	None					10	Water lily	15	Cattail	Yes		2020-09-16 20:02	Devon.Fowler@aecom.com_aecom	C20-A-1
			50	30	20		Stable	Stable	Protected Bank	Protected Bank					95	Duckweed, cattail	90	80	10		5		5	1 - 29%					75	Duckweed	25	Cattail, sedges	Yes		2020-09-17 15:07	Devon.Fowler@aecom.com_aecom	C17-B-1
																Cattails, phragmities, golden rod, aster, other wetland species	100	100						60 - 89%	The area is a wetland that is well vegetated						100	Cattails, phrag			2020-09-17 16:32	kate.crawford@aecom.com_aecom	C26-A-1
																																			2020-09-17 16:32	kate.crawford@aecom.com_aecom	C26-A-1
			50	30	20		Stable	Stable	Protected Bank	Protected Bank					10		80	60	20		10	5	5	None					50	Duckweed	50	Cattail	Yes		2020-09-17 16:32	kate.crawford@aecom.com_aecom	C17-B-1
			50	30	20		Stable	Stable	Protected Bank	Protected Bank					10		80	60	20		10	5	5	None					60	Duckweed	20	Cattail			2020-09-17 16:32	kate.crawford@aecom.com_aecom	C17-B-1
																Golden rod, aster, willow sp. Grass, a few cattails	90						90	90 - 100%											2020-09-17 17:32	kate.crawford@aecom.com_aecom	C25-A-2
																																			2020-09-17 17:32	kate.crawford@aecom.com_aecom	C25-A-2
																																			2020-09-17 17:45	kate.crawford@aecom.com_aecom	
																																			2020-09-17 17:45	kate.crawford@aecom.com_aecom	
																																			2020-09-17 18:15	kate.crawford@aecom.com_aecom	C25-A-1
																																			2020-09-17 18:36	kate.crawford@aecom.com_aecom	C24-A-1
			20	50		30									70	Trees, ferns, etc			100					90 - 100%											2020-09-17 20:19	kate.crawford@aecom.com_aecom	C12-A-1
			20	20	30	30										Trees, ferns, jewlweed, cattails								90 - 100%											2020-09-17 20:19	kate.crawford@aecom.com_aecom	C12-A-1
																																			2020-09-18 15:52	kate.crawford@aecom.com_aecom	C16-A-2
																																			2020-09-18 15:52	kate.crawford@aecom.com_aecom	C16-A-2
5	20	10	15	50			Slightly Unstable	Slightly Unstable	Vulnerable Bank	Vulnerable Bank				20	60									90 - 100%	Thicket covers majority of stream000	Yes									2020-09-18 15:52	kate.crawford@aecom.com_aecom	C16-A-1
																																			2020-09-18 15:52	kate.crawford@aecom.com_aecom	C16-A-1
																																			2020-09-18 16:01	kate.crawford@aecom.com_aecom	C16-A-3
																																			2020-09-18 16:01	kate.crawford@aecom.com_aecom	C16-A-3
																																			2020-09-18 16:58	kate.crawford@aecom.com_aecom	C14-A-1
																																			2020-09-18 16:58	kate.crawford@aecom.com_aecom	C14-A-1
																																			2020-09-18 18:19	kate.crawford@aecom.com_aecom	C13-A-1
																																			2020-09-18 18:19	kate.crawford@aecom.com_aecom	C13-A-1
30			25	40			Unstable	Slightly Unstable	Eroding Bank	Vulnerable Bank		20	40	40										90 - 100%	30%shrub. Wed Sept 23 @ 3:32 PM –	Yes								Low flow	2020-09-21 16:34	kate.crawford@aecom.com_aecom	C11-A-1flows
		10	10	80			Unstable	Unstable	Vulnerable Bank	Vulnerable Bank		40				Goldenrod, aster, willow, grass	80		80					60 - 89%											2020-09-21 16:34	kate.crawford@aecom.com_aecom	C11-A-1flows
																								90 - 100%	Phragmities grass, wet meadow species										2020-09-21 16:34	kate.crawford@aecom.com_aecom	C11-A-2
			10	10	35	40	Stable		Protected Bank	Vulnerable Bank		20	5		30	Moss, bluebead lily, wild grape	15		100	Fallen trees hanging over channel	30		30	60 - 89%	70% woodlot. Tues Sept 22 @ 1:46 PM – D/S of C10-C-2 minnows were	Yes								The creek only had water in a few pools at time of inspection	2020-09-21 18:42	kate.crawford@aecom.com_aecom	C10-C-2
			50	50			Slightly Unstable	Slightly Unstable	Protected Bank	Protected Bank		50			15		25	10	15					60 - 89%							10	Cattail, phragmites	Yes		2020-09-21 20:18	Devon.Fowler@aecom.com_aecom	C10-A-3
	10		85				Stable	Stable	Protected Bank	Protected Bank		80				ges, grass golden rod, aster, horsetail, bedstraw,	100	10	95					90 - 100%	Sedges, grass golden rod, aster, horsetail, bedstraw,						30	Watershield, cattails	Yes		44088.69671	kate.crawford@aecom.com_aecom	C10-A-2
10			90				Stable	Stable	Protected Bank	Protected Bank		60				ges, grass golden rod, aster, horsetail, bedstraw,	100	5	95					90 - 100%							30	Cattails, watershield			2020-09-14 16:43	kate.crawford@aecom.com_aecom	C10-A-2

	80	60				Stable	Stable	Protected Bank	Protected Bank	60				Meadow species	100	10	90				90 - 100%	Meadow plants, horsetail, cattail, asters, goldenrod, grasses		10	Cattails	Yes	2020-09-14 17:00	kate.crawford@aecom.com_aecom	C10-A-1
60		60				Stable	Stable	Protected Bank	Protected Bank	60				Wet Meadow species (same as d/s)	100	10	90				90 - 100%			10	Cattails	Yes	2020-09-14 17:00	kate.crawford@aecom.com_aecom	C10-A-1
				50	50	Stable	Stable	Vulnerable Bank	Vulnerable Bank			30	60	Grass	5	5		60	30	30	90 - 100%	Forested	Yes			Yes	2020-09-14 20:52	Devon.Fowler@aecom.com_aecom	C10-C-1
50				30	20	Slightly Unstable	Slightly Unstable	Vulnerable Bank	Vulnerable Bank	10	5	30	65					65	30	35	90 - 100%	Tues Sept 22 @ 1:46 PM – approx 670m D/S of C10-C-2 minnows were observed at the existing Line 8 crossing during Fluvial assessment. There was also an Algae Bloom occurring in this same location. The area was heavily vegetated with water-tolerant terrestrial plant species, and the water was deepest under the Line 8 bridge but ranged between ~5-10cm.	Yes			Yes	2020-09-14 20:52	Devon.Fowler@aecom.com_aecom	C10-C-1
	10		80			Stable	Stable	Protected Bank	Protected Bank					Cattail	40	30	10				1 - 29%			5		Yes	2020-09-14 20:52	Devon.Fowler@aecom.com_aecom	C10-A-4
																											2020-09-14 20:52	Devon.Fowler@aecom.com_aecom	C10-A-4
																											2020-09-14 21:21	kate.crawford@aecom.com_aecom	C10-B-1
																											2020-09-14 21:21	kate.crawford@aecom.com_aecom	C10-B-1
																											2020-09-14 21:21	kate.crawford@aecom.com_aecom	C10-B-2
																											2020-09-14 21:21	kate.crawford@aecom.com_aecom	C10-B-2

2021 Watercourse Field Data

ObjectID	GlobalID	Project Name:	Date:	Is stream realignment required	Collectors:	Time Started:	Weather - latitude	Weather - longitude	Location	Weather Conditions	Air Temperature (°C):	Velocity:	Name of Waterbody:	Crossing ID:	Location of Crossing:	Latitude	Longitude	MNRF District:	Surrounding Land Use:	Pollution Sources:
3	e3bf1e2e-b078-41c6-9577-97e9c2a0a716	<i>Bradford Bypass</i>	6/14/2021 16:00	Unknown	RH, AE	6/14/2021 14:03	44.1326981506489	-79.54489023608032	Bradford	overcast clouds	17.44		West Holland River	C17-A-1	West end of Hochreiter Road dead end.	44.13269815	-79.54489024	Aurora	Riparian grass and scrub land. Agricultural crop land use to the east, forested lands and wetland to the west.	Farm runoff.
4	20bb7783-43b8-4bbb-94de-e1f9bfc5051d	<i>Bradford Bypass</i>	6/14/2021 16:00	Unknown	RH, AE	6/14/2021 14:52	44.13267730807587	-79.54444161802869	Bradford	overcast clouds	17.71	Slow	Unnamed drainage channel	C17-B-1	20 m east of West Holland River. North of Hochreiter Road.	44.13267731	-79.54444162	Aurora	Riparian land and West Holland River to the west, crop land to the east.	Farm runoff.
5	28f38dd8-403e-43c8-92ff-823c0ee895c0	<i>Bradford Bypass</i>	6/14/2021 16:00	Unknown	RH, AE	6/14/2021 15:35	44.13239102647697	-79.54054009867335	Bradford	broken clouds	18.91		Unnamed	C17-C-1	North of Hochreiter Road.	44.13239103	-79.5405401	Aurora	Active crop field.	Farm runoff.
6	7f09b717-d038-4102-874a-367f8c00d273	<i>Bradford Bypass</i>	6/14/2021 16:00	Unknown	RH, AE	6/14/2021 15:46	44.13267303699582	-79.53995193352264	Bradford	broken clouds	19.01			C17-D-1		44.13267304	-79.53995193	Aurora		
7	a02b9bee-7fb1-4948-ba63-4ac285dfe004	<i>Bradford Bypass</i>	6/14/2021 16:00		RH AE	6/14/2021 15:49	44.132808395322314	-79.53945781461248	Bradford	broken clouds	19.01			C17-E-1		44.1328084	-79.53945781	Aurora		
8	c903a927-aeec-4b6d-9965-16159ba6ba2e	<i>Bradford Bypass</i>	6/14/2021 16:00			6/14/2021 15:53	44.13292749941054	-79.53894262961427	Bradford	broken clouds	19.01			C17-F-1		44.1329275	-79.53894263	Aurora		
9	224ee247-dd04-49ff-b6a2-be657af62355	<i>Bradford Bypass</i>	6/14/2021 16:00	Unknown	RH AE	6/14/2021 16:03	44.133419943692786	-79.53803501027153	Bradford	broken clouds	20.09		Unnamed drainage ditch.	C18-A-1	North of Hochreiter Road in farm field.	44.13341994	-79.53803501	Aurora	Active crop farm field.	Farm runoff.
10	0d031982-efb4-46e1-832b-685f92c0bf79	<i>Bradford Bypass</i>	6/14/2021 16:00		RH, AE	6/14/2021 16:16	44.13323942915909	-79.5369402565779	Bradford	broken clouds	20.64			C18-B-1		44.13323943	-79.53694026	Aurora		
11	fb79a0fc-3a88-4a01-bb6b-d6aaaa2869d2	<i>Bradford Bypass</i>	6/14/2021 16:00		RH, AE	6/14/2021 16:25	44.133485888892544	-79.53497307357968	Bradford	broken clouds	20.75			C18-C-1		44.13348589	-79.53497307	Aurora		
12	44b0f3f4-8b63-4fb8-9f84-b14528af128d	<i>Bradford Bypass</i>	6/14/2021 16:00	Unknown	RH, AE	6/14/2021 16:30	44.13374547256113	-79.53382081127391	Bradford	broken clouds	21.01		Unnamed drainage channel	C18-D-1	North side of Hochreiter Road.	44.13374547	-79.53382081	Aurora	Farm field to the north	Farm field runoff.
13	517bd292-6c80-4ee5-988f-204a38d45364	<i>Bradford Bypass</i>	6/14/2021 16:00	Unknown	RH, AE	6/14/2021 17:51	44.134525142653125	-79.52785270824953	Bradford	broken clouds	18.93		Unnamed drainage feature	C18-F-1	South of Hochreiter Road on east side of Bathurst Stree.	44.13452514	-79.52785271	Aurora	Forested area to the west	Road runoff.
14	f3a1be40-c4d4-4b9b-af61-d80343fd95b8	<i>Bradford Bypass</i>	6/14/2021 16:00	Unknown	RH AE	6/14/2021 18:01	44.13379598742511	-79.52750762691119	Bradford	broken clouds	18.59		Unnamed drainage channel	C18-H-1	East side of Bathurst Drive, north and south of marina entrance	44.13379599	-79.52750763	Aurora	Private property to the east of Bathurst Street, surrounded by forested lands.	Road runoff and garbage.
15	3d436a8a-ad4f-42df-862c-d367ee9ebe50	<i>Bradford Bypass</i>	6/15/2021 16:00	Unknown	RH, AE	6/15/2021 14:32	44.1363815539055	-79.51306870755327	Bradford	clear sky	16.6	Slow	Holland River east branch	C20-A-1	Immediately southeast of Albert's Marina on main branch of Holland River east branch.	44.13638155	-79.51306871	Aurora	Riparian forests along upstream assessment area and east bank, marina at northwest corner of assessment area.	Marina boat traffic and pollutants.
16	c0e9cad3-f96e-4d80-bbd0-8ccb0291e75c	<i>Bradford Bypass</i>	6/15/2021 16:00	Unknown	RH AE	6/15/2021 19:07	44.13231573088903	-79.56175038868179	Bradford	scattered clouds	19.73		Unmanaged drain	C16-A-1	600 m east of Yon	44.13231573	-79.56175039	Midhurst	Active farm field planted with winter wheat.	Farm runoff.
17	4123d2f8-0365-4b99-9f7b-78623ae56d23	<i>Bradford Bypass</i>	6/15/2021 16:00			6/15/2021 17:23	44.14603633790304	-79.4782322150217	East Gwillimbury	scattered clouds	19.93		Unnamed drainag	C23-A-1	Roadside ditch on	44.14603634	-79.47823222	Aurora	Roadside drainage ditches and sod field to the east.	Roadside and farm runoff.
18	4938ac74-c5bc-4bcb-8d7f-abce231acb1e	<i>Bradford Bypass</i>	6/15/2021 16:00	Unknown	RH AE	6/15/2021 16:51	44.14180160634798	-79.48789155704068	East Gwillimbury	scattered clouds	20.15		Unnamed drainag	C22-A-1	830 m west of 2n	44.14180161	-79.48789156	Aurora	Active farm fields.	Farm runoff.
19	f6a95b71-d7c5-4f45-87c4-a467ade989f3	<i>Bradford Bypass</i>	6/17/2021 16:00	Unknown	RH AE	6/17/2021 13:09	44.15130496394622	-79.4561691157971	East Gwillimbury	clear sky	16.93		Unnamed	C25-A-1	250 m west of Les	44.15130496	-79.45616912	Aurora	Active crop fields.	Farm runoff.
20	8cff45a6-6779-4938-aa7f-4ce116c8e674	<i>Bradford Bypass</i>	6/17/2021 16:00		RH AE	6/17/2021 13:37	44.15159054746979	-79.46056177130393	East Gwillimbury	scattered clouds	18.28		Unnamed	C24-A-1	650 m west of Les	44.15159055	-79.46056177	Aurora	Active crop field.	Farm runoff.
21	ab53cdad-0269-4ccc-b20e-eb353b33ed80	<i>Bradford Bypass</i>	6/17/2021 16:00			6/17/2021 13:55	44.15269091174686	-79.45400101351947	East Gwillimbury	scattered clouds	18.63		Unnamed	C25-B-1	10 m east of Leslie	44.15269091	-79.45400101	Aurora	Active crop field.	Farm field runoff
22	948f6940-fde1-4812-9fed-e1d2124b9192	<i>Bradford Bypass</i>	6/17/2021 16:00	Unknown	RH, AE	6/17/2021 14:06	44.155502821054306	-79.4546225661305	East Gwillimbury	overcast clouds	24.18	Slow	Unnamed.	C25B-1	Crossed Leslie St 1	44.15550282	-79.45462257	Unknown	Crop and pasture fields.	Farm field and road runoff.
23	7b4486c2-2cd7-49d1-acec-2a35395884fa	<i>Bradford Bypass</i>	6/17/2021 16:00	Unknown	RH AE	6/17/2021 15:06	44.150488180216435	-79.44055584388907	East Gwillimbury	scattered clouds	21.06		Unnamed.	C25-A-2	Hwy 404 west side, 1 km south of Holborn Road.	44.15048818	-79.44055584	Aurora	Crop field to the northwest, forested area to the south.	Farm field runoff.
24	7a73804e-ed01-4a19-88a8-53df1856f66a	<i>Bradford Bypass</i>	6/17/2021 16:00	Unknown	RH AE	6/17/2021 15:27	44.151240670985096	-79.43956727464945	East Gwillimbury	scattered clouds	20.93		Unnamed	C26-A-1	East side of Hwy 404, 1 km south of Holborn Road.	44.15124067	-79.43956727	Aurora	Natural lands consisting of grass and scrubland.	Highway runoff.

ObjectID	Existing Structure Type:	Existing Structure Width (m2):	Existing Structure Height (m2):	Downstream Section (Reach) Identifier:	Downstream Section location:	Downstream Section Type:	Downstream Section Type Status:	Downstream Pool:	Downstream Flats:	Downstream Run Percentage of area:	Downstream Run Mean wetted depth (m):	Downstream Run Mean wetted width (m):	Downstream Run Mean bankful depth (m):	Downstream Run Substrate Type:	Downstream Run Substrate Percentage:	Downstream Pool - Percentage of area:	Downstream Pool - Mean wetted depth (m):	Downstream Pool - Mean wetted width (m):	Downstream Pool - Mean bankful depth (m):	Downstream Pool - Mean bankful width (m):	Downstream Pool - Substrate Type:	Downstream Pool - Substrate Percentage:	Downstream Flats - Percentage of area:	Downstream Flats - Mean wetted depth (m):	Downstream Flats - Mean wetted width (m):	Downstream Flats - Mean bankful depth (m):	Downstream Flats - Mean bankful width (m):	Downstream Flats - Substrate Type:	Downstream Flats - Substrate Percentage:
3	N/A			Downstream	Downstream	Steam_River	Permanent		Yes														100		95		260		
4	N/A			Downstream	Mid ROW to downstream	Steam_River	Permanent		Yes														100	1.5	5	2.5	7	Muck	60
5	N/A																												
6																													
7																													
8																													
9						Channelized	Ephemeral		Yes														100	0.23	1	0.5	1.6	Muck	100
10																													
11																													
12	N/A			Downstream.		Channelized	Intermittent		Yes														100	0.25	1.1	1.5	4.5	Muck	90
13	N/A			Downstream	Centre ROW to north 150 m,	Channelized	Permanent		Yes														100	0.7	5	1.5	7	Detritus	70
14	CSP			Downstream.	Centre ROW to north 150 m.	Channelized	Permanent		Yes														100	0.25	2.2	1.2	5	Detritus	80
15	N/A			Downstream	Centre ROW to downstream	Steam_River	Permanent		Yes														100		70		110	Silt	80
16	N/A						Ephemeral																						
17	N/A			Downstream	Centre ROW south 80 m.	Channelized	Ephemeral																						
18	N/A			Downstream	Centre ROW to north 50 m.	Channelized	Ephemeral																						
19	N/A			Downstream			Ephemeral																						
20	N/A																												
21	N/A																												
22	CSP	2	2	Downstream	Culvert outlet to downstream	Steam_River	Ephemeral	Yes	Yes							20	0.15	1.2	0.5	4	Silt	100	80	0.05	0.15	0.5	4	Detritus	80
23	Box Culvert																												
24	Box Culvert																												

ObjectID	Downstream Left Bank Stability:	Downstream Right Bank Stability:	Downstream Left Bank Description:	Downstream Right Bank Description:	Downstream Habitat None:	Downstream Organic Debris (%):	Downstream Vascular Macrophytes Species:	Downstream Vascular Macrophytes Total Cover (%):	Downstream Vascular Macrophytes Instream Cover (%):	Downstream Vascular Macrophytes Overhanging Cover (%):	Downstream Woody Debris Description:	Downstream Woody Debris Total Cover (%):	Downstream Woody Debris Instream Cover (%):	Downstream Woody Debris Overhanging Cover (%):	Downstream Shore Cover % of steam shaded:	Downstream Shore Cover Comments:	No Downstream Vegetation:	Downstream Submergent Vegetation (%):	Downstream Predominant Submergent Species:	Downstream Floating Vegetation (%):	Downstream Predominant Floating Species:	Downstream Emergent Vegetation(%):	Downstream Predominant Emergent Species:	Downstream No Migratory Obstructions:	Downstream Permanent Obstructions:	Downstream Seasonal Obstructions:	Downstream Spawning Critical Habitat:	Downstream Potential Enhancement Opportunities:	Downstream Additional Comments:	Upstream Section (Reach) Identifier:
3	Stable	Stable	Protected Bank	Protected Bank		15	Cattails, Phragmites	20	90	10	No woody debris observed.				1 to 29 Pct	Dense 45 m cattail and phragmites thicket along shoreline on east side, 85 m on west side. Provides little overhanging cover or shade to main channel.				15	Floating pond lily, duckweed, algae.	10	Cattail		None	None			Large wide slow moving watercourse. No visible flow. Similar habitat throughout consisting of cattail riparian lands within bankfull channel and pond lillies along cattail border. No visible structure or channel features. Cattail thicket along shoreline can be walked through, wet soils underneath.	Upstream
4	Stable	Unstable	Protected Bank	Vulnerable Bank		40	Cattails	15	100		None observed.				1 to 29 Pct	Steep berm bank on the west side with small shrubs amd riparian cattails. East bank has narrow (1m) strip of cattails before actively farmed crop		60	Milfoil	80	Duckweed	10	Cattail		None observed.				Channelized drainage channel along active crop field. Similar habitat throughout. Small meander in channel along earth berm to the west.	Upstream
5																														
6																														
7																														
8																														
9	Unstable	Unstable	Vulnerable Bank	Vulnerable Bank	Yes										None		Yes									Downstream outlet into ditch at Hochreiter Road is elevated, which cuts off access into ditch.			Similar channel feature as others in field but is holding water. Small minnows observed in channel. Likely accessed ditch during overnight rainfall. Poor seasonal habitat at best. Fish become stranded after rainfalls. Algae observed in channel. Painted turtle observed in channel.	
10																														
11																														
12	Slightly Unstable	Moderately Unstable	Vulnerable Bank	Eroding Bank		10									1 to 29 Pct	Steep banks along each side, sparse shrubs provide little shade.		50	Milfoil and algae.					Yes					Channelized ditch feature along Hochreiter Road with similar features as upstream end. Slightly deeper water. No visible flow with algae observed. Poor seasonal fish habitat as best. Dense algae and submerged vegetation.	Upstream
13	Stable	Stable	Protected Bank	Protected Bank		50	Cattails and grasse	5	50	50	Abundance of larg	40	50	50	60 to 89 Pct	Abundance of shade from riparian forest and woody debris. Channel is set back from Bathurst Street which allows for trees and shrubs to grow on both sides of channel.				10	Duckweed	5	Cattails and grasses.	Yes					No observable flow throughout assessed area. No connection observed underneath Hochreiter Road to connect standing water in either channel/ditch. Deep 80cm pool of standing water at SW corner of Hochreiter Road and Bathurst. Ditches do not appear to be directly connected to any other watercourse systems. Dense overhanging trees provide 80+% shading through assessed area. Assessed channels appear to be ditch features that	Upstream
14	Stable	Stable	Protected Bank	Protected Bank		40	Cattails, grasses.	50	80	20	Dense woody deb	20	60	40	30 to 59 Pct	Riparian grasses and cattails along Bathurst Street provide little shading, overhanging trees and shrubs east of Bathurst along marina entrance provide 70%+ shading.		30	Milfoil	40	Duckweed	25	Cattails and grasses.			Potentially low seasonal water levels limiting connectivity to surrounding watercourses.			No flow observed throughout assessed reach. No flow direction observed at entrance culvert underneath marina driveway. Dense duckweed and cattails at northeast channel at Bathurst and marina entrance. East along marina entrance on south side, channel is well shaded by overhanging trees and woody debris with minimal floating or emerging aquatic vegetation in this area.	Upstream
15	Stable	Stable	Protected Bank	Protected Bank		10	Cattails, grasses, p	25	80	20	Large woody debr	10	90	10	1 to 29 Pct	Cattails border entire river shoreline, which reduces shading from trees and shrubs.		10	Milfoil	20	Pond lilly	10	Cattail	Yes				Maintain riparian vegetation (floating pond lilies and cattails) along with woody debris to maintain fish ha that structure.	Channel is uniform in shape and size throughout upstream and downstream assessment areas. Similar aquatic vegetation, riparian lands, and vegetation. Downstream marina at northwest corner of assessment area was not overly active in terms of boat traffic at time of investigation. Turbid water present in creek with abundant floating vegetation and woody debris along shoreline on both sides.	Upstream
16	Unstable	Unstable																											Not fully completed - downstream section was located on property where PTE was not granted. Downstream section was observed to run through actively farmed crop field. Channel consists of a drainage swale with no defined feature and was dry.	Upstream
17					Yes										None	Sparse cattails with grass throughout entire ditch area	Yes												Not fish habitat. Dry ditch feature with sparse cattails and grasses. No water observed throughout entire ROW, and no direct connections observed to nearby watercourses. Sod farm to the east, crop field to the west. Upstream and downstream sections are the same - uniform ditch drainage feature.	
18	Stable	Stable	Protected Bank	Protected Bank											1 to 29 Pct	Riparian grasses present both north of the culvert and around the north pond feature. No riparian trees or shrubs, so very little shading of the pond or channel.				95	Algae and duckweed.					Dry channel observed south of pond.			Channel was dry north of culvert to pond. Pond was covered in consistent layer of algae and duckweed. Pond connects to additional pond further north under farm access road. Drainage ditches enter channel from hedgerows to the east and west, both of which were also dry. Pond is used for watering field - pumps installed.	
19																													No defined feature. 35 m wide grassed area with sparse trees and shrubs. Active crop fields to the east and west. No wetted area found. Slopes towards active farm field to the north.	Upstream
20																													Not fish habitat. No defined feature. Agricultural swale through active crop field. No feature observed downslope through more farm fields.	
21																													No fish habitat. No defined feature. Slight swale observed in farm field with minimal crop disturbance. Drains into Leslie St ditch.	
22	Stable	Stable	Protected Bank	Protected Bank	Yes										30 to 59 Pct	Dense grasses and shrubs along poorly defined channel downstream of culvert.	Yes												Poorly defined channel downstream of culvert in grassland riparian area. Channel continues into trees area but no PTE. Small pool outlet at culvert outlet with silty substrate. No minnow observed. Trickle flow observed in narrow poorly defined channel that flows through grassy ROW section for 5 m before entering private lands.	Upstream
23																													Downstream section assessed under	Upstream
24																														

25	409d5b4d-bd9c-4c2a-994a-4d136f3006c6	<i>Bradford Bypass</i>	6/29/2021 16:00	Unknown	RH, AE	6/2/2021 12:45	44.12401517104204	-79.60622177615622	Bradford West Gw	Clear, sunny, no p	14		Unnamed	C12-A-1	East side of Sideroad 10, 650 m north of Line 8	44.12401517	-79.60622178	Midhurst	Residential and forested lands to the north and east, concrete and aggregate company to the south, crop fields to the west of Sideroad 10.	Potential farm field and road runoff, off site runoff from concrete and aggregate company to the south.	N/A			downstream	Centre ROW to downstream 125 m to the northe		Ephemeral																																																					No fish habitat observed. Feature is characterized as a drainage swale with no defined features. Lowland area with soggy/wet ground that drains through shrub thicket before entering small wetland feature (5x5 m). Abundance of cattails, sedges, grasses. No substrate sorting, small pockets of standing water in cattails. Sparse trees and dense shrubs shade area to the northeast of road. Feature enters wooded lands further to the northeast on private lands.	Upstream
26	2561c621-aa86-48cc-9906-8ac54b6a8644	<i>Bradford Bypass</i>	6/2/2021 16:00	Unknown	RH AE	6/2/2021 14:00	44.127700793441925	-79.58526815849902	Bradford	16 degC, sunny, n	28.05		Unnamed	C14-A-1	Between Line 8 and Line 9, 300 m northeast of the terminus of Crossland Boulevard.	44.12770079	-79.58526816	Midhurst	Forested land.	Farm field runoff from upland.	N/A																																																					Not fish habitat. No defined feature upstream or downstream of ROW crossing area. Poorly defined forested swale through dense trees. Opening in forested area found at ROW crossing location, but area was dry with no standing water and no wet soils. Approximately 200 m downstream there is a poorly defined feature that was dry, with cattails and pockets of moist soils.	
27	91baf8e4-dd35-4304-8cfd-8cf7925ee330	<i>Bradford Bypass</i>	6/2/2021 16:00	Unknown	RH AE	6/2/2021 14:30	44.127233274581414	-79.59037900491876	Bradford	Clear, sunny, no p	28.05		Unnamed	C13-A-1	170 m north of Crossland Boulevard between two active farm fields.	44.12723327	-79.590379	Midhurst	Active crop farm fields.	Farm field runoff.	N/A				Entire ROW crossing location.	Channelized	Intermittent			100	0.03	0.2	0.1	Silt																Slightly Unstable	Slightly Unstable			Yes																								Similar habitat upstream and downstream. Entire feature within the ROW consists of a 15 m grassed area with a channelized feature through the middle. Dense grasses noted along the wetted channel with clear water observed. No pools observed. Channel originated from hedgerow upstream to the north, and enters scrubland to the south with sparse shrubs and trees. Patch of phragmites noted at the downstream end. Farm field access road cuts through center of grasses riparian feature and disrupts channel flow and form. Likely poor seasonal fish habitat at best, may become dry in the summer months.	
28	db14531e-02d5-4f7c-bb39-3915d7e1efc4	<i>Bradford Bypass</i>	6/2/2021 16:00	Unknown	RH AE	6/2/2021 15:30	44.11956216222501	-79.62605594352354	Bradford West Gw	Clear, sunny, no p	28.92		Unnamed	C10-C-1	Between Line 8 an	44.11956216	-79.62605594	Midhurst	Forested lands.	Farm field runoff upland.	N/A			Downstream	ROW centre to downstream 5	Steam_River	Permanent		Yes														100	0.15	4	1	6	Silt	60	Slightly Unstable	Slightly Unstable	Vulnerable Bank	Vulnerable Bank		10					Log jams observed	15	75	25	60 to 89 Pct	Forested lands provide 80% shading of creek	Yes								No permanent obstructions observed.	Log jams may hinder fish passage.			Low water levels observed in creek, no visible flow noted. Riparian forest lands within valley lands. No aquatic vegetation observed. No aquatic life noted - no fish, frogs, tadpoles observed.	Upstream
29	ae461c85-2a51-4227-8210-c7a69dd2721a	<i>Bradford Bypass</i>	6/2/2021 16:00	Unknown	RH AE	6/2/2021 16:05	44.649577401428125	-79.67345216061844	Waubaushene	Sunny, no precipit	22		Unnamed	C10-C-1	550 m south of Li	44.6495774	-79.67345216	Midhurst	Forested lands in valley	Potential farm field runoff u	N/A			Downstream	Centre ROW to downstream 5	Steam_River	Permanent			100	0.15	1.5	0.8	Silt	60															Slightly Unstable	Slightly Unstable																											Similar channel morphology and characteristics as upstream end. Potential fish barrier due to low seasonal flows. Feature could be considered intermittent. No fish observed and efishing not attempted due to low water levels - no suitable pools or locations to fish.	Upstream
30	ce5c8485-8667-441b-b477-9c7d6f05c8da	<i>Bradford Bypass</i>	6/2/2021 16:00	Unknown	RH AE	6/2/2021 17:40	44.64953686630316	-79.6734254305721	Waubaushene	Clear skies, sunny,	22			C11-A-2	900 m west of Sideroad 10, 550 m north of Line 8.	44.64953687	-79.67342543	Midhurst																																																										Not fish habitat. Feature consists of a farm field drainage swale at the upslope end to the east, which it originated in an actively cropped farm field. A poorly defined eroded swale was observed in the hedge row, and a tile drain outlet was noted in the forested area which outlets into a man-made ditch. The ditch runs along the southern edge of the forested area, 3-5 m into the forest from the fields edge. Drainage channel outlets into C-11-A-1 near a phragmites patch. Channel was entirely dry at time of site visit.	
31	aeeff4ce-090e-4ea2-8ba1-5732d3105a28	<i>Bradford Bypass</i>	6/2/2021 16:00	Unknown	RH AE	6/2/2021 17:00	44.12138076402548	-79.61838655341379	Bradford West Gw	Clear sunny skies	20.25		Unnamed	C11-A-1	650 m north of Line 8, 950 m west of Sideroad 10.	44.12138076	-79.61838655	Midhurst	Forested lands in isolated tree patch surrounded by cropped fields.	Farm field runoff	N/A			Downstream	Centre ROW to downstream 50 m.	Steam_River	Permanent																																																	Similar channel morphology and characteristics as upstream end. No significant pools features observed at downstream end. Channel enters farm field and channelized drainage swale between two farm fields, which probably provides poor fish habitat. Clay substrate noted through run sections at downstream end.	Upstream
32	64a37d85-3996-4f57-b138-e7f7cd297670	<i>Bradford Bypass</i>	8/12/2021 16:00	Unknown	RH, KC	8/12/2021 13:01	44.153794461643024	-79.45029862247927	East Gwillimbury	overcast clouds	23.51		Unnamed	C25-C-1	375 m northeast of Leslie St.	44.15379446	-79.45029862	Aurora	Active crop farm field.	Farm field runoff.	Other			Downstream	Centre ROW to downstream 200 m	Steam_River	Intermittent																							Stable	Stable	Protected Bank	Protected Bank	Yes										30 to 59 Pct	Dense grasses and cattails with sparse riparian trees. 30 m wide riparian section with grasses and trees between two active crop fields.						100	Cattails and grasses.		Pond drop outlet structure. Appears to be a type of hickenbottom, but unclear. May be simple overflow type structure. Not passable upstream for fish. May allow unintended downstream passage of fish during storm events.				Online pond with outlet pool immediately downstream of large earth berm. Earth berm approximately 5 m wide at top, and 8 m from top to bottom on downstream (west) side. Channel is dry downstream of outlet pool with moist soils. No pools or standing water observed. Patch of Phragmites around outlet pool.	Upstream
33	9cd395a0-90ab-4b47-8630-9ee561535767	<i>Bradford Bypass</i>	8/12/2021 16:00	Unknown	RH, KC	8/12/2021 15:02	44.131129665944705	-79.55312653764		overcast clouds	25.28			C16-A-1	200 m east of Arte	44.13098843	-79.553931	Midhurst	Forested and Meadow lands along railroad tracks.	Industrial site runoff upstream.				Downstream	Railway crossing downstream 50 m	Steam_River	Permanent	Yes	Yes							20	1	1.2			Muck		80	1	1.2			Muck		Stable	Stable	Protected Bank	Protected Bank		20									1 to 29 Pct	Overhanging cattails and grasses shaded parts of the channel, grass hummocks provide additional shading.			30	Milfoil		20	Cattails and grasses.				Known Northern Pike spawning habitat.		Wetland feature with multiple channel and backwater locations. No defined bankfull or channel banks. Dense riparian cattails and grasses made access difficult along with unknown PTE for railway.	Upstream
34	b4b8b2be-34f4-40ab-b57d-fe0f8886dd02	<i>Bradford Bypass</i>	8/12/2021 16:00	Unknown	RH KC	8/12/2021 14:02	44.13398295360573	-79.52927157141826	Bradford	overcast clouds	24.3			C18-G-1		44.13398295	-79.52927157	Aurora																																																										Not fish habitat. Dry lowland area in forested area. Not directly connected to fish habitat	
35	3fc15a76-f06a-49f0-af19-c1a1f52a506b	<i>Bradford Bypass</i>	8/12/2021 16:00	Unknown	RH KC	8/12/2021 14:20	44.133387868221135	-79.53264210719284	Bradford	overcast clouds	24.29			C18-E-1		44.13338787	-79.53264211	Aurora																																																									Not fish habitat. Dry lowland area in forested area. Not directly connected to fish habitat	
36	48f2b264-b6c7-4730-97a5-6aa35026633c	<i>Bradford Bypass</i>	8/18/2021 16:00	Unknown	RH KC	8/5/2021 15:50	44.131875465062116	-79.55950458606661	Bradford	overcast clouds	24.25			C16-A-2		44.13187547	-79.55950459	Midhurst																																																									Not fish habitat. Dry swale in actively farmed crop field. Planted with corn at time of site visit. Poorly defined feature. Not directly connected to fish habitat.	
37	dd674f18-04ac-41ca-9a03-8a90b97fc66e	<i>Bradford Bypass</i>	9/30/2021 16:00	Unknown	RH, KC	9/30/2021 13:36	44.128425949543924	-79.56870002144015	Bradford	clear sky	12.93	Slow	Unnamed	CR4 crossing	220 m north of 8th line on Yonge St.	44.12842595	-79.56870002		Residential subdivision on the west side of Yonge St, crop farm land on the east side.	Residential and road runoff, farm field runoff.	Box Culvert	1.5	1	CR4 downstream	CR4 downstream	Steam_River	Permanent			100	0.15	1.2	0.2	Detritus	80															Stable	Stable	Protected Bank	Protected Bank				100	100						90 to 100 Pct	Dense phragmites patch 20-30 m wide which channel flows through. No defined or specific morphology observed due to dense phragmites.						100	Phragmites		Culvert not passable at upstream end due to shallow laminar flow overtop of concrete bottom.	Dense phragmites may choke out channel in some locations, making fish passage difficult - especially during low flow periods.		Remove Phragmites along channel banks.	Channel inspected 150-200 m downstream. Dense phragmites were still present. Water was still present in channel but no observable flow.	CR4 crossing upstream

SiteID	Upstream Section Location	Upstream Section Type	Upstream Section Type Status	Upstream Run	Upstream Pool	Upstream Riffle	Upstream Flats
3	Upstream	Steam_River	Permanent				Yes
4	[illegible]	Steam_River	Permanent				Yes
5							
6							
7							
8							
9							
10							
11							
12		Channelized	Intermittent				Yes
13	Centre ROW to south 150 m.	Channelized	Ephemeral				Yes
14	ROW centre to south 150 m.	Channelized	Intermittent				Yes
15	ROW centre to upstr	Steam_River	Permanent				Yes
16	Centre ROW upstream to the west 200m		Ephemeral				
17							
18	Not completed due t	Channelized	Ephemeral				
19			Ephemeral				
20							
21							
22	Culvert inlet upstream 50 m.	Steam_River	Ephemeral		Yes	Yes	Yes
23	ROW to upstream 50 m	Steam_River	Ephemeral				
24							

SiteID	Upstream Run Percentage of Area	Upstream Run Mean wetted depth (m)	Upstream Run Mean wetted width (m)	Upstream Run Mean bankful depth (m)	Upstream Run Mean bankful width (m)	Upstream Run Substrate Type	Upstream Run Substrate Percentage	Upstream Pool Percentage of Area	Upstream Pool Mean wetted depth (m)	Upstream Pool Mean wetted width (m)	Upstream Pool Mean bankful depth (m)	Upstream Pool Mean bankful width (m)	Upstream Pool Substrate Type	Upstream Pool Substrate Percentage
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22								15	0.3	0.8	1.1	3	Clay	90
23														
24														

SiteID	Upstream Riffle Percentage of Area	Upstream Riffle Mean wetted depth (m)	Upstream Riffle Mean wetted width (m)	Upstream Riffle Mean bankful depth (m)	Upstream Riffle Mean bankful width (m)	Upstream Riffle Substrate Type	Upstream Riffle Substrate Percentage	Upstream Flats Percentage of Area	Upstream Flats Mean wetted depth (m)	Upstream Flats Mean wetted width (m)	Upstream Flats Mean bankful depth (m)	Upstream Flats Mean bankful width (m)	Upstream Flats Substrate Type	Upstream Flats Substrate Percentage
3								100		80		150		
4								100	1.5	3	2.5	7	Muck	60
5														
6														
7														
8														
9														
10														
11														
12								100	0.1	1	1.5	4.5	Muck	95
13								100	0.05	0.8	0.6	3	Detritus	70
14								100	0.35	2	1.2	4	Muck	80
15								100		70		110	Silt	80
16														
17														
18														
19														
20														
21														
22	10	0.04	0.3	1.1	3	Cobble	90	85	0.1	0.4	1.1	3	Clay	90
23														
24														

SiteID	Upstream Left Bank Stability	Upstream Right Bank Stability	Upstream Left Bank Description	Upstream Right Bank Description	Upstream Undercut banks (%)	Upstream Boulders (%)	Upstream Cobbles (%)	Upstream Organic Debris (%)	Upstream Vascular Macrophyte Species	Upstream Vascular Macrophyte Total Cover (%)	Upstream Vascular Macrophyte Instream Cover (%)	Upstream Vascular Macrophyte Overhanging Cover (%)
3	Stable	Stable	Protected Bank	Protected Bank				5	Cattails, phragmites	25	90	10
4	Unstable	Stable	Vulnerable Bank	Protected Bank				10	Cattails	15	85	15
5												
6												
7												
8												
9												
10												
11												
12	Unstable	Moderately Unstable	Vulnerable Bank	Eroding Bank					Cattails	3	100	
13	Stable	Stable	Protected Bank	Protected Bank					Cattails	20	75	25
14	Stable	Stable	Protected Bank	Protected Bank				20	Cattails, grasses	70	85	15
15	Stable	Stable	Protected Bank	Protected Bank	5			10	Cattails, pond lillies, milfoil, grasses	25	90	10
16	Moderately Unsta	Moderately Unsta	Eroding Bank	Eroding Bank								
17												
18												
19												
20												
21												
22	Stable	Stable	Protected Bank	Protected Bank			10		Grasses	70		70
23												
24												

SiteID	Upstream Woody Debris Description	Upstream Woody Debris Total Cover (%)	Upstream Woody Debris Instream Cover (%)	Upstream Woody Debris Overhanging Cover (%)	Upstream Stream Cover % of stream shaded	Upstream Comments	Upstream No Vegetation	Upstream Submergent Vegetation (%)	Upstream Predominant Submergent Species	Upstream Floating Vegetation (%)	Upstream Predominant Floating Species	Upstream Emergent Vegetation (%)	Upstream Predominant Emergent Species
3	[illegible]	5	100		1 to 29 Pct	[illegible]				25	Pond lillies, duck weed, algae	10	Cattails, grasses, phragmites
4	None observed				1 to 29 Pct	[illegible]		75	Milfoil	30	Duckweed	5	Cattail
5													
6													
7													
8													
9													
10													
11													
12	None observed				1 to 29 Pct							3	Cattails, algae
13	No woody debris observed.				30 to 59 Pct	Channel is well shaded from forested lands to the west.						5	Cattails and grasses.
14	Sparse small sticks and branches.	5	75	25	30 to 59 Pct	Dense cattails and grasses in sections, partial overhanging shade from forested lands to the east.		20	Milfoil	5	Duckweed	50	Cattails and grasses
15	Large woody debris logs and sticks along both shorelines.	15	90	10	1 to 29 Pct	Similar to downstream, dense cattails and pond lillies along entire shoreline on both sides. West bank near centre line has undercut banks.		15	Milfoil	20	Pond lilly	10	Cattail
16					1 to 29 Pct	Upstream section is well shaded by hedge row for 180 m prior to continuing into farm field further upslope, where there is no shade or defined feature.	Yes						
17													
18													
19													
20													
21													
22					60 to 89 Pct	Overhanging grass	Yes						
23													
24													

SiteID	Upstream No Migratory Obstructions	Upstream Permanent Obstructions	Upstream Seasonal Obstructions	Upstream Spawning Critical Habitat	Upstream Groundwater Critical Habitat	Upstream Other Critical Habitat	Upstream Potential Enhancement Opportunities	Upstream Additional Comments
3		None	None					[illegible]
4								[illegible]
5								[illegible]
6								[illegible]
7								[illegible]
8								[illegible]
9								
10								[illegible]
11								Feature no longer present in field. Farmer has installed drainage system in crop field.
12	Yes							Channelized ditch feature along farm field to the west and forested area to the east. Stagnant water with no flow. Sparse cattails with tadpoles observed. Steep channel banks with little riparian vegetation.
13			Low seasonal water levels may limit connectivity to other drainage systems or watercourses.					No observable flow. Channel appears stagnant with large dry sections to the south along Bathurst Street. Large amount of garbage noted in ditch line. No fish habitat noted in this location. Pooled water in sections was shallow and not suitable for fish.
14			Dry conditions may create barriers to additional habitat upstream.					Channelized ditch feature. Potential to be permanent or intermittent - overnight rain did occur resulting in elevated water levels. No observable connection to channel features on west side of Bathurst. All ditches in this area may be holding water due to drainage ditches being dug in lowland or wetland areas.
15	Yes			Bay feature on west side would be suitable for rearing and juvenile fish species.				Similar habitat to downstream in terms of riparian and aquatic vegetation. Bay feature on west bank is unique and would provides refuge for juvenile fish. Riparian lands along entire upstream section are well vegetated and naturalized. Cattail thicket borders most of the river and is approximately 10-20 m wide.
16								Not fish habitat. Poorly defined drainage channel through hedge row and actively farmed field. No defined feature where channel is actively farmed.
17								
18								Assessment could not be completed for upstream section due to PTE issues. Channel was observed to be dry with moist soils with cattails and grasses riparian vegetation. Riparian vegetation was approximately 7 m wide with farm fields on either side. Channel has been straightened for agricultural purposes.
19								No defined channel similar to downstream side. Small ponded area (15x15 m) in northern end of assessment area, potentially caused by access road to farm field across grassed area. Pond has cattails and shallow waters - not anticipated to be fish habitat. No defined feature upstream - appears to capture overland flow drainage from farm fields.
20								
21								
22		Culvert has rusted	Low water levels over cobble, impedes travel upstream.					Channelized ditch feature for 30 m before bending to the southeast onto private property. PTE not granted outside road ROW. Dense grasses in riparian zone with trickle flow observed in channel. Oil staining also noted on water surface.
23								Not fish habitat. Dry channel in ROW with no aquatic vegetation, minimal wet soils, no defined features. Rip rap substrate around culvert inlet. Riparian grasses and shrubs along drainage swale for 50 m before swale enters forested area. 50 m Upstream near treed area - wet soils with shallow pockets of water and cattails. Not suitable fish fish.
24								No defined channel east of culvert inlet. Moist soils in within dense patch of cattails with sparse phragmites and shrubs. Small section of standing water at culvert outlet. Large culvert likely designed for wildlife passage - flat soil section along edge of culvert wall inside.

SiteID	CreationDate	Creator	EditDate	Editor	x	y
3	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	[illegible]	[illegible]
4	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	[illegible]	[illegible]
5	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	[illegible]	[illegible]
6	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	[illegible]	[illegible]
7	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	[illegible]	[illegible]
8	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	[illegible]	[illegible]
9	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	[illegible]	[illegible]
10	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	6/14/2021 [illegible]	roger.holmes@aecom.com_aecom	[illegible]	[illegible]
11	6/14/2021 16:29	roger.holmes@aecom.com_aecom	6/14/2021 16:29	roger.holmes@aecom.com_aecom	-79.53497307	44.1334858
12	6/14/2021 21:10	roger.holmes@aecom.com_aecom	6/14/2021 21:10	roger.holmes@aecom.com_aecom	-79.53382081	44.1337454
13	6/14/2021 22:38	roger.holmes@aecom.com_aecom	6/14/2021 22:38	roger.holmes@aecom.com_aecom	-79.52785271	44.1345251
14	6/14/2021 22:55	roger.holmes@aecom.com_aecom	6/14/2021 22:55	roger.holmes@aecom.com_aecom	-79.52750763	44.1337959
15	6/15/2021 15:10	roger.holmes@aecom.com_aecom	6/15/2021 15:10	roger.holmes@aecom.com_aecom	-79.51306871	44.1363815
16	6/15/2021 21:02	roger.holmes@aecom.com_aecom	6/15/2021 21:02	roger.holmes@aecom.com_aecom	-79.56175039	44.1323157
17	6/15/2021 21:11	roger.holmes@aecom.com_aecom	6/15/2021 21:11	roger.holmes@aecom.com_aecom	-79.47823222	44.1460363
18	6/15/2021 21:16	roger.holmes@aecom.com_aecom	6/15/2021 21:16	roger.holmes@aecom.com_aecom	-79.48789156	44.1418016
19	6/17/2021 13:33	roger.holmes@aecom.com_aecom	6/17/2021 13:33	roger.holmes@aecom.com_aecom	-79.45616912	44.1513049
20	6/17/2021 13:41	roger.holmes@aecom.com_aecom	6/17/2021 13:41	roger.holmes@aecom.com_aecom	-79.46056177	44.1515905
21	6/17/2021 14:00	roger.holmes@aecom.com_aecom	6/17/2021 14:00	roger.holmes@aecom.com_aecom	-79.45400101	44.1526909
22	6/17/2021 19:49	roger.holmes@aecom.com_aecom	6/17/2021 19:49	roger.holmes@aecom.com_aecom	-79.45462257	44.1555028
23	6/17/2021 19:50	roger.holmes@aecom.com_aecom	6/17/2021 19:50	roger.holmes@aecom.com_aecom	-79.44055584	44.1504881
24	6/17/2021 19:51	roger.holmes@aecom.com_aecom	6/17/2021 19:51	roger.holmes@aecom.com_aecom	-79.43956727	44.1512406

25	ROW centre upstream 100 m to the south		Ephemeral																									
26																												
27																												
28	Centre ROW upstrea	Steam_River	Permanent	Yes				100	0.15	4	1	6	Silt	60														
29	Centre row upstrean	Steam_River	Permanent	Yes				100	0.1	0.3	0.8	6	Silt	80														
30																												
31	Centre ROW upstrea	Steam_River	Permanent	Yes	Yes	Yes		60	0.1	1.2	0.5	4	Silt	80	20	0.15	1.5	1	6	Silt	50	20	0.03	1.2	0.5	4	Cobble	80
32	Centre ROW to upstream 50 m	Steam_River	Intermittent	Yes				100	0.2	0.15	0.3	1.2	Silt	90														
33	Railway crossing upstream 75 m to the west.	Steam_River	Permanent	Yes	Yes	Yes	Yes	30							30	0.3	2.5	1	3.5	Silt	70	10						
34																												
35																												
36																												
37	CR4 crossing	Steam_River	Permanent	Yes				100	0.25	1.2	0.5	4	Clay	50														

25																										
26																										
27																										
28								Slightly Unstable	Slightly Unstable	Vulnerable Bank	Vulnerable Bank				15					Dense woody debris causing log jams.	20	80	20	60 to 89 Pct	Same as downstre	Yes
29								Slightly Unstable	Slightly Unstable	Protected Bank	Protected Bank									Large amount of woody debris and log jams	20	80	20	60 to 89 Pct	Riparian forested :	Yes
30																										
31								Slightly Unstable	Slightly Unstable	Vulnerable Bank	Protected Bank	10	10	30	10					Overhanging and l	15	80	20	90 to 100 Pct	Dense overhangin	Yes
32								Slightly Unstable	Slightly Unstable	Vulnerable Bank	Vulnerable Bank													30 to 59 Pct	Very low water levels, not suitable for fish habitat during site visit. Overhanging trees approximately 40 m upstream of pond, dense grasses along channel outletting into pond.	
33	40	1	1.5			Muck		Slightly Unstable	Slightly Unstable	Protected Bank	Protected Bank	5	0	0	20	Cattails	15	25	20	Minimal small stick and debris	5	3	2	30 to 59 Pct	Dense riparian vegetation consisting of cattails and shrubs. Scrubland trees provide some shading.	
34																										
35																										
36																										
37								Stable	Stable	Protected Bank	Protected Bank					Cattails, grasses	75	50	50		0			60 to 89 Pct	Dense cattails and grasses in channel 3 m downstream of pond culvert outlet. Creates vegetation debris jam at end of open water section and near CR4 culvert inlet.	

25														Similar to downstream, not fish habitat. Feature consists of a road side ditch with poorly defined edges and wet/soggy ground. No connection observed to west side of road where lands consist of an actively cropped farm field. Cattails and grasses present, no substrate sorting. No riparian trees or shrubs noted.	6/29/2021 19:00	roger.holmes@aecom.com_aecom	6/29/2021 19:00	roger.holmes@aecom.com_aecom	-79.60622178	44.1240151
26															6/29/2021 19:16	roger.holmes@aecom.com_aecom	6/29/2021 19:16	roger.holmes@aecom.com_aecom	-79.58526816	44.1277007
27															6/29/2021 19:29	roger.holmes@aecom.com_aecom	6/29/2021 19:29	roger.holmes@aecom.com_aecom	-79.590379	44.1272332
28														Similar habitat and channel form upstream and downstream. Trickle flow of water observed upstream through log jam. No pools observed throughout study area.	6/29/2021 20:06	roger.holmes@aecom.com_aecom	6/29/2021 20:06	roger.holmes@aecom.com_aecom	-79.62605594	44.1195621
29														Low water levels resulting in no visible flow at the upstream end. Channel meanders through larger bankfull feature. No aquatic vegetation observed. Riparian forests with mature overhanging trees.	7/2/2021 16:17	roger.holmes@aecom.com_aecom	7/2/2021 16:17	roger.holmes@aecom.com_aecom	-79.67345216	44.649577
30															7/2/2021 16:23	roger.holmes@aecom.com_aecom	7/2/2021 16:23	roger.holmes@aecom.com_aecom	-79.67342543	44.6495368
31							Yes							Channel has a natural meandering profile through the forested area. Steep slightly unstable banks provide undercut cover and resulted in a large amount of instream and overhanging woody debris. Pools were observed, most notably at upstream end and center ROW point that provide refuge during summer months for fish. Minnows observed at both pool locations.	7/2/2021 16:36	roger.holmes@aecom.com_aecom	7/2/2021 16:36	roger.holmes@aecom.com_aecom	-79.61838655	44.1213807
32					100	Grasses, cattails			Low water levels.					Pond is fed by small creek. No flow at time of site visit. Creek meanders through lowland grasses area with treed area approximately 40 m upstream. No barrier between pond and upstream channel.	8/18/2021 16:32	roger.holmes@aecom.com_aecom	8/18/2021 16:32	roger.holmes@aecom.com_aecom	-79.45029862	44.1537944
33	20	Milfoil	0		20	Cattail, arrowhead	Yes							Clear water with abundance of minnow observed. Silty substrate with clay underneath and gravely sections 50+ m west of railway crossing. At railway crossing, habitat transitions into wetland feature with flat morphology and dense cattails riparian vegetation.	8/18/2021 16:32	roger.holmes@aecom.com_aecom	8/18/2021 16:44	roger.holmes@aecom.com_aecom	-79.55312654	44.1311296
34															8/18/2021 16:47	roger.holmes@aecom.com_aecom	8/18/2021 16:47	roger.holmes@aecom.com_aecom	-79.52927157	44.1339829
35															8/18/2021 16:50	roger.holmes@aecom.com_aecom	8/18/2021 16:50	roger.holmes@aecom.com_aecom	-79.53264211	44.1333878
36															8/18/2021 16:52	roger.holmes@aecom.com_aecom	8/18/2021 16:52	roger.holmes@aecom.com_aecom	-79.55950459	44.1318754
37														Clear water with clay substrate. Gravel and silt overtop of clay. Flowing water in channel to CR4 inlet. Ditch inlets from north and south, but both were dry.	9/30/2021 17:40	roger.holmes@aecom.com_aecom	9/30/2021 17:40	roger.holmes@aecom.com_aecom	-79.56870002	44.1284259

2020 and 2021 Waterbody Field Survey Data

ObjectID	GlobalID	Project Name:	Date:	Collectors:	Time Started:	Weater Conditions:	Air Temp (°C):	Surface Conditions:	Water Surface Condition:	Name of Waterbody:	Crossing ID:	Station ID:	Location of Station:	Latitude	Longitude	MNRF District:	Surrounding Land Use or Terrain:	Sources of Pollution	Waterbody Type	Waterbody Morphology
1		<i>Bradford Bypass</i>	9/16/2020 16:00	DF KC	9/16/2020 16:00	Sunny, breezy	23	Calm, no flow observed.	Calm	Unnamed pond.	C20-B-1		Pond off of Hole 2 at Gold Course	44.1367	-79.510808	Aurora	Actively used, maintained golf course	potential nutrient loading from golf course	Pond	Not connected
2	768363a1-2263-479b-b6cd-3c4a0bf67b89	<i>Bradford Bypass</i>	6/15/2021 16:00	RH AE	6/15/2021 15:43	clear sky	17.78	Calm, no flow observed.	Calm	Unnamed pond.	C20-B-1		Southwest corner of golf course.	44.1368	-79.511024	Aurora	Active maintained golf course.	Potential golf course runoff with fertilizers.	Pond	Not connected

ObjectID	Waterbody Length (m)	Waterbody Mean Width (m)	Water Colour:	Bank Cover - Vascular Macrophytes (% surface area)	Near Shore Slope (%):	Shoreline Substrate - Sand (%)	Shoreline Substrate - Muck (%)	Shore Cover (% shaded):	Underwater Cover - Organic Debris (% surface area)	Underwater Cover - Vascular Macrophytes (% surface area)	Vegetation Type - Floating (%)	Predominant species of floating vegetation:	Vegetation Type - Emergent (%)	Predominant species of emergent vegetation:	Permanent Migratory Obstructions:	Additional Comments:	CreationDate	Creator	EditDate	Editor
1			Brown			20		1 29								Pond is off of hole 2 on the golf course, it has some marsh vegetation in the <0.5m riparian zone however there is not a very steep bankand. surrounding lawn is maintained right up to 0.5 m next to pond. Cannot assume vegetation throughout entire pond, but duckweed, white water lily, and coontail were along edge of pond	9/16/2020 20:17	kate.crawford@aecom.com_aecom	9/19/2021 17:36	Devon.Fowler@aecom.com_aecom
2	120	60	Yellow_Brown	80	30		100	1 to 29	10	15	15	Pond lillies with algae	5	Cattails	Pond appears to be off line, no access to watercourses or other systems.	Offline pond feature within a golf course. Thin (<3 metre) riparian vegetation of cattails and grasses before manicured lawn is present. Thick muck substrate along edge of pond in shallow water. Pond lillies and algae present along edge of pond. Minimal shading from trees at south end of property.	6/16/2021 17:03	roger.holmes@aecom.com_aecom	6/16/2021 17:03	roger.holmes@aecom.com_aecom

2020 Fish Community Sampling

Project Number	Project Description:	Date:	Collectors:	Time Started:	Time Ended:	Surface Conditions	Name of Waterbody:	Crossing ID	Location of Crossing	Latitude
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	DF, KC	2020-09-16 17:10	2020-09-16 17:20	Calm	Holland River - Trib	C17-B-1	Trib adjacent to Holland River (w)	44.1132997
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	DF, KC					C18-H-1		44.1138581
60636190	Bradford Bypass - Preliminary Design	2020-09-15 16:00	DF, KC				Unnamed Drain	C18-F-1		44.1144901
60636190	Bradford Bypass - Preliminary Design	2020-09-16 16:00	DF, KC	2020-09-16 17:20	2020-09-16 17:30	Calm	Unnamed Drain	C18-E-1		44.1314
60636190	Bradford Bypass - Preliminary Design	2020-09-17 16:00	DF, KC	2020-09-18 13:22	2020-09-11 13:35	Calm	Holland River East Branch - Trib	C22-A-1	South irrigation pond on crossing location	44.1431616

Longitude	Township:	MNRF District:	Water Colour:	Minnow Trap:	Minnow Trap Number:	Set Time:	Clear Time:	Were Fish Kept:	Final Additional Comments:	Additional Notes Appended:	CreationDate	Creator
-79.5457508	TOWNSHIP OF KING	Aurora	Turbid	Yes	1	11:00	13:00	No	No fish caught	Yes	2020-09-16 17:15	Devon.Fowler@aecom.com_aecom
-79.566821	TOWN OF EAST GWILLIMBURY	Aurora	Yellow/Brown							Yes	2020-09-16 17:15	Devon.Fowler@aecom.com_aecom
-79.5639967	TOWNSHIP OF KING	Aurora	Yellow/Brown							Yes	2020-09-16 17:15	Devon.Fowler@aecom.com_aecom
-79.5438676	TOWNSHIP OF KING	Aurora	Turbid	Yes	2	11:00	13:00	No	No fish captured	No	2020-09-17 17:33	Devon.Fowler@aecom.com_aecom
-79.4899197	TOWN OF EAST GWILLIMBURY	Aurora	Turbid	Yes	3	14:30		No		No	2020-09-18 13:29	Devon.Fowler@aecom.com_aecom

Crossing ID	Capture Number:	Was Samples Kept?	Common Name:	Top Predator · Age Class	ParentGlobalID	CreationDate	Creator
C17-B-1	0	No			{D9EAC386-DA1D-4F7A-B031-2BF91300DE12}	2020-09-16 17:15	Devon.Fowler@aecom.com_aecom
C18-H-1		No			{8B35BFC4-C97D-45DE-BAC6-781C44CCD630}	2020-09-16 17:15	Devon.Fowler@aecom.com_aecom
C18-F-1		No			{20A376D1-BB2B-465E-9773-AEDE1B942C1F}	2020-09-16 17:15	Devon.Fowler@aecom.com_aecom
C18-E-1		No			{00F953D1-56B4-4200-8ABA-A31B2B040782}	2020-09-17 17:33	Devon.Fowler@aecom.com_aecom
C22-A-1	1	No	Pumkinseed	Juvenile	{01502F83-D2B0-455C-8C84-6F3C4F712FAA}	2020-09-18 13:29	Devon.Fowler@aecom.com_aecom
C22-A-1	2	No	Pumpkinseed	Juvenile	{01502F83-D2B0-455C-8C84-6F3C4F712FAA}	2020-09-18 13:29	Devon.Fowler@aecom.com_aecom
C22-A-1	3	No	Pumpkinseed	Juvenile	{01502F83-D2B0-455C-8C84-6F3C4F712FAA}	2020-09-18 13:29	Devon.Fowler@aecom.com_aecom
C22-A-1	4	No	Brown bullhead	Juvenile	{01502F83-D2B0-455C-8C84-6F3C4F712FAA}	2020-09-18 13:29	Devon.Fowler@aecom.com_aecom

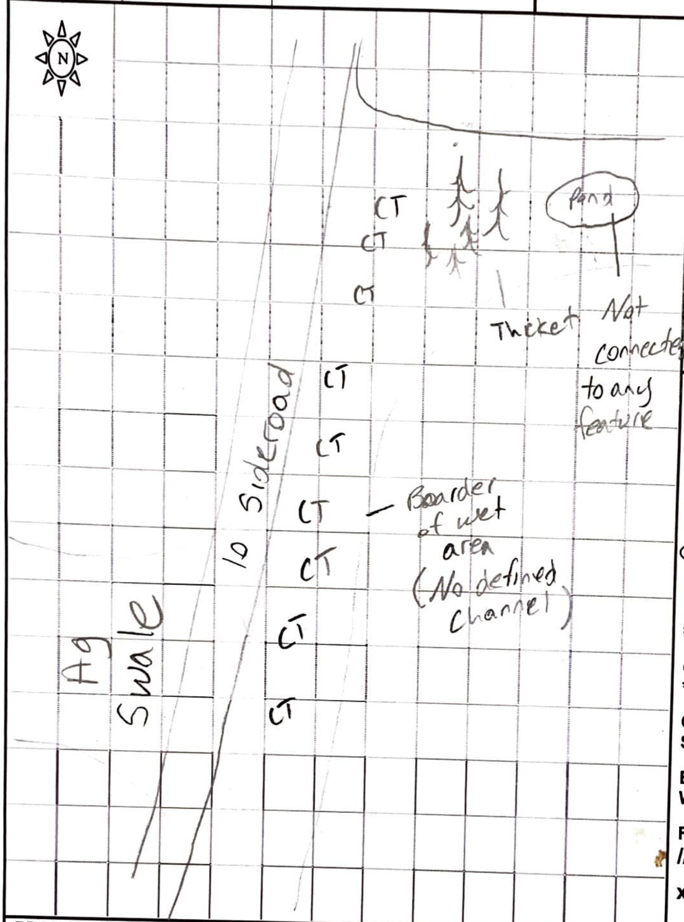
2021 Fish Community Sampling

ObjectID	GlobalID	Project Name:	Date:	Collectors:	Time Started:	Time Ended:	Surface Conditions	Name of Waterbody:	Crossing ID	Station ID	Location of Crossing	Latitude	Longitude	MTO Chainage:	Township:	MNRF District:	Upstream - Length (m)	Water Colour:	Electrofisher Lenth (m):	Electrofisher Settings:	Electrofisher Seconds:	Minnow Trap:	Minnow Trap Number:	Minnow Trap Comments:	Dip Net:	Dip Net Number:	Dip Net Comments:	Trap Net Comments:	Seine:	Number of Hauls:	Set Time:	Clear Time:	Were Fish Kept:	Final Additional Comments:	CreationDate	Creator	EditDate	Editor	x	y
1	e366182d-a696-4190-8f2b-87968008b02b	<i>Bradford Bypass</i>	6/15/2021 16:00	RH AE	6/15/2021 18:07			Unnamed drainage channel	C17-B-1			44.13168	-79.54452			Aurora		Yellow/ Brown				Yes	2	2 minnow traps set in drainage channel, near south end of assessment area and near ROW centre.							09:30	15:30	No	One minnow caught between both minnow traps.	6/15/2021 20:52	roger.holmes@aecom.com_aecom	6/15/2021 20:52	roger.holmes@aecom.com_aecom	-79.5445	44.13168
2	b98089a8-0b0d-493e-ba4c-fc83cda1708c	<i>Bradford Bypass</i>	6/16/2021 16:00	RH AR	6/15/2021 13:00		Calm		C18-F-1			44.6496	-79.67347			Aurora		Yellow/ Brown				Yes	1	One minnow trap set in deep pool at southwest corner of Bathurst and Hochreiter Road.							09:00	15:00	No	No fish caught.	6/16/2021 17:09	roger.holmes@aecom.com_aecom	6/16/2021 17:09	roger.holmes@aecom.com_aecom	-79.6735	44.6496
3	418a09b0-11eb-4d0e-be7f-17ec221ef3fe	<i>Bradford Bypass</i>	6/15/2021 16:00	RH AE	6/15/2021 13:10	6/15/2021 19:10	Calm		C18-H-1			44.13565	-79.52724			Aurora		Yellow/ Brown				Yes	1	Minnow trap set on south side of Albert's Marina entrance driveway, 30 m east of Bathurst Street.							09:10	15:10	No	No fish caught.	6/16/2021 17:14	roger.holmes@aecom.com_aecom	6/16/2021 17:14	roger.holmes@aecom.com_aecom	-79.5272	44.13565
4	ba2dc254-1904-4890-a1bfd1a77e637c9e	<i>Bradford Bypass</i>	6/15/2021 16:00	RH AE	6/15/2021 13:15		Calm		C18-A-1		Minnow trap set along Hochreiter Road ditch to the south of assessment area. The ditch line had deeper water and was more suitable for a minnow trap.	44.13286	-79.53772			Aurora		Yellow/ Brown				Yes	1										No	No fish caught. Yoy minnow were observed in the ditch, but were too small to catch or identify.	6/16/2021 17:17	roger.holmes@aecom.com_aecom	6/16/2021 17:17	roger.holmes@aecom.com_aecom	-79.5377	44.13286
5	b041f385-3b06-4904-a1ba-1a5fc4744c86	<i>Bradford Bypass</i>	6/17/2021 16:00	RH AE	6/17/2021 15:30		Calm	Unnamed	C25B-1		Crosses Leslie St 150 m south of Holborn Road.	44.15544	-79.45451			Unknown	10	Yellow/ Brown							Yes	2	Attempted to dip net only viable pool within the ROW on upstream (east) side of Leslie Street.						No	No fish caught. No minnows observed.	6/17/2021 19:44	roger.holmes@aecom.com_aecom	6/17/2021 19:44	roger.holmes@aecom.com_aecom	-79.4545	44.15544
6	0eb2e9f6-bf40-4ce7-81a9-ea9183fcce94	<i>Bradford Bypass</i>	6/2/2021 16:00	RH AE	6/2/2021 14:45		Calm	Unnamed	C13-A-1			44.12721	-79.59037			Midhurst		Colourless							Yes	1	Attempted to dip net open sections of channel. Channel was too shallow and narrow to effectively efish or set minnow traps.						No	No fish captured. Potentially not fish habitat.	6/29/2021 19:31	roger.holmes@aecom.com_aecom	6/29/2021 19:31	roger.holmes@aecom.com_aecom	-79.5904	44.12721
7	539cd6b4-8e76-4313-970b-7c0093f0d01d	<i>Bradford Bypass</i>	6/2/2021 16:00	RH AE	6/2/2021 15:45		Calm	Unnamed	C10-C-2			44.11934	-79.62575			Midhurst		Yellow/ Brown	30	150-175-200 volts, 40 hz	168												No	No fish caught or observed.	6/29/2021 20:08	roger.holmes@aecom.com_aecom	6/29/2021 20:08	roger.holmes@aecom.com_aecom	-79.6258	44.11934
8	52ba6a12-8ee2-4a56-b42f914a6df6f2ab	<i>Bradford Bypass</i>	6/2/2021 16:00	RH AE	6/2/2021 18:00		Calm	Unnamed.	C11-A-1			44.12135	-79.61828			Midhurst		Colourless	40	150 volts, 40 hz	112												No		7/2/2021 16:39	roger.holmes@aecom.com_aecom	7/2/2021 16:39	roger.holmes@aecom.com_aecom	-79.6183	44.12135
9	bcc9df09-f46e-453f-a54a-8f585c9fa292	<i>Bradford Bypass</i>	8/12/2021 16:00	RH KC	8/12/2021 13:15		Calm	Unnamed	C25-C-1		Pond feature 350 m east of Leslie St.	44.15292	-79.44923			Aurora		Yellow/ Brown											Yes	3			No		8/18/2021 18:47	roger.holmes@aecom.com_aecom	8/18/2021 18:47	roger.holmes@aecom.com_aecom	-79.4492	44.15292

ObjectID	GlobalID	Capture Number:	Was Sample Kept?	Common Name:	Top Predator - Age Class	ParentGlobalID	CreationDate	Creator	EditDate	Editor
1	df7bc6cc-c883-452f-b2bb-45be8ffe6bc6	1	No	Northern Redbelly Dace	Adult	e366182d-a696-4190-8f2b-87968008b02b	6/15/2021 20:52	roger.holmes@aecom.com_aecom	6/15/2021 20:52	roger.holmes@aecom.com_aecom
2	00d602cb-b613-46fe-bab5-ffa3763ef8d4	0	No			b98089a8-0b0d-493e-ba4c-fc83cda1708c	6/16/2021 17:09	roger.holmes@aecom.com_aecom	6/16/2021 17:09	roger.holmes@aecom.com_aecom
3	44deb281-e775-4daf-ab50-1f75110af35b	0	No			418a09b0-11eb-4d0e-be7f-17ec221ef3fe	6/16/2021 17:14	roger.holmes@aecom.com_aecom	6/16/2021 17:14	roger.holmes@aecom.com_aecom
4	bcc039a2-fe5a-436e-bc29-78c7a40bd273	0	No			ba2dc254-1904-4890-a1bf-d1a77e637c9e	6/16/2021 17:17	roger.holmes@aecom.com_aecom	6/16/2021 17:17	roger.holmes@aecom.com_aecom
5	2aabdf4b-732b-4b1f-bba3-cf887b485555	0	No			b041f385-3b06-4904-a1ba-1a5fc4744c86	6/17/2021 19:44	roger.holmes@aecom.com_aecom	6/17/2021 19:44	roger.holmes@aecom.com_aecom
6	0fa48f81-39b1-48d7-941e-276071affd96	0	No			0eb2e9f6-bf40-4ce7-81a9-ea9183fcce94	6/29/2021 19:31	roger.holmes@aecom.com_aecom	6/29/2021 19:31	roger.holmes@aecom.com_aecom

7	e31a7627-749a-4926-9b43-e8bb686e2253		No			539cd6b4-8e76-4313-970b-7c0093f0d01d	6/29/2021 20:08	roger.holmes@aecom.com_aecom	6/29/2021 20:08	roger.holmes@aecom.com_aecom
8	bd63153b-bf51-4889-ac2b-3c42890e6115	15	No	Creek Chub	Adult	52ba6a12-8ee2-4a56-b42f-914a6df6f2ab	7/2/2021 16:39	roger.holmes@aecom.com_aecom	7/2/2021 16:39	roger.holmes@aecom.com_aecom
9	09a25d9b-9bcc-4208-8cb0-9fa9c40fd53b	2	No	Northern Redbelly Dace	Adult	52ba6a12-8ee2-4a56-b42f-914a6df6f2ab	7/2/2021 16:39	roger.holmes@aecom.com_aecom	7/2/2021 16:39	roger.holmes@aecom.com_aecom
10	e2dcffe3-3b01-4f32-87a1-af32b3e6fb4e	1	No	Brook Stickleback	Adult	52ba6a12-8ee2-4a56-b42f-914a6df6f2ab	7/2/2021 16:39	roger.holmes@aecom.com_aecom	7/2/2021 16:39	roger.holmes@aecom.com_aecom
11	f5acabe6-ab5e-4804-b6ec-426ac5c41793	1	No	Brook Stickleback	Adult	bcc9df09-f46e-453f-a54a-8f585c9fa292	8/18/2021 18:47	roger.holmes@aecom.com_aecom	8/18/2021 18:47	roger.holmes@aecom.com_aecom
12	2e379848-4cf1-4316-ac5f-2841ab2e65fd	16	No	Creek Chub	Adult	bcc9df09-f46e-453f-a54a-8f585c9fa292	8/18/2021 18:47	roger.holmes@aecom.com_aecom	8/18/2021 18:47	roger.holmes@aecom.com_aecom

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C12-A-1			



PROJECT #: Bradford Bypass

MAPPER: AE

NAME OF WATERBODY:

CROSSING #:

STATION #:

DATE: DD-MMM-YY 02-Jun-21

LEGEND

10d depth (cm)
6w width

Riffle
Run/Glide
Pool
Island/Bar

Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

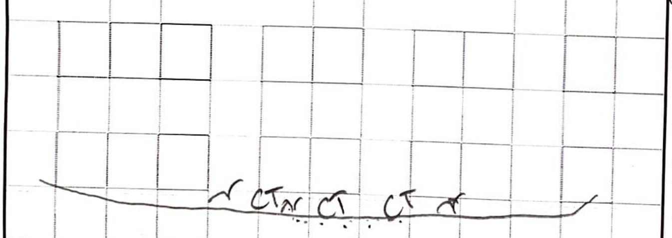
® Riparian Tree

Seep/Spring
-------- Undercut Bank

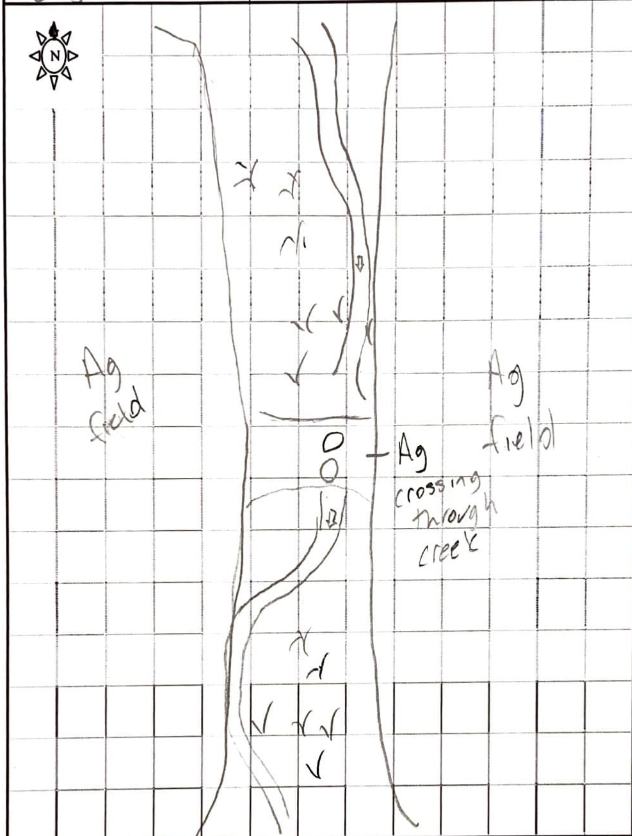
— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C13-A-1			



PROJECT #: Bradford Bypass

MAPPER: AE

NAME OF WATERBODY:

CROSSING #:

STATION #:

DATE: DD-MMM-YY 02-Jun-21

LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▓ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

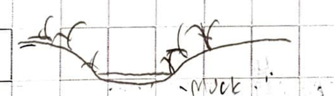
® Riparian Tree

├▶ Seep/Spring
-------- Undercut Bank

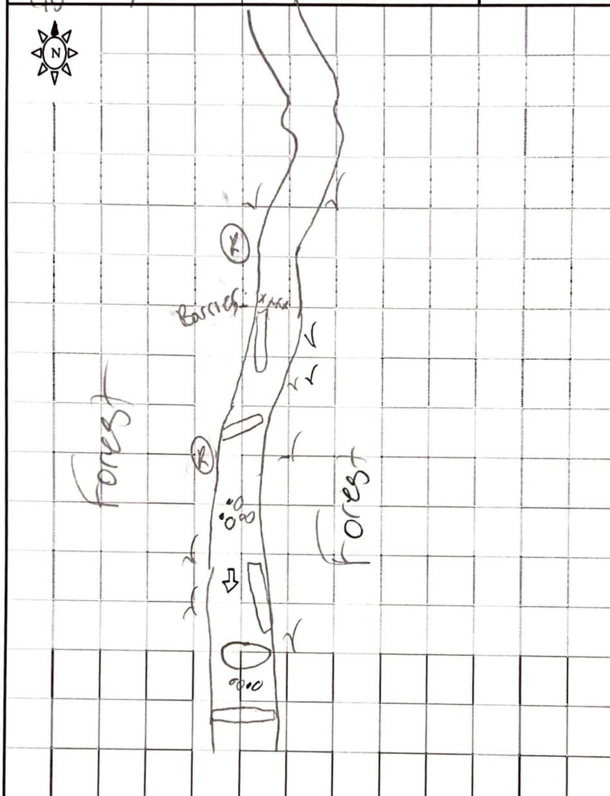
— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
└┘ Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C10-C-1			



PROJECT #:	Bradford Bypass
MAPPER:	AE
NAME OF WATERBODY:	
CROSSING #:	
STATION #:	
DATE: DD-MMM-YY	02-Jun-21

LEGEND

10d depth (cm)
6w width

Riffle
Run/Glide
Pool
Island/Bar

Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

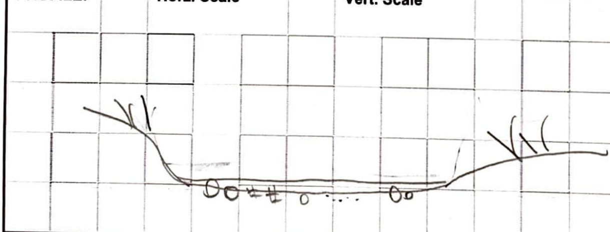
® Riparian Tree

Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C11-A-1			

PROJECT #: Bradford Bypass

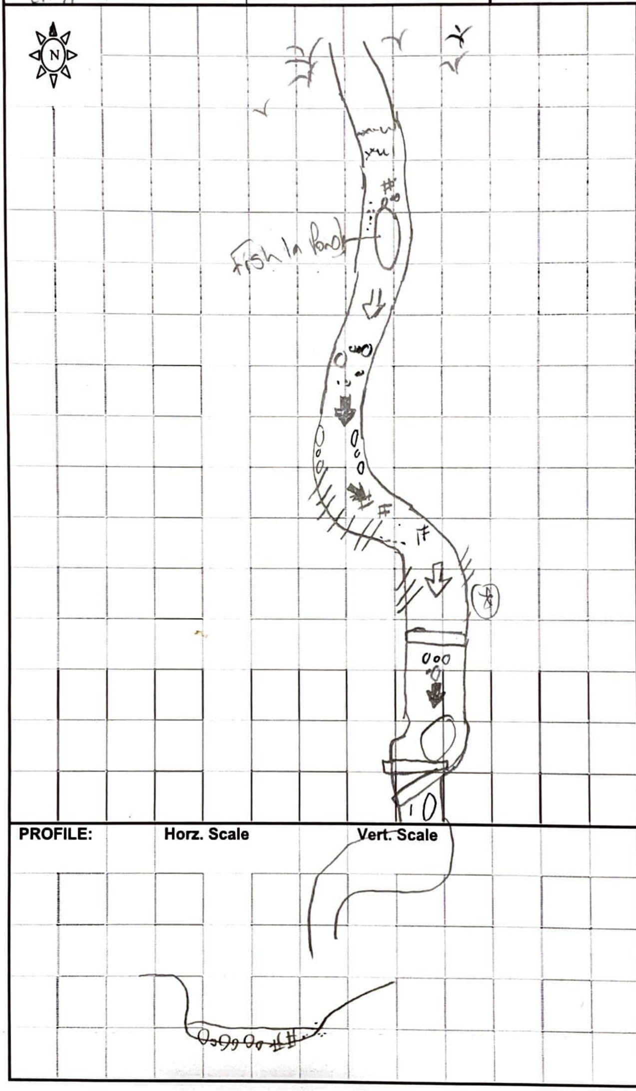
MAPPER: AE

NAME OF WATERBODY:

CROSSING #:

STATION #:

DATE: DD-MMM-YY 02-Jun-21



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
█ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

® Riparian Tree

├▶ Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
└─┘ Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C10-C-2			

PROJECT #: Bradford Bypass

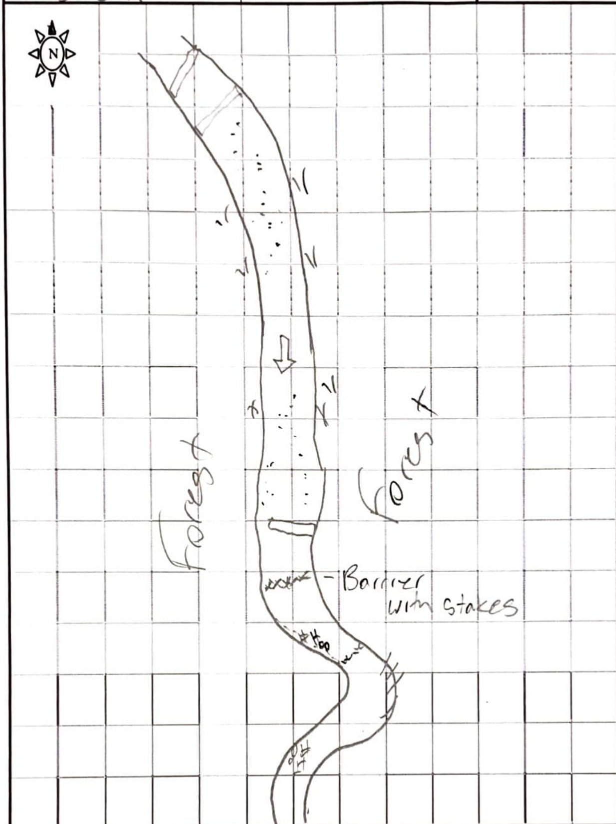
MAPPER: AE

NAME OF WATERBODY:

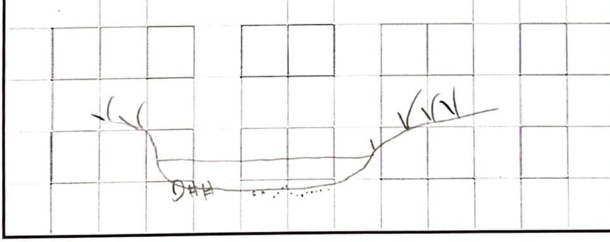
CROSSING #:

STATION #:

DATE: DD-MMM-YY 02-Jun-21



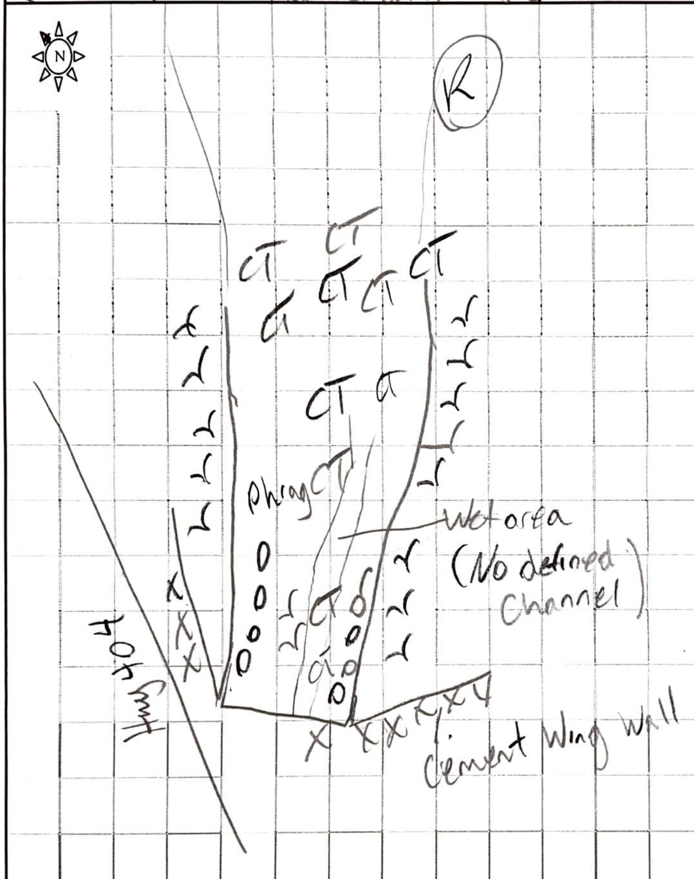
PROFILE: **Horz. Scale** **Vert. Scale**



LEGEND

- **10d** depth (cm)
- **6w** width
- ➡ Riffle
- ⇨ Run/Glide
- ⬭ Pool
- ▓ Island/Bar
- ░ Fine Substrate
- ### Gravel Substrate
- **oOooO** Cobble /Boulder
- * * * Debris
- **CT** Cattail
- **SV/FV** Submerg/Float Veg
- **EV** Emergent Vegetation
- **W** Watercress
- **Fe** Iron Staining
- **///////** Eroded Bank
- **XXX** Riprap / Other Stabilization
- Instream Log/Tree
- **^^^** Dam/Weir/Obstruction
- ® Riparian Tree
- ├► Seep/Spring
- -------- Undercut Bank
- ▬ Barrier to Fish Movement
- **-S-** Seasonal Barrier
- **-x--x-** Fence line
- ⊔ Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C26- A-1	Downstream -~50m		



PROJECT #: Bradford Bypass

MAPPER: AE

NAME OF WATERBODY:

CROSSING #:

STATION #:

DATE: DD-MMM-YY 17-Jun-21

LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
█ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

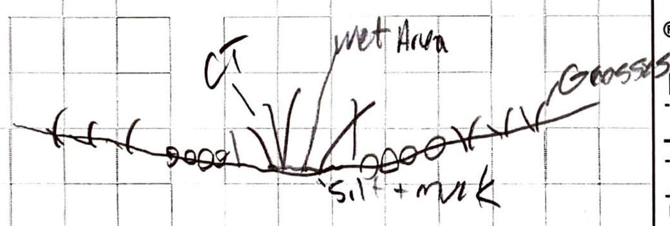
® Riparian Tree

├► Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
└┘ Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C25-A-2	Upstream - 50m		

PROJECT #: Bradford Bypass

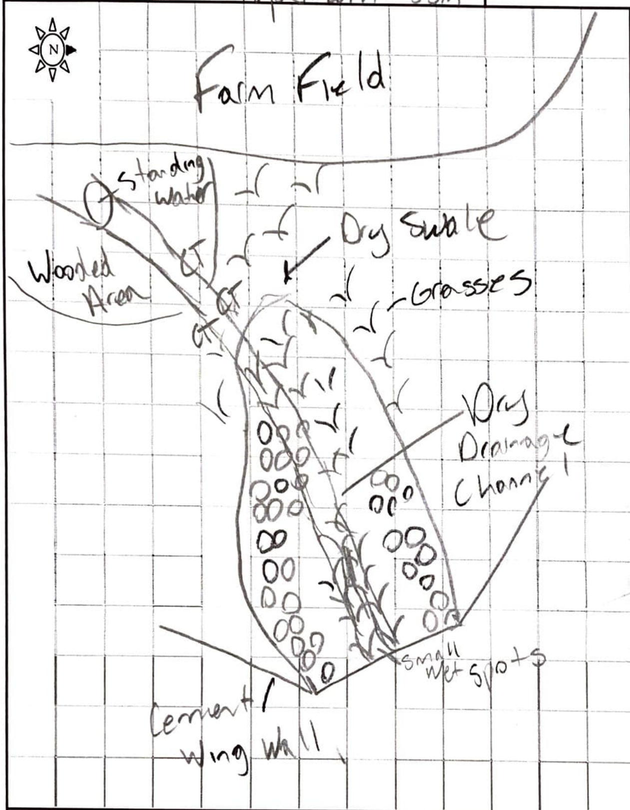
MAPPER: AE

NAME OF WATERBODY:

CROSSING #:

STATION #:

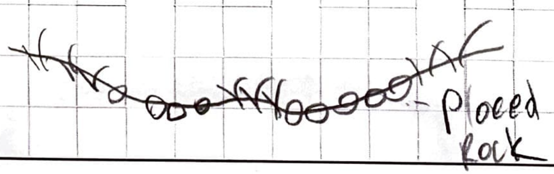
DATE: DD-MMM-YY 17-Jun-21



LEGEND

- **10d** depth (cm)
- **6w** width
- ➡ Riffle
- ⇨ Run/Glide
- ⬭ Pool
- ■ Island/Bar
- ░ Fine Substrate
- ### Gravel Substrate
- oOooO Cobble /Boulder
- * * * Debris
- **CT** Cattail
- **SV/FV** Submerg/Float Veg
- **EV** Emergent Vegetation
- **W** Watercress
- **Fe** Iron Staining
- ////// Eroded Bank
- **XXX** Riprap / Other Stabilization
- Instream Log/Tree
- ^^^ Dam/Weir/Obstruction
- ® Riparian Tree
- ├► Seep/Spring
- -------- Undercut Bank
- — Barrier to Fish Movement
- **-S-** Seasonal Barrier
- **-x--x-** Fence line
- └┘ Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C-17-A-01	Downstream	~250m	1:20

PROJECT #: Bradford Bypass

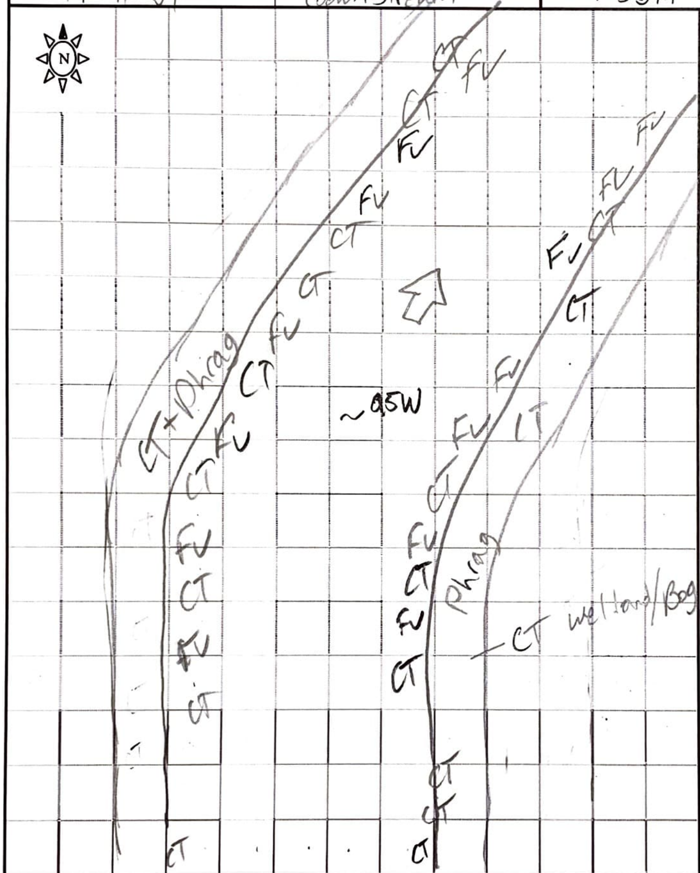
MAPPER: AE

NAME OF WATERBODY:

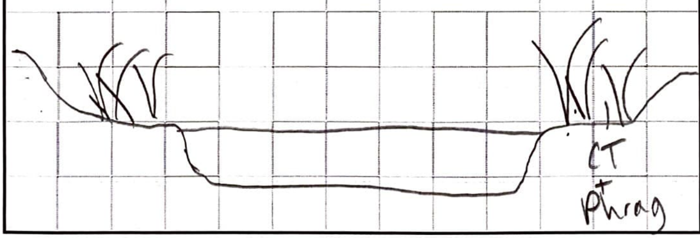
CROSSING #:

STATION #:

DATE: DD-MMM-YY 14-Jun-21



PROFILE: **Horz. Scale** **Vert. Scale**



LEGEND

- **10d** depth (cm)
- **6w** width
- ➡ Riffle
- ⇨ Run/Glide
- ⬭ Pool
- ▌ Island/Bar
- ░ Fine Substrate
- **###** Gravel Substrate
- **oOooO** Cobble /Boulder
- *** Debris
- **CT** Cattail
- **SV/FV** Submerg/Float Veg
- **EV** Emergent Vegetation
- **W** Watercress
- **Fe** Iron Staining
- ***//////*** Eroded Bank
- **XXX** Riprap / Other Stabilization
- Instream Log/Tree
- **^^^** Dam/Weir/Obstruction
- ® Riparian Tree
- ├▶ Seep/Spring
- -------- Undercut Bank
- **—** Barrier to Fish Movement
- **-S-** Seasonal Barrier
- **-x--x-** Fence line
- └┘ Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C-17-A-01	Upstream	~100	1/10

PROJECT #: Bradford Bypass

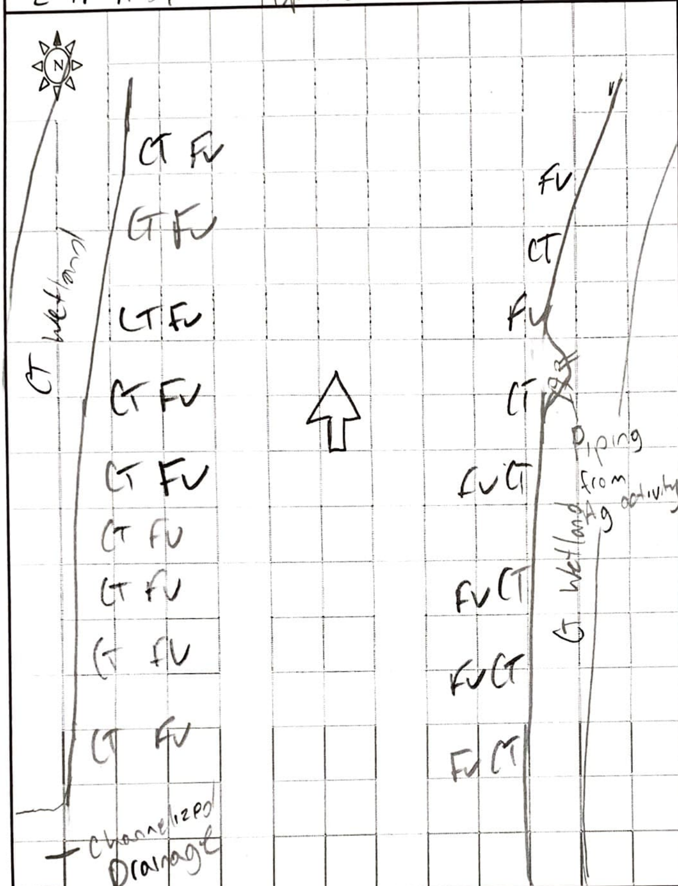
MAPPER: AE

NAME OF WATERBODY:

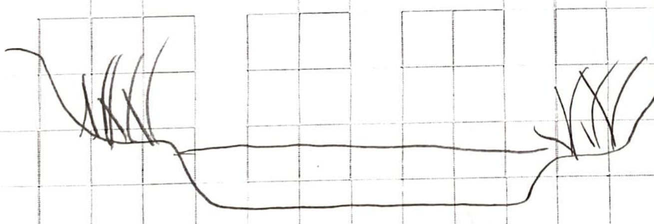
CROSSING #:

STATION #:

DATE: DD-MMM-YY 14-Jun-21



PROFILE: **Horz. Scale** **Vert. Scale**



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▇ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

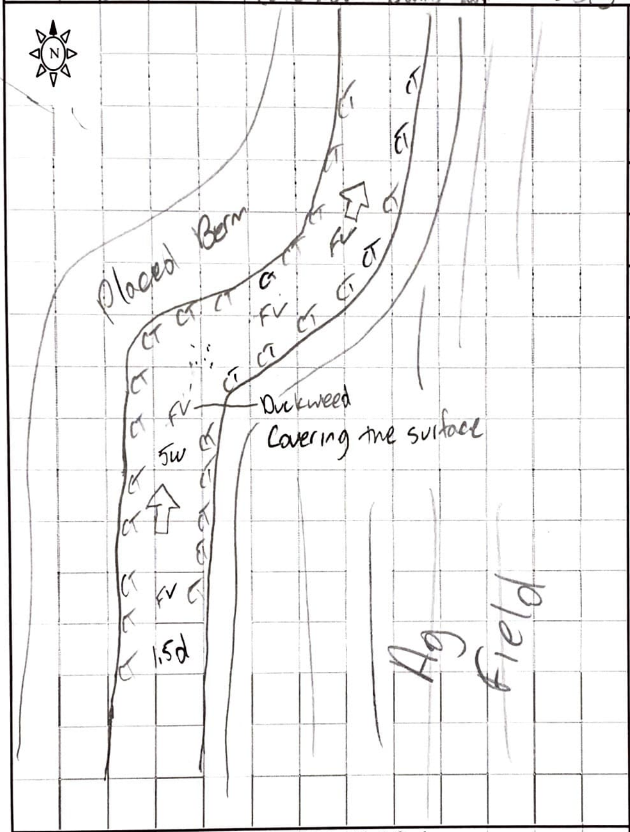
® Riparian Tree

├▶ Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
└┘ Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C-17-B-01	Center ROW - Downstream	~250	1/20



PROJECT #: Bradford

MAPPER: AE

NAME OF WATERBODY:

CROSSING #:

STATION #:

DATE: DD-MMM-YY 14-Jun-21

LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
Pool
Island/Bar

Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

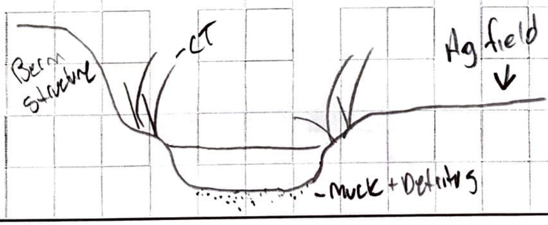
® Riparian Tree

Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C17-B-01	Center ROW - Upstream 60m	~60m	1/5

PROJECT #: Bradford Bypass

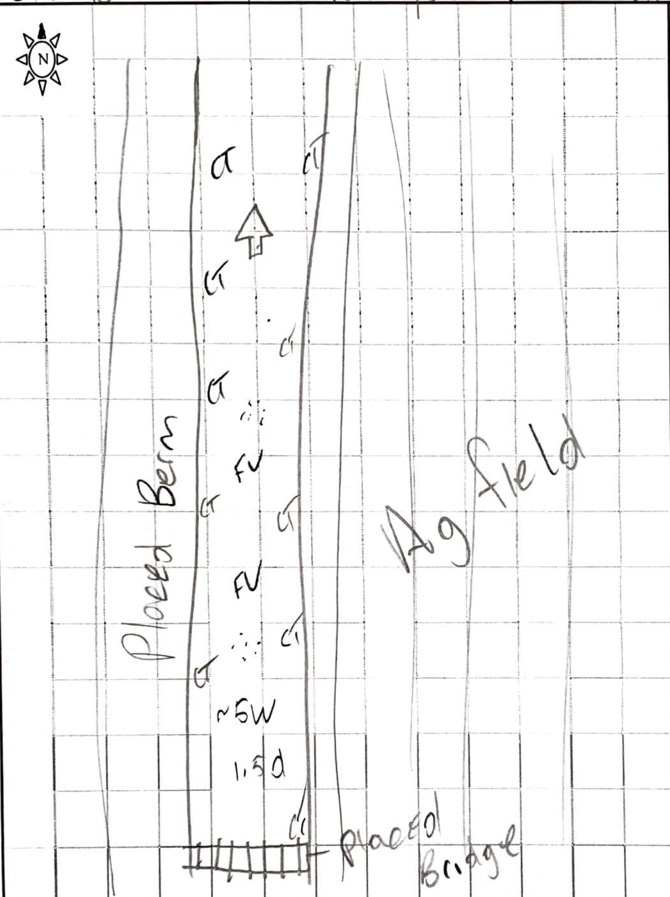
MAPPER: AE

NAME OF WATERBODY:

CROSSING #:

STATION #:

DATE: DD-MMM-YY 14-Jun-21



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▓ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
. * Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

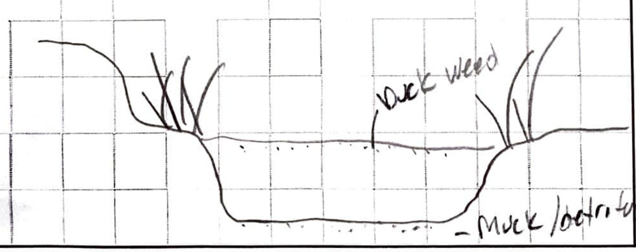
® Riparian Tree

├▶ Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C18-A-1	Upstream ROW - Downstream	~150 m	1/10

PROJECT #: Bradford Bypass

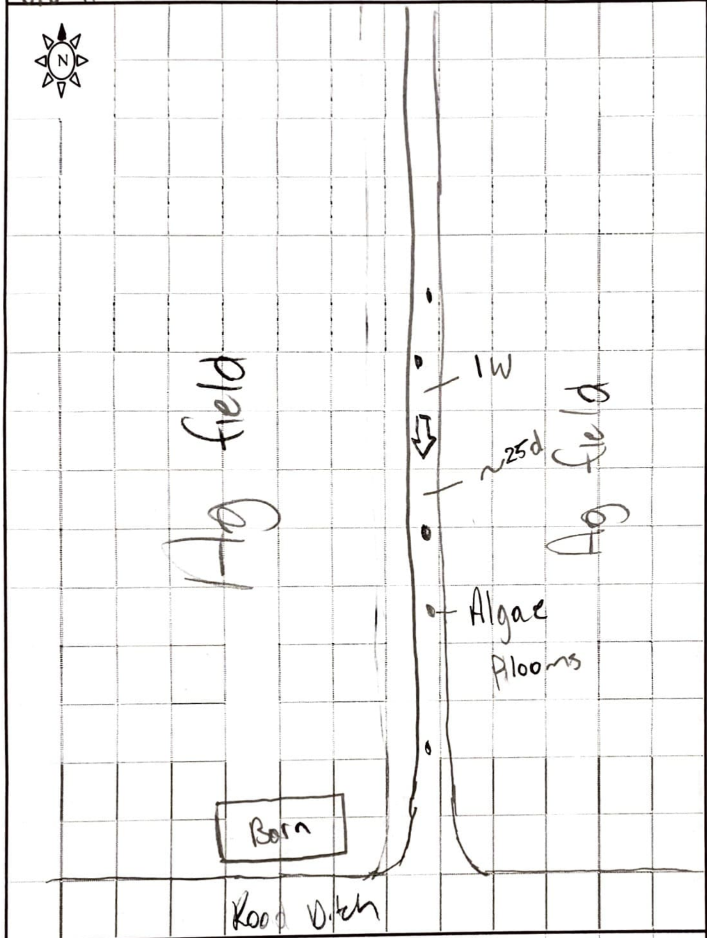
MAPPER: AE

NAME OF WATERBODY:

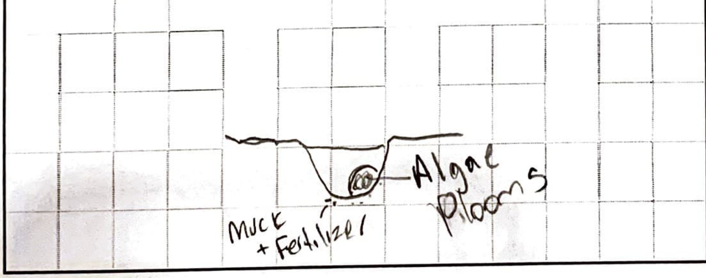
CROSSING #:

STATION #:

DATE: DD-MMM-YY 14-Jun-21



PROFILE: **Horz. Scale** **Vert. Scale**



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▮ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

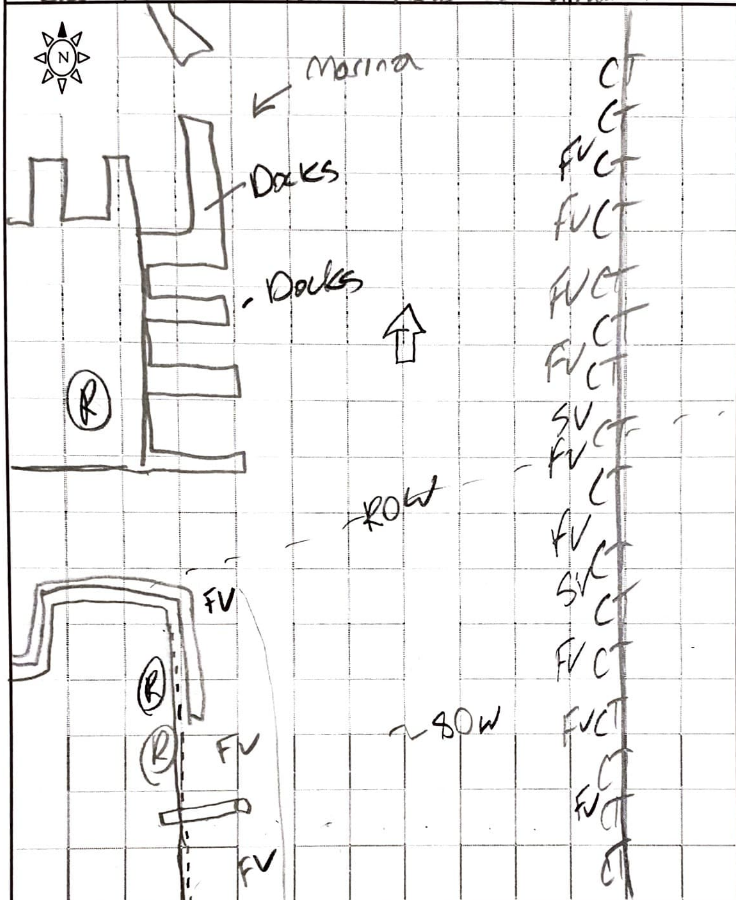
® Riparian Tree

Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C20 -A-1	Center ROW - Downstream	~100	1/10



PROJECT #: Bradford

MAPPER: AE

NAME OF WATERBODY:

CROSSING #:

STATION #:

DATE: DD-MMM-YY 15-Jun-21

LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▓ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

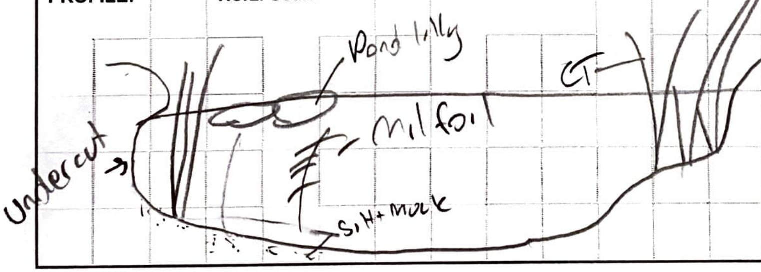
Instream Log/Tree
^^^ Dam/Weir/Obstruction
® Riparian Tree

Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C18-D-1		~150m	1/5

PROJECT #: Bradford Bypass

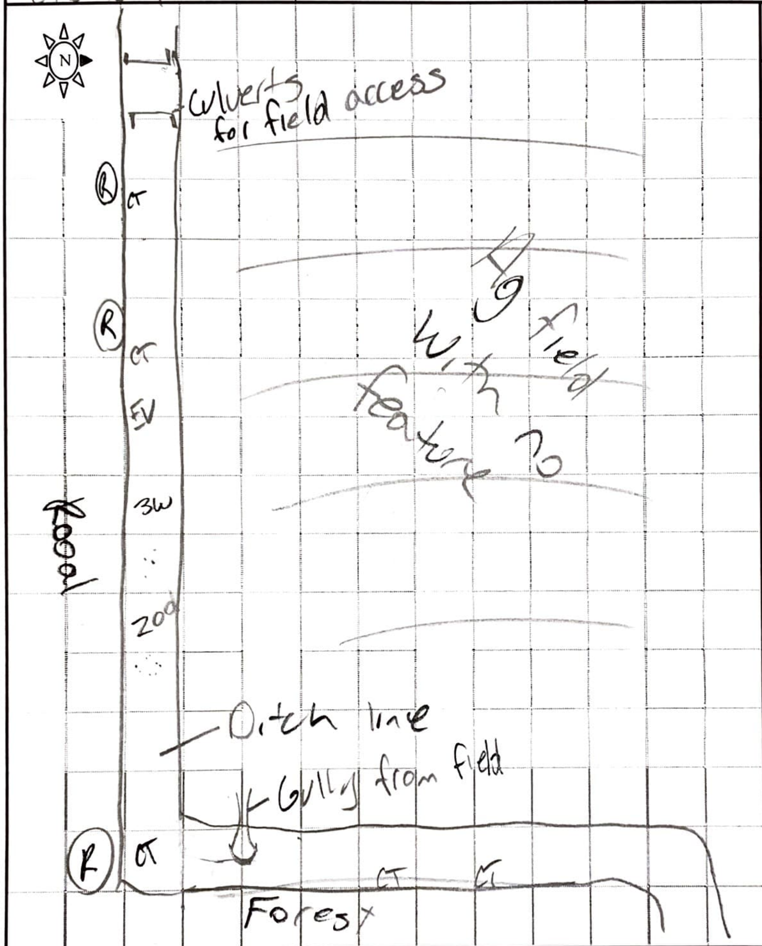
MAPPER: AE

NAME OF WATERBODY:

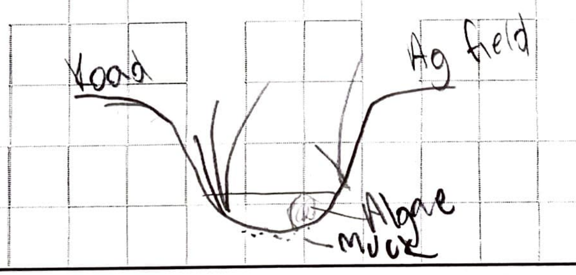
CROSSING #:

STATION #:

DATE: DD-MMM-YY 14-Jun-21



PROFILE: **Horz. Scale** **Vert. Scale**



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▮ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

® Riparian Tree

├► Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
└┘ Culvert

SECTION IDENTIFIER: C25-B-1

SECTION LOCATION: upstream Inlet - ~50 m

SECTION LENGTH (m):

SCALE (cm / m):

PROJECT #: Bradford Bypass

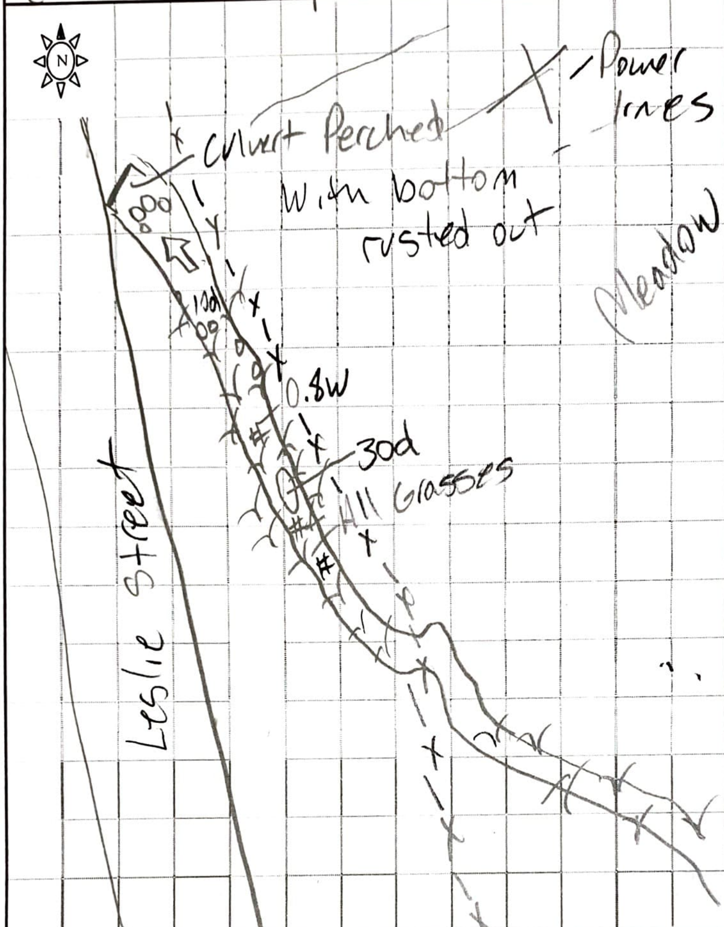
MAPPER: AE

NAME OF WATERBODY:

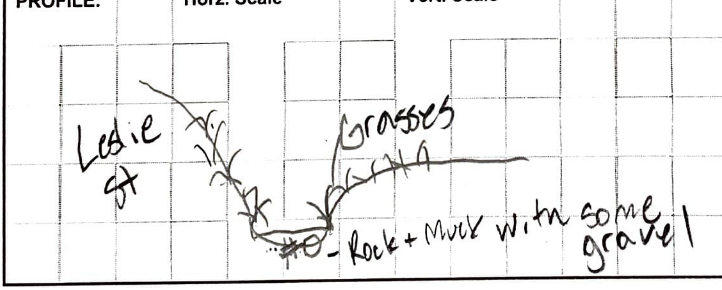
CROSSING #:

STATION #:

DATE: DD-MMM-YY 17-Jun-21



PROFILE: **Horz. Scale** **Vert. Scale**



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▓ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
* * * Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

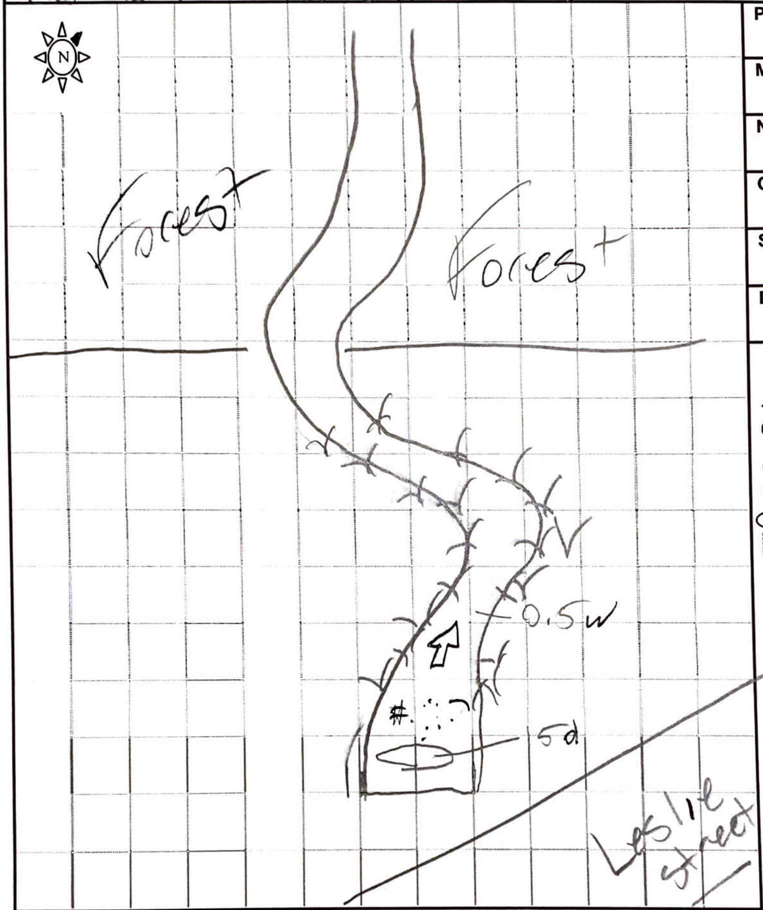
® Riparian Tree

Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C25-B-1	Downstream - ~50m		1/5



PROJECT #: Bradford Bypass

MAPPER: AE

NAME OF WATERBODY:

CROSSING #:

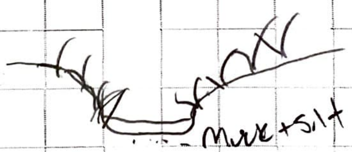
STATION #:

DATE: DD-MMM-YY 17-Jun-21

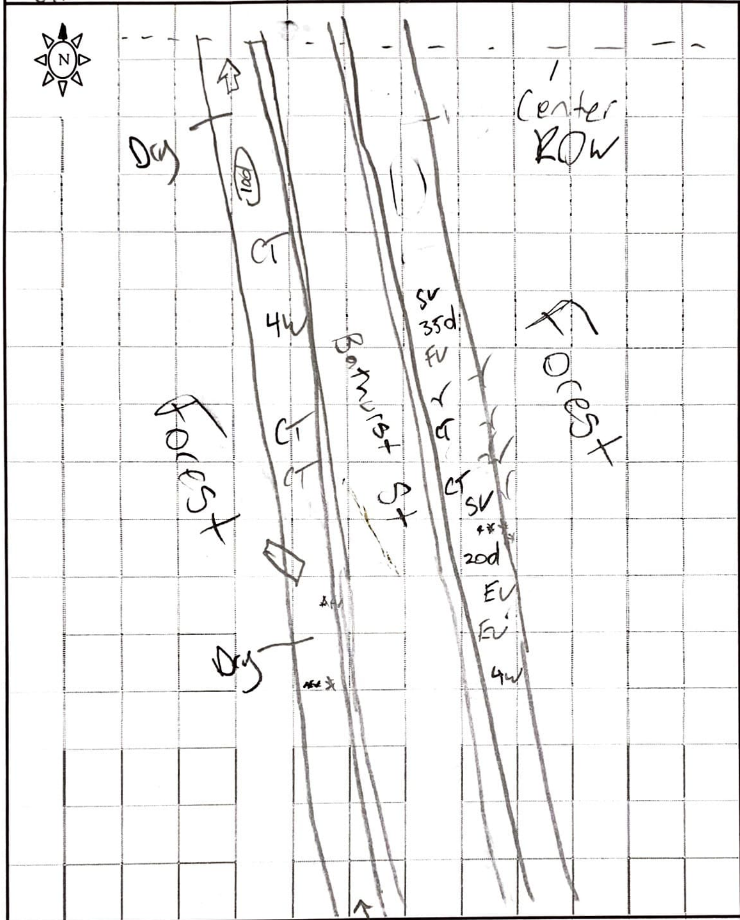
LEGEND

10d depth (cm)
6w width
➡ Riffle
⇨ Run/Glide
⬭ Pool
▮ Island/Bar
░ Fine Substrate
Gravel Substrate
oOooO Cobble /Boulder
*** * *** Debris
CT Cattail
SV/FV Submerg/Float Veg
EV Emergent Vegetation
W Watercress
Fe Iron Staining
/////// Eroded Bank
XXX Riprap / Other Stabilization
Instream Log/Tree
^^^ Dam/Weir/Obstruction
® Riparian Tree
├► Seep/Spring
-------- Undercut Bank
— Barrier to Fish Movement
-S- Seasonal Barrier
-x--x- Fence line
⊔ Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C18-F-1 + C18-H-1	Center ROW - South 150m	~150m	1/20



PROJECT #: Bradford Bypass

MAPPER: AE

NAME OF WATERBODY:

CROSSING #:

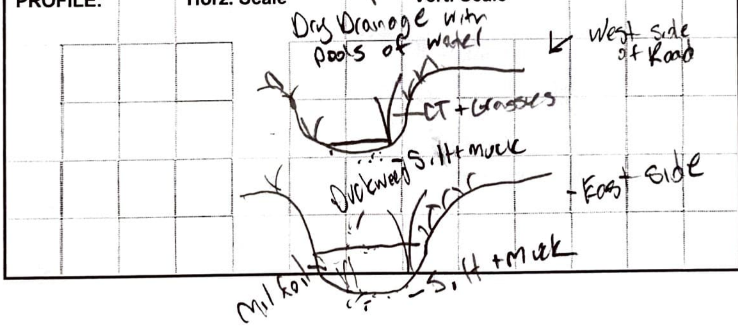
STATION #:

DATE: DD-MMM-YY 15-Jun-21

LEGEND

- **10d** depth (cm)
- **6w** width
- ➡ Riffle
- ⇨ Run/Glide
- ⬭ Pool
- ▓ Island/Bar
- ░ Fine Substrate
- **###** Gravel Substrate
- **oOooO** Cobble /Boulder
- *** * *** Debris
- **CT** Cattail
- **SV/FV** Submerg/Float Veg
- **EV** Emergent Vegetation
- **W** Watercress
- **Fe** Iron Staining
- ***///////*** Eroded Bank
- **XXX** Riprap / Other Stabilization
- Instream Log/Tree
- **^^^** Dam/Weir/Obstruction
- ® Riparian Tree
- |▶ Seep/Spring
- **--------** Undercut Bank
- **▬** Barrier to Fish Movement
- **-S-** Seasonal Barrier
- **-x--x-** Fence line
- └┘ Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C20-A-1	Center ROW-upstream	100m	1/10

PROJECT #: Bradford

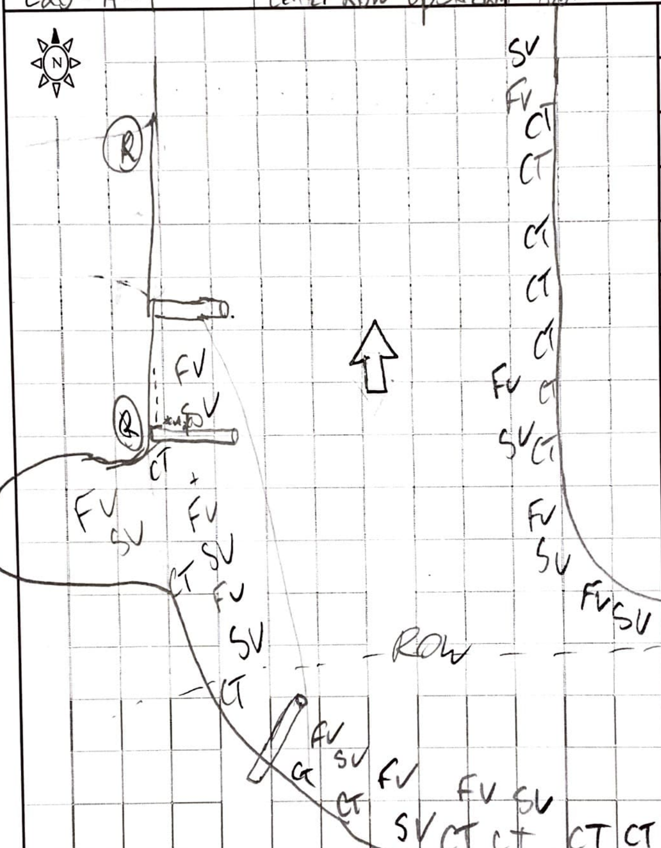
MAPPER: AE

NAME OF WATERBODY:

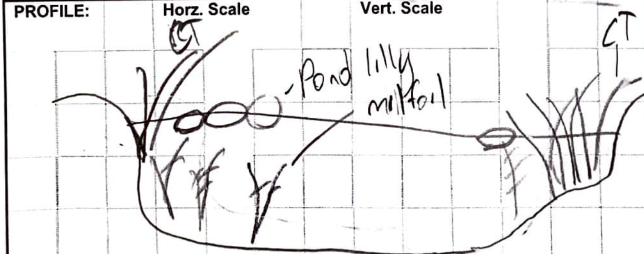
CROSSING #:

STATION #:

DATE: DD-MMM-YY 15-Jun-21



PROFILE: **Horz. Scale** **Vert. Scale**



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▮ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
* * * Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

® Riparian Tree

├▶ Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
⊔ Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C18-F-1 + C18-H-1	Center ROW - 150m u/s-rean (N)	~150m	1/20

PROJECT #: Bradford Bypass

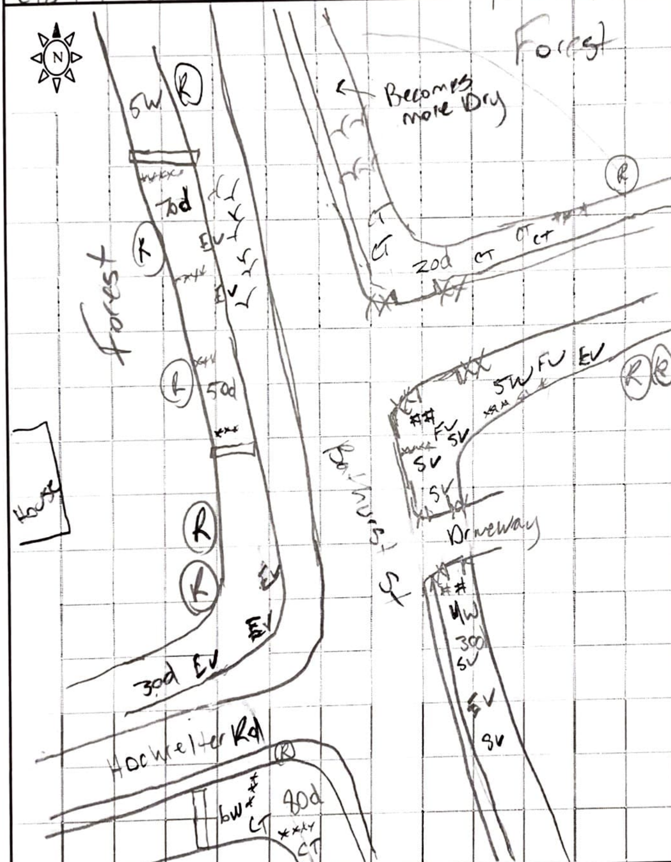
MAPPER: HE

NAME OF WATERBODY:

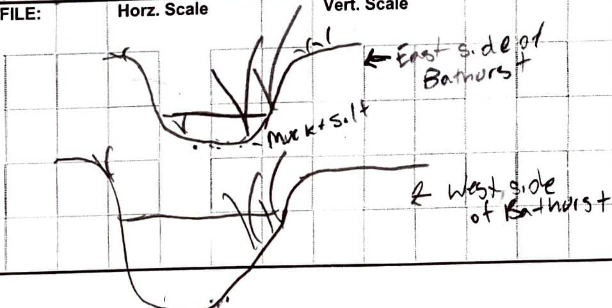
CROSSING #:

STATION #:

DATE: DD-MMM-YY 15-Jun-21



PROFILE: Horz. Scale Vert. Scale



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▮ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

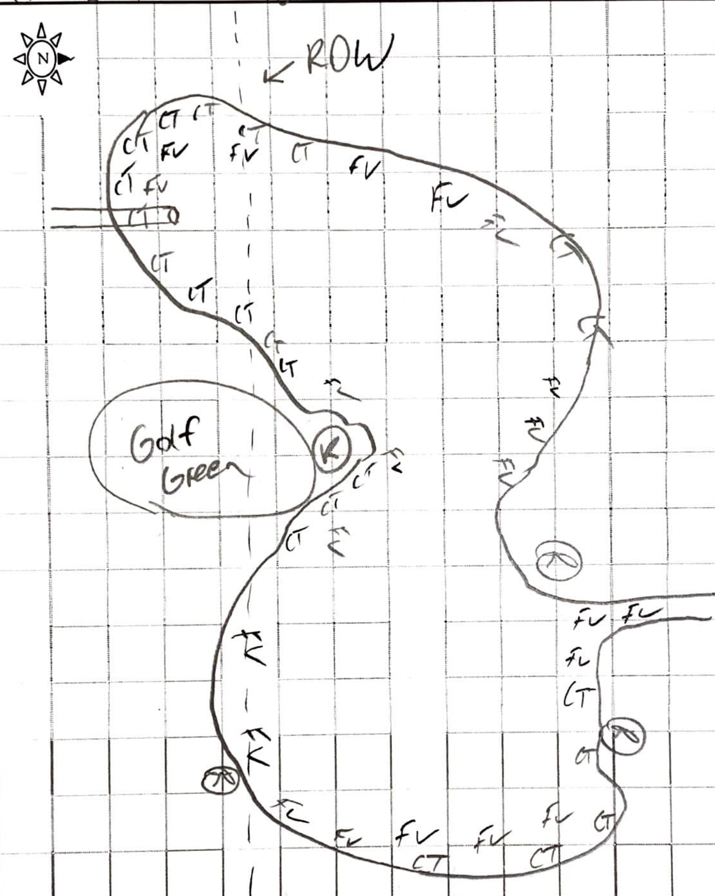
® Riparian Tree

|► Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
⊔ Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C20-B-1	Golf Course Pond		1/10



PROJECT #: Bradford Bypass

MAPPER: AE

NAME OF WATERBODY:

CROSSING #:

STATION #:

DATE: DD-MMM-YY 17-Jun-21

LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
Pool
Island/Bar

Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

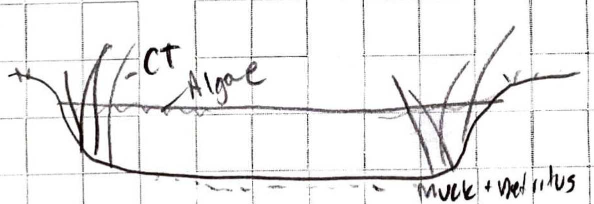
® Riparian Tree

Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C22-A-1	Center Row - North	~150 m	1/10

PROJECT #: Bradford

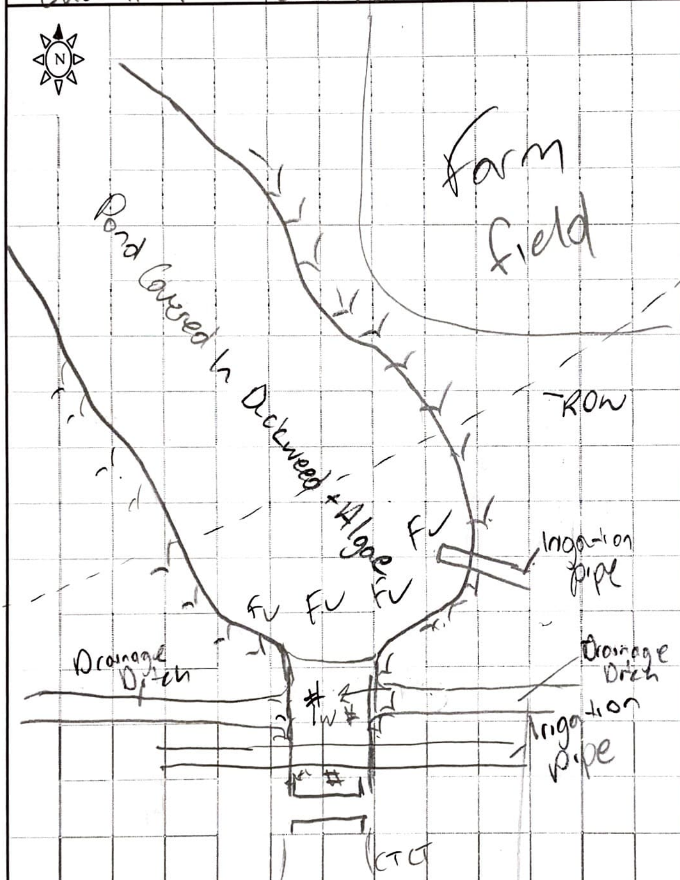
MAPPER: AE

NAME OF WATERBODY:

CROSSING #:

STATION #:

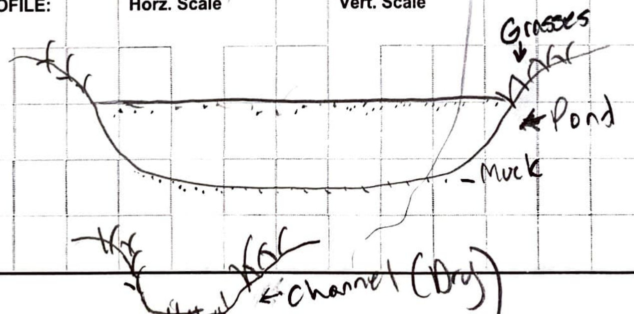
DATE: DD-MMM-YY 17-Jun-21



LEGEND

10d depth (cm)
6w width
➡ Riffle
⇨ Run/Glide
Pool
Island/Bar
Fine Substrate
Gravel Substrate
oOooO Cobble /Boulder
* * * Debris
CT Cattail
SV/FV Submerg/Float Veg
EV Emergent Vegetation
W Watercress
Fe Iron Staining
/////// Eroded Bank
XXX Riprap / Other Stabilization
Instream Log/Tree
^^^ Dam/Weir/Obstruction
® Riparian Tree
Seep/Spring
-------- Undercut Bank
— Barrier to Fish Movement
-S- Seasonal Barrier
-x--x- Fence line
Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C25-A-1			1/10

PROJECT #: Bradford

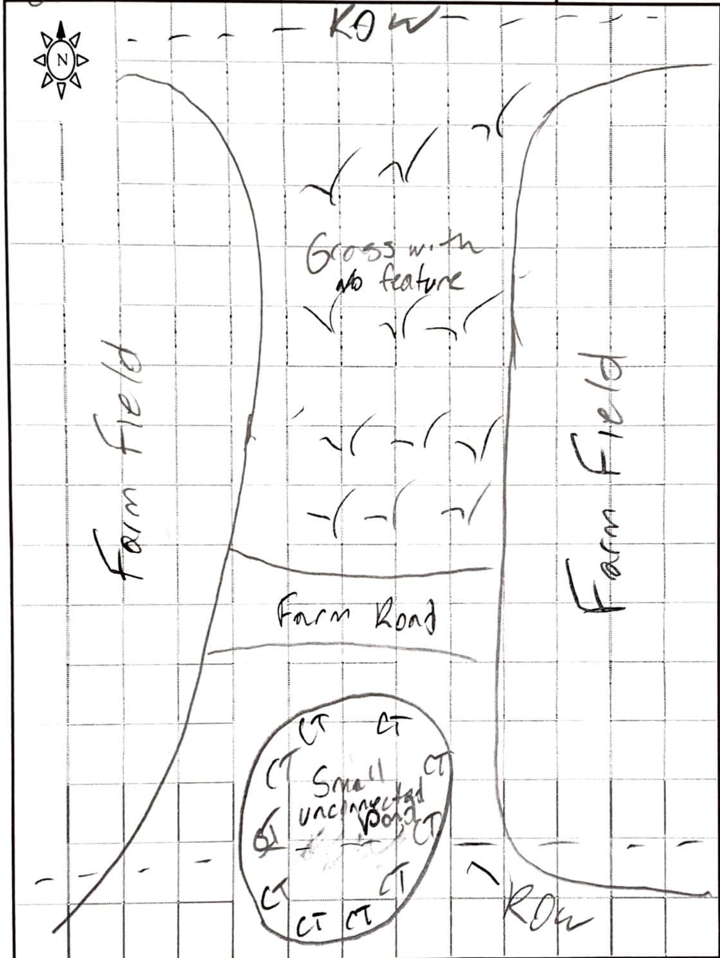
MAPPER: AE

NAME OF WATERBODY:

CROSSING #:

STATION #:

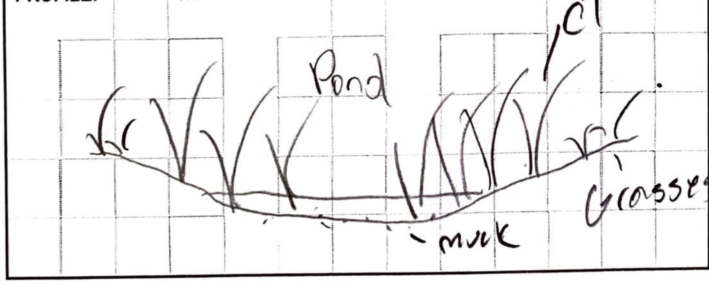
DATE: DD-MMM-YY 17-Jun-21



LEGEND

- **10d** depth (cm)
- **6w** width
- ➡ Riffle
- ⇨ Run/Glide
- ⬭ Pool
- ▮ Island/Bar
- ░ Fine Substrate
- ### Gravel Substrate
- **oOooO** Cobble /Boulder
- *** Debris
- **CT** Cattail
- **SV/FV** Submerg/Float Veg
- **EV** Emergent Vegetation
- **W** Watercress
- **Fe** Iron Staining
- **///////** Eroded Bank
- **XXX** Riprap / Other Stabilization
- Instream Log/Tree
- **^^^** Dam/Weir/Obstruction
- ® Riparian Tree
- ├▶ Seep/Spring
- -------- Undercut Bank
- **—** Barrier to Fish Movement
- **-S-** Seasonal Barrier
- **-x--x-** Fence line
- └┘ Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
Upstream	Row to u/s 30m	30 m	2 m

PROJECT #: Brad Ford By Pass

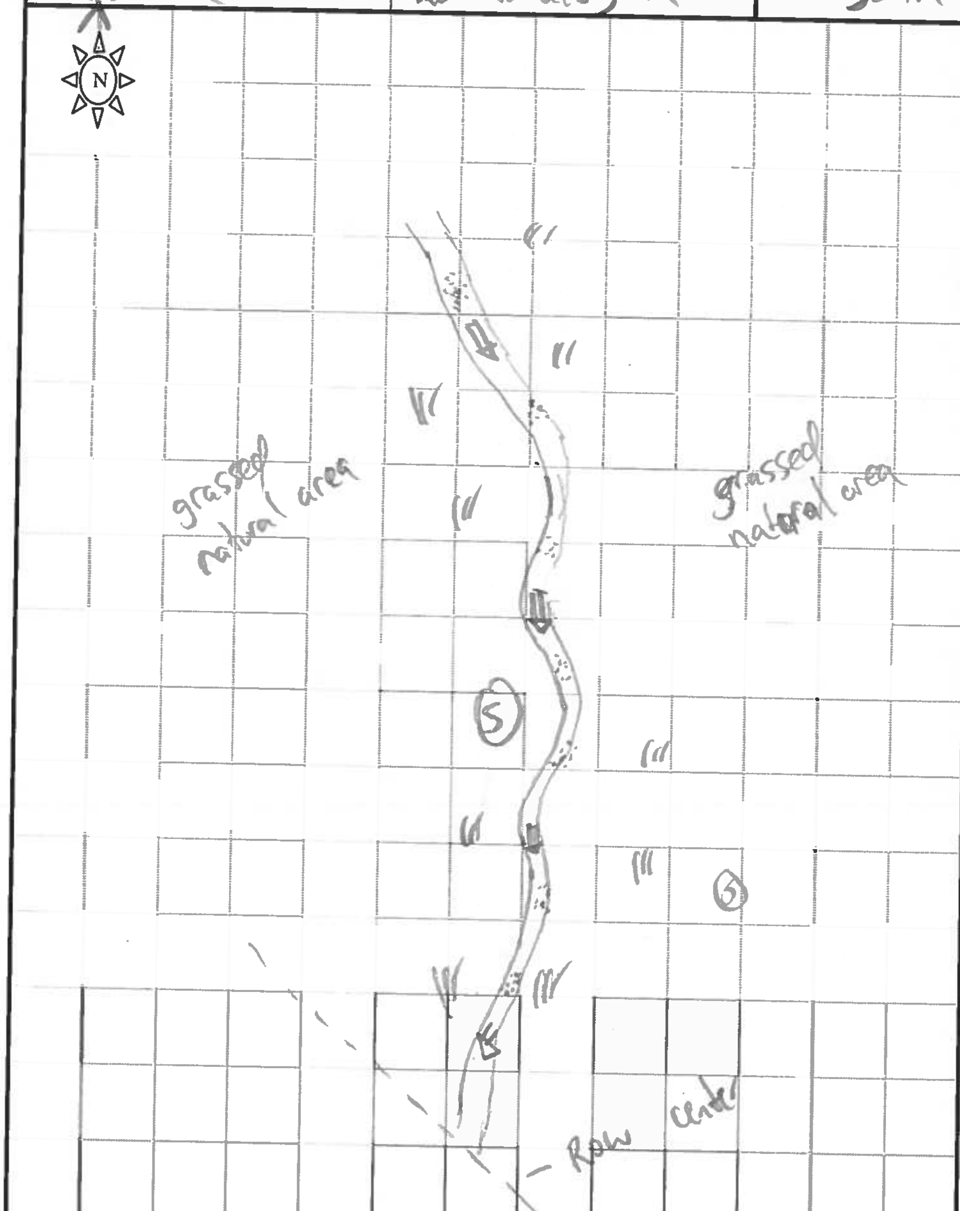
MAPPER: R. Holmes

NAME OF WATERBODY: Unnamed

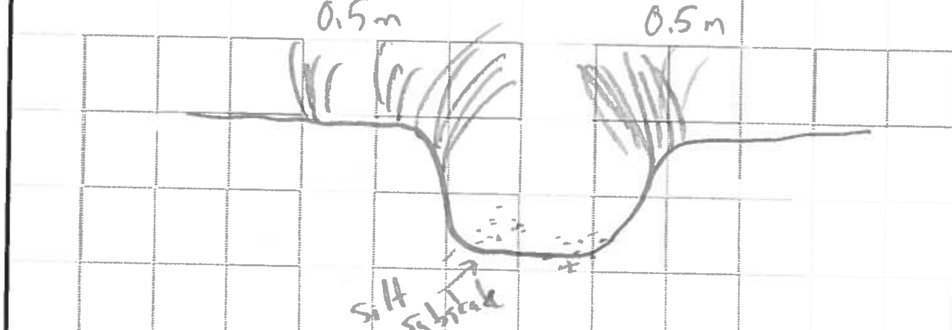
CROSSING #: C10 - A-1

STATION #:

DATE: DD-MMM-YY 01-06-2021



PROFILE: **Horz. Scale** 0.5m **Vert. Scale** 0.5 m



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▮ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
* * * Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

⊂⊃ Instream Log/Tree
^^^ Dam/Weir/Obstruction

® Riparian Tree
Ⓢ shrub
├▶ Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
⊔ Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
downstream	Row to d/s 30m	30m	2m

PROJECT #: Bradford Bypass

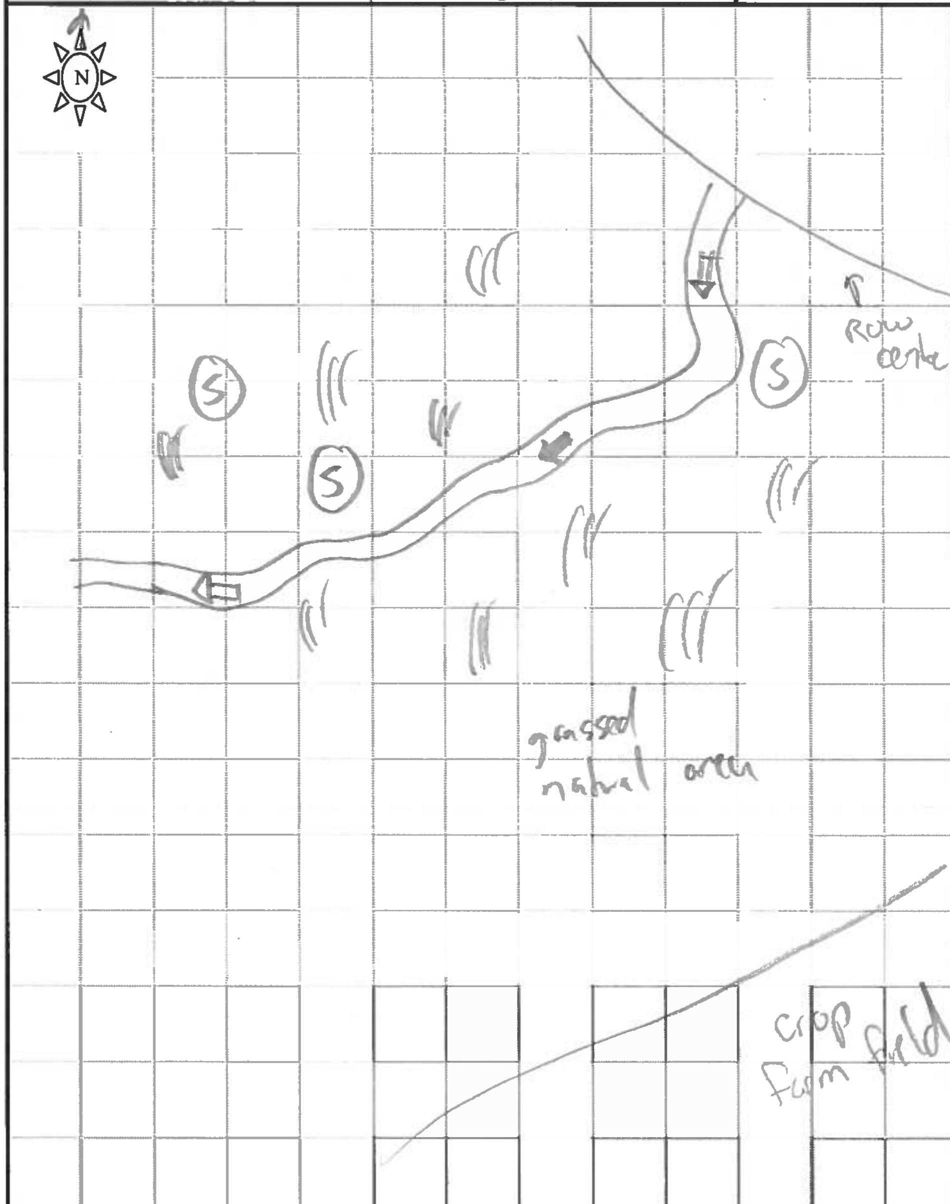
MAPPER: R. Holmes

NAME OF WATERBODY: Unnames

CROSSING #: C10-A-1

STATION #:

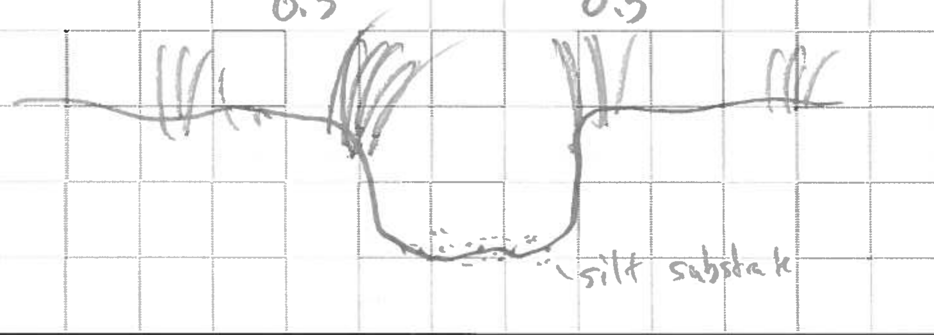
DATE: DD-MMM-YY 01-June-2021



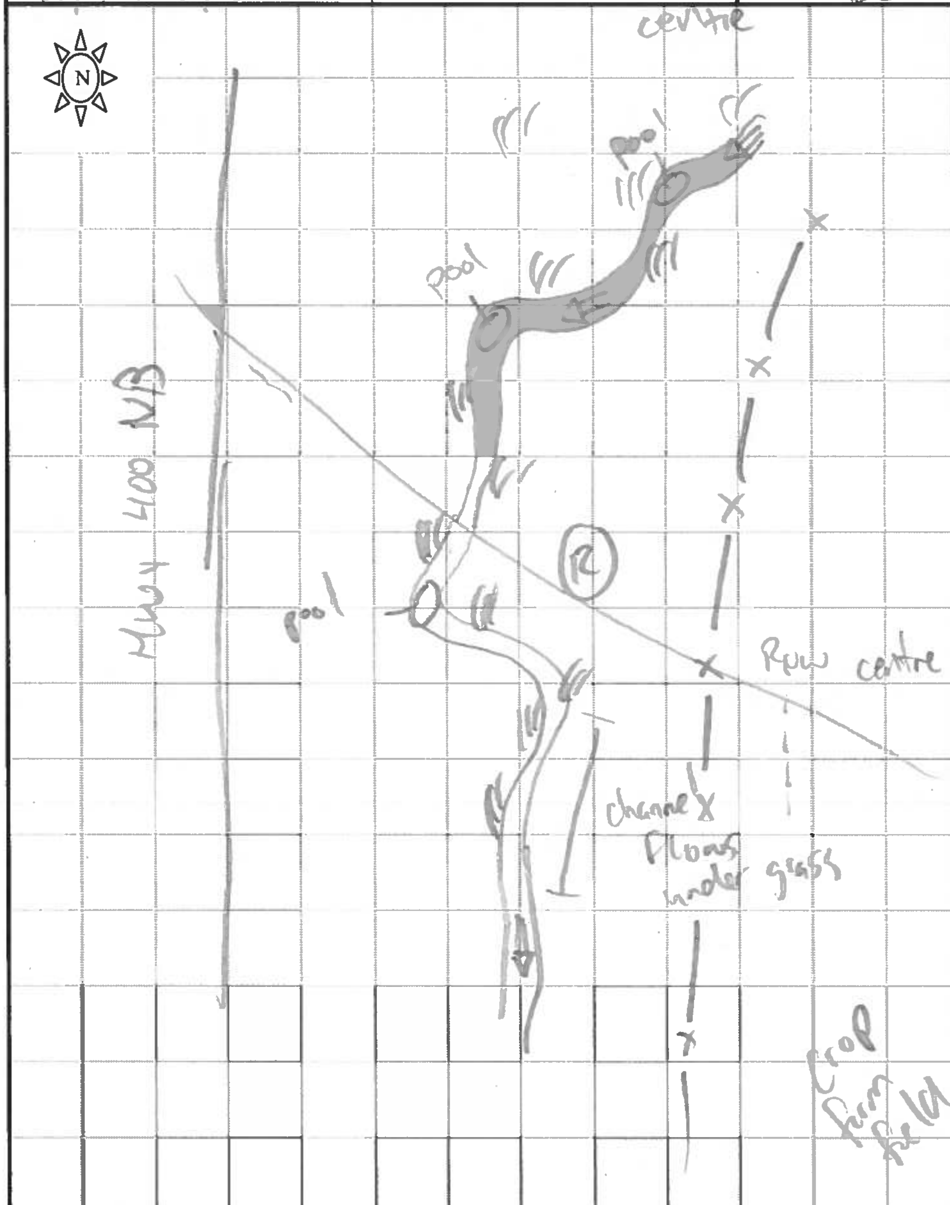
LEGEND

- **10d** depth (cm)
- **6w** width
- ➡ Riffle
- ⇨ Run/Glide
- ⬭ Pool
- ▮ Island/Bar
- Fine Substrate
- ### Gravel Substrate
- **oOooO** Cobble /Boulder
- * * * Debris
- **CT** Cattail
- **SV/FV** Submerg/Float Veg
- **EV** Emergent Vegetation
- **W** Watercress
- **Fe** Iron Staining
- ////// Eroded Bank
- **XXX** Riprap / Other Stabilization
- Instream Log/Tree
- ^^^ Dam/Weir/Obstruction
- ® Riparian Tree
- Ⓢ Shrub
- ├▶ Seep/Spring
- -------- Undercut Bank
- **—** Barrier to Fish Movement
- **-S-** Seasonal Barrier
- **-x--x-** Fence line
- └┘ Culvert

PROFILE: **Horz. Scale** 0.5 **Vert. Scale** 0.5



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
U/S + D/S	30 m u/s + d/s of ROW centre	60m	3



PROJECT #: Bradford Bypass

MAPPER: R. Holmes

NAME OF WATERBODY: Unnamed

CROSSING #: C10-A-2

STATION #:

DATE: DD-MMM-YY 01-June-2021

PROFILE: **Horz. Scale** 0.25 **Vert. Scale** 0.25

LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▮ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
* * * Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction
® Riparian Tree

├▶ Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
└┘ Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
US + D/S	East Hwy 400 ditch	200 m	10 m

PROJECT #: Bradford Bypass

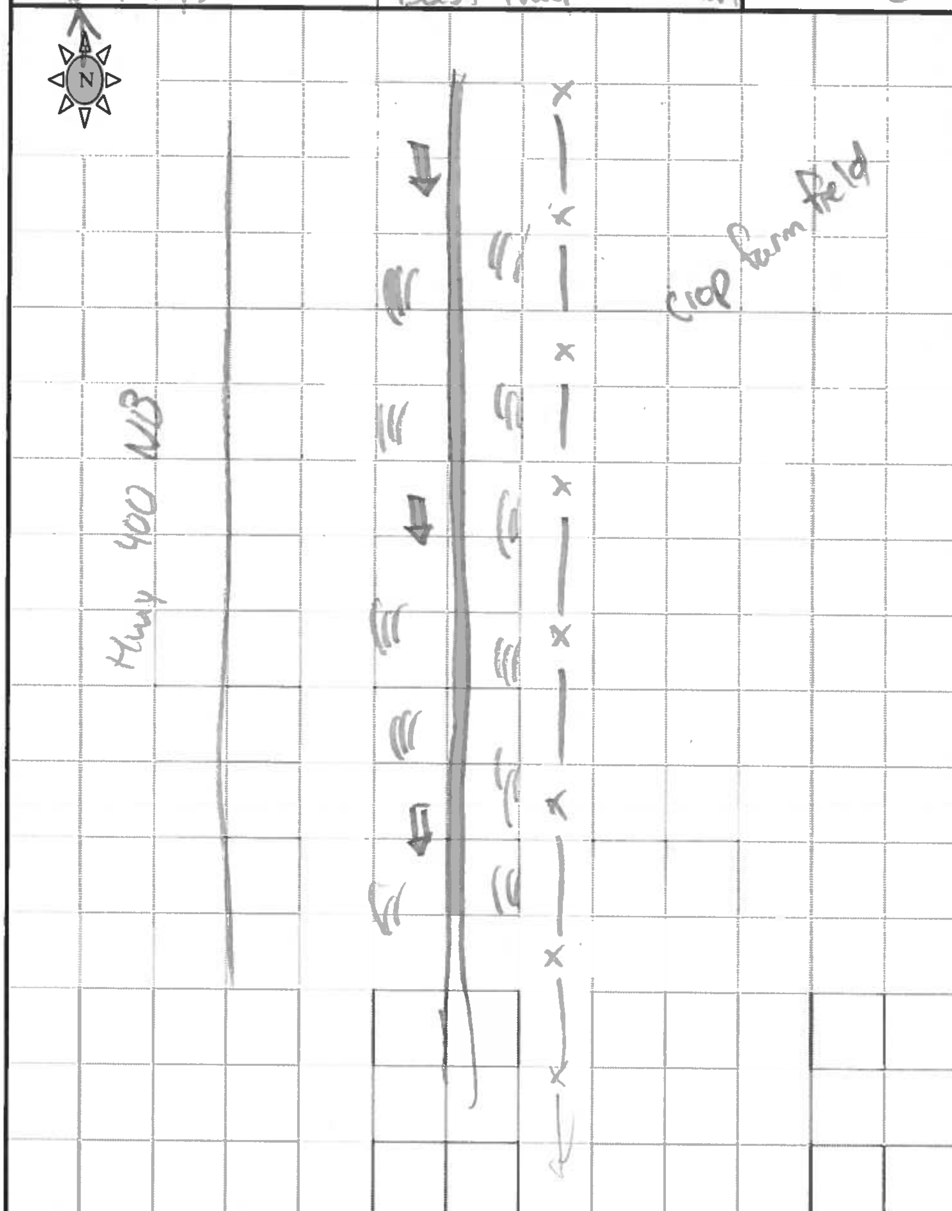
MAPPER: R. Holmes

NAME OF WATERBODY: Unnamed

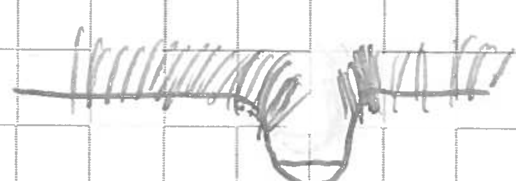
CROSSING #: C10-A-3

STATION #:

DATE: DD-MMM-YY 01-June-21



PROFILE: **Horz. Scale** 0.25 **Vert. Scale** 0.25



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
Pool
Island/Bar

Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

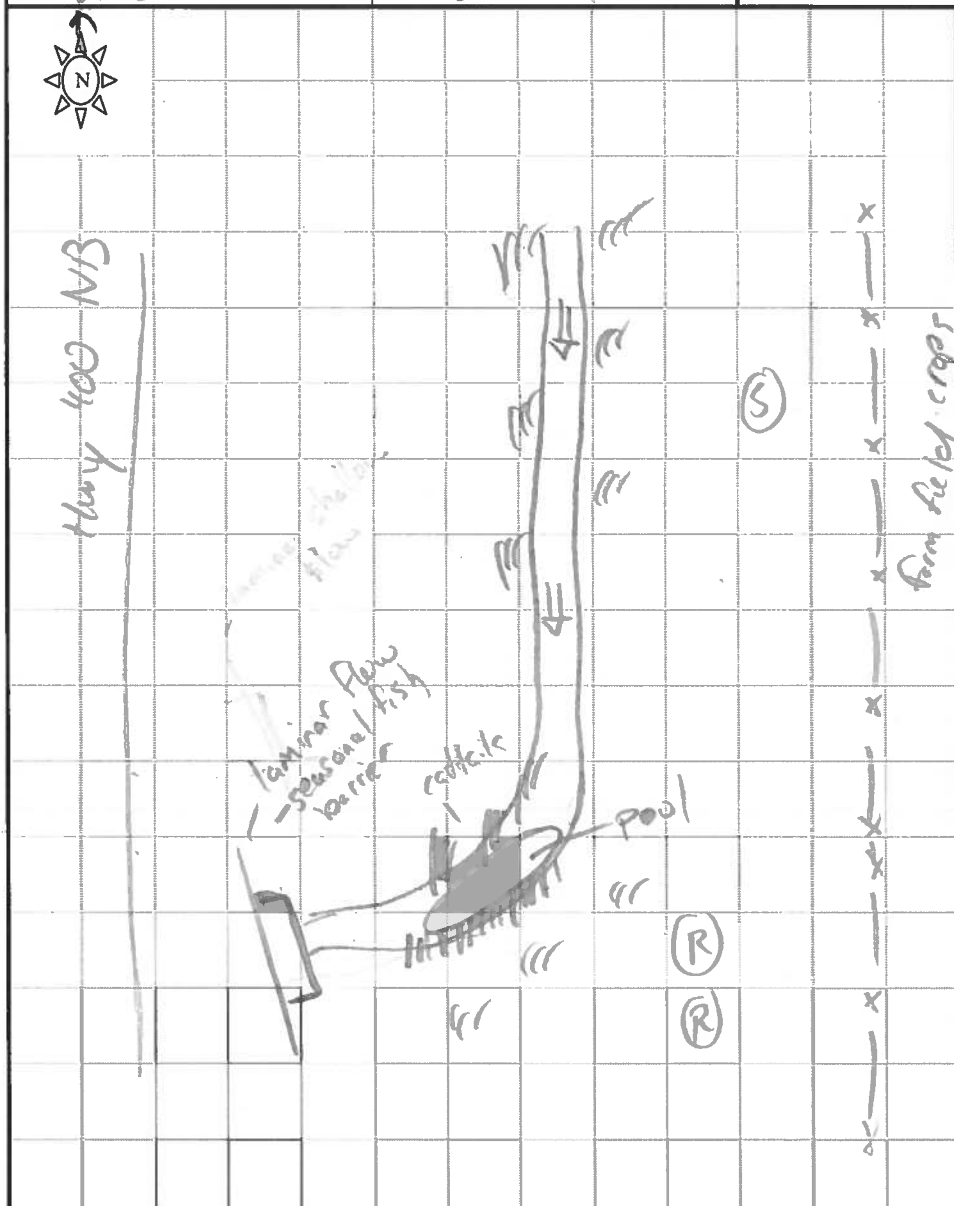
® Riparian Tree

Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
upstream	400 Culvert u/s 50m	50m	3



PROJECT #: Bradford Bypass

MAPPER: R. Holmes

NAME OF WATERBODY: Unnamed

CROSSING #: C10-A-4

STATION #:

DATE: DD-MMM-YY 01-June-21

LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▮ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
* * * Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

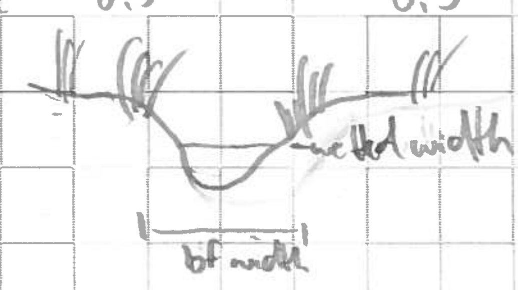
® Riparian Tree

├► Seep/Spring
-------- Undercut Bank

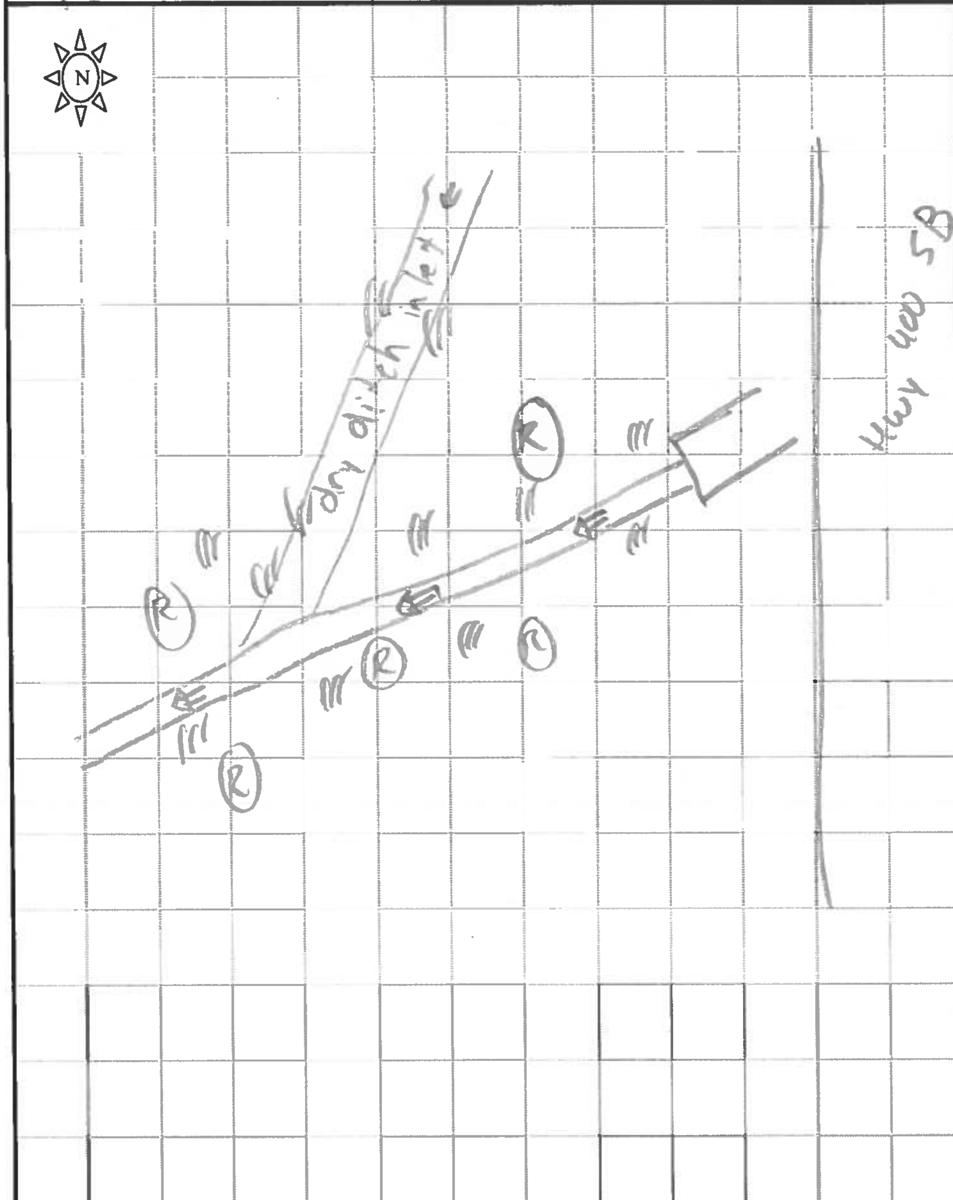
— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
└┘ Culvert

PROFILE: run feature **Horz. Scale** 0.5 **Vert. Scale** 0.5



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
Downstream	400 culvert d/s 50m	50m	3



PROJECT #: Bradford bypass

MAPPER: R. Holmes

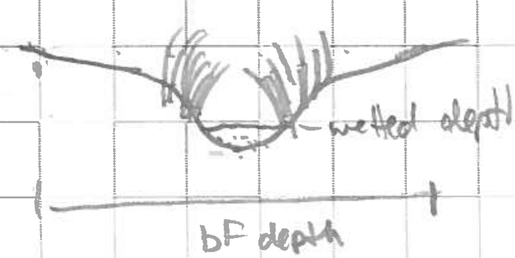
NAME OF WATERBODY: Unnamed

CROSSING #: C10-A-4

STATION #:

DATE: DD-MMM-YY 01-June-21

PROFILE: Horz. Scale 1m Vert. Scale 1m



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▮ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
* * * Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction
® Riparian Tree

├▶ Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
└┘ Culvert

GENERAL INFORMATION

PROJECT #:	PROJECT DESCRIPTION: Bradford Bypass	DAY:	MONTH:	YEAR:

Is STREAM REALIGNMENT required for this section:
O Yes O No ~~O~~ Unknown

COLLECTORS: RH, KC	WEATHER CONDITIONS: overcast	TIME STARTED: 1015	TIME FINISHED: 1030

AIR TEMP: 15°C	WATER TEMP:	CONDUCTIVITY (µS/cm):

PHOTO NUMBERS AND DESCRIPTIONS:

LOCATION

NAME OF WATERBODY:	DRAINAGE SYSTEM:	CROSSING #: C10-A-5	STATION #:

LOCATION OF CROSSING: East of Hwy 400 @ McKenzie Road ~ 150 m south of 8th Line

GPS COORDINATES: 44.110519, -79.632596	MTO CHAINAGE:
TOWNSHIP:	MNR DISTRICT:

LAND USE AND POLLUTION

SURROUNDING LAND USE:	SOURCES OF POLLUTION:
Row + ag field	Hwy + farm field runoff

EXISTING STRUCTURE TYPE

Bridge O	Box Culvert O	Open Foot Culvert O	CSP ~~O~~	N/A O

Other O Describe: | Size (w x h) m^2

SECTION TYPE AND MORPHOLOGY

SECTION IDENTIFIER:

SECTION LOCATION: (include on habitat map)

TYPE:	Stream / river	Channelized	Permanent	Intermittent	Ephemeral	ASSOCIATED WETLAND:
	O	O	O	~~O~~	O	

TOTAL SECTION LENGTH (m):

CURRENT VELOCITY (m/s):

SUB-SECTION(S)	Run ~~O~~	Pool O	Riffle O	Flats O	Inside culvert O	Other
Percentage of area	100					
Mean depth wetted (m)	0.8					
Mean width wetted (m)	0.03					
Mean bankfull width (m)	1.2					
Mean bankfull depth(m)	2					
Substrate	Si, Sa, Mu					

Bedrock	Boulder	Cobble	Gravel	Sand	Silt	Clay	Muck	Detritus
Br	Bo	Co	Gr	Sa	Si	Cl	Mu	D

BANK STABILITY

	Stable	Slightly Unstable	Moderately Unstable	Unstable
Left Upstream Bank	O	Ø	O	O
Right Upstream Bank	O	Ø	O	O

HABITAT

IN-STREAM COVER (% surface area):	Undercut banks	Boulders	Cobble	Woody Debris	Organic debris	Vascular Macrophytes	None
30				Instream Overhanging		Instream 100 Overhanging	

SHORE COVER (% stream shaded):	100 – 90 %	90 – 60%	60- 30%	30 – 1%	None
	O	O	Ø	O	O

VEGETATION TYPE (%): 100	Submergent	Floating	Emergent	None
			cattail/grasses	
Predominant Species			"	

MIGRATORY OBSTRUCTIONS:	None	Seasonal	Permanent
		low flow	

POTENTIAL CRITICAL HABITAT LIMITING:	Spawning	Evidence of Groundwater	Other

POTENTIAL ENHANCEMENT OPPORTUNITIES:

- increase width of rip vegetation
- add rip trees for shade
- restore nat. channel morphology

COMMENTS:

- straightened ag field drain
- dense cattails throughout
- trickle flow obs → lots of rain in past 48-72 hrs
- no minnows obs, shallow (3cm) depth
- minimal substrate sorting
- U-shaped channel, no clear transition from bank to floor

Additional Notes Appended? O No O Yes **number of pages** _________

GENERAL INFORMATION

PROJECT #:	PROJECT DESCRIPTION: Bradford Bypass	DAY: 09	MONTH: June	YEAR: 2022

Is STREAM REALIGNMENT required for this section:
O Yes O No ✓ Unknown

COLLECTORS: RY RC	WEATHER CONDITIONS: Overcast	TIME STARTED: 9:30	TIME FINISHED: 9:45
AIR TEMP: 14°C	WATER TEMP:	CONDUCTIVITY (µS/cm):	

PHOTO NUMBERS AND DESCRIPTIONS:

LOCATION

NAME OF WATERBODY: unknown	DRAINAGE SYSTEM:	CROSSING #: C10-A-13	STATION #:

LOCATION OF CROSSING: east side of Hwy 400, north of 88

GPS COORDINATES: 44.129274, -79.637270	MTO CHAINAGE:
TOWNSHIP:	MNR DISTRICT:

LAND USE AND POLLUTION

SURROUNDING LAND USE: Hwy ROW	SOURCES OF POLLUTION: Hwy runoff

EXISTING STRUCTURE TYPE

Bridge O	Box Culvert ✓	Open Foot Culvert O	CSP O	N/A O

Other O Describe: Size (w x h) m^2 1.2×0.8m

SECTION TYPE AND MORPHOLOGY

SECTION IDENTIFIER: entire ROW	SECTION LOCATION: (Include on habitat map)

TYPE:	Stream / river	Channelized	Permanent	Intermittent	Ephemeral	ASSOCIATED WETLAND:
	O	O	✓	O	O	

TOTAL SECTION LENGTH (m):	CURRENT VELOCITY (m/s):

SUB-SECTION(S)	Run ✓	Pool O	Riffle ✓	Flats O	Inside culvert O	Other
Percentage of area	90		10			
Mean depth wetted (m)	0.07		0.03			
Mean width wetted (m)	0.6		0.8			
Mean bankfull width (m)	1.2		1.2			
Mean bankfull depth(m)	1.0		1.0			
Substrate	Si, Sa, Cl		Si, Sa, Cl			

Bedrock Br	Boulder Bo	Cobble Co	Gravel Gr	Sand Sa	Silt Si	Clay Cl	Muck Mu	Detritus D

BANK STABILITY

	Stable	Slightly Unstable	Moderately Unstable	Unstable
Left Upstream Bank	O	O ✓	O	O
Right Upstream Bank	O	O ✓	O	O

HABITAT

IN-STREAM COVER (% surface area): 10	Undercut banks	Boulders	Cobble	Woody Debris	Organic debris	Vascular Macrophytes	None
			50	Instream Overhanging		Instream Overhanging 50	

SHORE COVER (% stream shaded):	100 – 90 %	90 – 60%	60- 30%	30 – 1%	None
	O	O	O	O ✓	O

VEGETATION TYPE (%): none	Submergent	Floating	Emergent	None
Predominant Species				

MIGRATORY OBSTRUCTIONS:	None	Seasonal	Permanent
		-potential low flows	

POTENTIAL CRITICAL HABITAT LIMITING:	Spawning	Evidence of Groundwater	Other

POTENTIAL ENHANCEMENT OPPORTUNITIES:

-stabilize scoured banks

COMMENTS:

- defined run/riffle channel on east side of Hwy
- no minnows obs.
- shallow water, no fish barriers obs throughout ROW or d/s
- may be seasonal use depending on water levels → large amount of rain in past 48-72 hours may have increased water depths.
- minimal in stream cover → small section of open clay bottom, no pools of refuge locations.

Additional Notes Appended? O No O Yes number of pages ______

GENERAL INFORMATION

PROJECT #:	PROJECT DESCRIPTION:	DAY:	MONTH:	YEAR:
	Bradford Bypass	09	June	2022

Is STREAM REALIGNMENT required for this section:

O Yes O No O Unknown ✓

COLLECTORS:	WEATHER CONDITIONS:	TIME STARTED:	TIME FINISHED:
RA KC	Overcast	9:45	1000

AIR TEMP:	WATER TEMP:	CONDUCTIVITY (µS/cm):
14°C		

PHOTO NUMBERS AND DESCRIPTIONS:

LOCATION

NAME OF WATERBODY:	DRAINAGE SYSTEM:	CROSSING #:	STATION #:
Unknown		C10-A-A	

LOCATION OF CROSSING: East side of Hwy here

GPS COORDINATES:	MTO CHAINAGE:
44.133522, -79.638587	
TOWNSHIP:	**MNR DISTRICT:**

LAND USE AND POLLUTION

SURROUNDING LAND USE:	SOURCES OF POLLUTION:
Hwy + ag field	Ag field, Hwy runoff

EXISTING STRUCTURE TYPE

Bridge O	Box Culvert O	Open Foot Culvert O	CSP ✓	N/A O

Other O Describe:

Size (w x h) m^2

SECTION TYPE AND MORPHOLOGY

SECTION IDENTIFIER:

SECTION LOCATION: (Include on habitat map)

TYPE:	Stream / river	Channelized	Permanent	Intermittent	Ephemeral	ASSOCIATED WETLAND:
	O	O	O	✓	O	

TOTAL SECTION LENGTH (m):

CURRENT VELOCITY (m/s):

SUB-SECTION(S)	Run O	Pool O	Riffle O	Flats O	Inside culvert O	Other
Percentage of area						
Mean depth wetted (m)						
Mean width wetted (m)						
Mean bankfull width (m)						
Mean bankfull depth(m)						
Substrate						

Bedrock Br	Boulder Bo	Cobble Co	Gravel Gr	Sand Sa	Silt Si	Clay Cl	Muck Mu	Detritus D

BANK STABILITY

	Stable	Slightly Unstable	Moderately Unstable	Unstable
Left Upstream Bank	O	O	O	O
Right Upstream Bank	O	O	O	O

HABITAT

IN-STREAM COVER (% surface area): 100	**Undercut banks**	**Boulders**	**Cobble**	**Woody Debris** Instream / Overhanging	**Organic debris**	**Vascular Macrophytes** Instream 100 / Overhanging	**None**

SHORE COVER (% stream shaded):	100 – 90 %	90 – 60%	60- 30%	30 – 1%	None
	O	O	O	O	O

VEGETATION TYPE (%): 100	Submergent	Floating	Emergent	None
			phrag	
Predominant Species				

MIGRATORY OBSTRUCTIONS:	None	Seasonal	Permanent

POTENTIAL CRITICAL HABITAT LIMITING:	Spawning	Evidence of Groundwater	Other

POTENTIAL ENHANCEMENT OPPORTUNITIES:

- Remove ~~[illegible]~~ invasive Phrag, restore channel form + function
- add rip plantings

COMMENTS:

- entire ROW + channel location choked out by phrag.
- no defined channel obs.
- standing water obs in phrag, but no flow.

Additional Notes Appended? O No O Yes number of pages ________

GENERAL INFORMATION

PROJECT #:	PROJECT DESCRIPTION:	DAY:	MONTH:	YEAR:
Bradford Bypass		9	June	2022

Is STREAM REALIGNMENT required for this section:

O Yes ☒ No ☒ Unknown

COLLECTORS:	WEATHER CONDITIONS:	TIME STARTED:	TIME FINISHED:
RM, RC	overcast, windy, light showers.		

AIR TEMP:	WATER TEMP:	CONDUCTIVITY (µS/cm):
14°C		

PHOTO NUMBERS AND DESCRIPTIONS:

LOCATION

NAME OF WATERBODY:	DRAINAGE SYSTEM:	CROSSING #:	STATION #:
Unknown		C10-A-C	

LOCATION OF CROSSING: north of 9th Line on private lands, 50-100 m east of Hwy 400

GPS COORDINATES: 44.12536641, -79.6352996	**MTO CHAINAGE:**
TOWNSHIP:	**MNR DISTRICT:** Aurora

LAND USE AND POLLUTION

SURROUNDING LAND USE:	SOURCES OF POLLUTION:

EXISTING STRUCTURE TYPE

Bridge O	Box Culvert O	Open Foot Culvert O	CSP O	N/A O

Other O Describe:

Size (w x h) m^2

SECTION TYPE AND MORPHOLOGY

SECTION IDENTIFIER:	SECTION LOCATION: (include on habitat map)
Mid section	

TYPE:	Stream / river	Channelized	Permanent	Intermittent	Ephemeral	ASSOCIATED WETLAND:
	☒	O	☒	O	O	

TOTAL SECTION LENGTH (m):	CURRENT VELOCITY (m/s):

SUB-SECTION(S)	Run	Pool	Riffle	Flats	Inside culvert	Other
	☒	☒	☒	O	O	Diffuse flow @ u/s end
Percentage of area	35		~~20~~ 15			50
Mean depth wetted (m)	0.2		0.15			~~2.0~~ 0.2
Mean width wetted (m)	0.4		0.5			3.0
Mean bankfull width (m)	1.0		1.5			5.0
Mean bankfull depth(m)	0.8		0.6			1.0
Substrate	Sa, Si, Mu		Co, Gr, Si.			Mu, D.

Bedrock Br	Boulder Bo	Cobble Co	Gravel Gr	Sand Sa	Silt Si	Clay Cl	Muck Mu	Detritus D

BANK STABILITY

	Stable	Slightly Unstable	Moderately Unstable	Unstable
Left Upstream Bank	O	O	O	O
Right Upstream Bank	O	O	O	O

HABITAT

IN-STREAM COVER (% surface area):	**Undercut banks**	**Boulders**	**Cobble**	**Woody Debris** **Instream** **Overhanging**	**Organic debris**	**Vascular Macrophytes** **Instream** **Overhanging**	**None**

SHORE COVER (% stream shaded):	**100 – 90 %**	**90 – 60%**	**60- 30%**	**30 – 1%**	**None**
	O	O	O	O	O

VEGETATION TYPE (%):	**Submergent**	**Floating**	**Emergent**	**None**
Predominant Species				

MIGRATORY OBSTRUCTIONS:	**None**	**Seasonal**	**Permanent**

POTENTIAL CRITICAL HABITAT LIMITING:	**Spawning**	**Evidence of Groundwater**	**Other**

POTENTIAL ENHANCEMENT OPPORTUNITIES:

COMMENTS:

Additional Notes Appended? O **No** O **Yes** **number of pages** _________

Ministry of Transportation

Ontario

PONDS AND LAKES FIELD COLLECTION FORM

GENERAL INFORMATION

Project #	Project Description:	Date:
	Bradford Bypass	June 9/2022

Collectors:	Time Started:	Time Finished:
RM, KC	1200	1345

Weather Conditions:	Air Temp (°C):
Sunny, no prec, clear skies	16°C

Surface Conditions:

calm, no flow obs

Calm	Rippled	Wavy	Rough
☒	○	○	○

Photos Numbers and Descriptions:

LOCATION

Name of Waterbody:	Station #:	Location of Station:
	C12-A-1	

GPS Coordinates:	MTO Chainage:
44.125683, -79.604743	

Township:	MNRF District:

LAND USE AND POLLUTION

Surrounding Land Use / Terrain:	Sources of Pollution:
Manicured lawn w/ forested land further back	grass clippings

WATERBODY TYPE AND MORPHOLOGY

Large Lake ○	Small Lake ○	Pond ☒	Reservoir ○	Dug-out ○	Wetland ○
Intermittent ○	Run-off ○	Spring-Fed ○	In-stream ☒	Bypass ○	Not connected ○

Waterbody Dimensions:

Length (m)	Mean Width (m)
60	15

WATER CHEMISTRY

Water Colour:

Colourless	Yellow / Brown	Blue / Green	Other (Describe):
○	☒	○	○

Secchi Depth (m):	pH (as required):

Conductivity (µS/cm):

Surface:	Bottom:

DISSOLVED OXYGEN / TEMPERATURE PROFILE

Depth (m)	**0.0**	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
Water Temp (°C)							
Dissolved Oxygen (mg/L)							
Depth (m)	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
Water Temp (°C)							
Dissolved Oxygen (mg/L)							
Depth (m)	**7.0**	**7.5**	**8.0**	**8.5**	**9.0**	**9.5**	**10.0**
Water Temp (°C)							
Dissolved Oxygen (mg/L)							

Max Depth (m):

Bottom Substrate: Muck, detritus, Silt

Bedrock (Br)	*Boulder (Bo)*	*Cobble (Co)*	*Gravel (Gr)*	*Sand (Sa)*	*Silt (Si)*	*Clay (Cl)*	*Muck (Mu)*	*Detritus (D)*

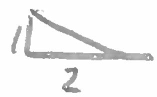
BANK HABITAT

Bank Cover (% surface area): 15

Undercut banks	Boulders	Cobbles	Woody Debris	Organic Debris	Vascular Macrophytes	None
				80	20	○

Near Shore Slope (%):

1:2



Shoreline Substrate (%):

Bedrock	Boulder	Cobble	Gravel	Sand	Silt	Clay	Muck	Marl	Detritus
							50		50

Shore Cover (% shaded): minimal shade, sparse tree @ N. ed

100-90%	89-60%	59-30%	29-1%	None
○	○	○	⊗	○

IN-WATER HABITAT

Underwater Cover (% surface area):

Boulders	Cobbles	Woody Debris	Organic Debris	Vascular Macrophytes	Other

Vegetation Type:

Vegetation Type	Submerged	Floating	Emergent	None
(%) 15	80	15	5	○
Predominant Species:		algae	cattail	

MIGRATORY OBSTRUCTIONS

None	Seasonal	Permanent
	low flow condition u/s + d/s of pond	

POTENTIAL CRITICAL HABITAT

POTENTIAL ENHANCEMENT OPPORTUNITIES

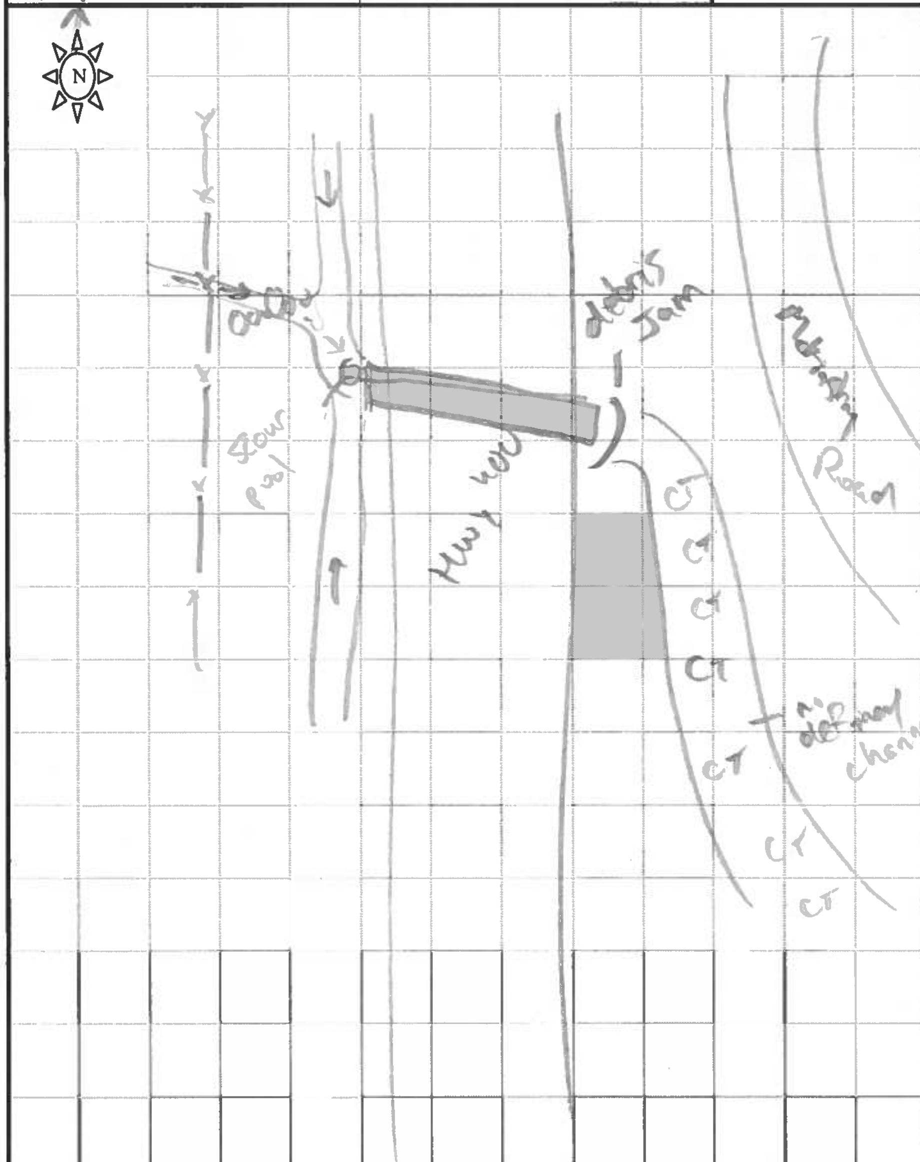
-riparian plantings + grasses

ADDITIONAL COMMENTS

- no inflow from u/s end, poorly defined channel u/s, no substrate sorting or banks.
- abundance of sub. veg w/ floating algae.
- d/s channel poorly defined, trickle flows, minimal sub. sorting
- soft muck bottom, difficult to walk out w/ seine
- 3 seine pulls → caught only Fathead minnows (12 total)

Additional Notes Appended? O No O Yes Number of Pages __________

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
Entire ROW			



PROJECT #: Bradford Bypass

MAPPER: R. Holmes

NAME OF WATERBODY: Unknown

CROSSING #: C10-A-6

STATION #:

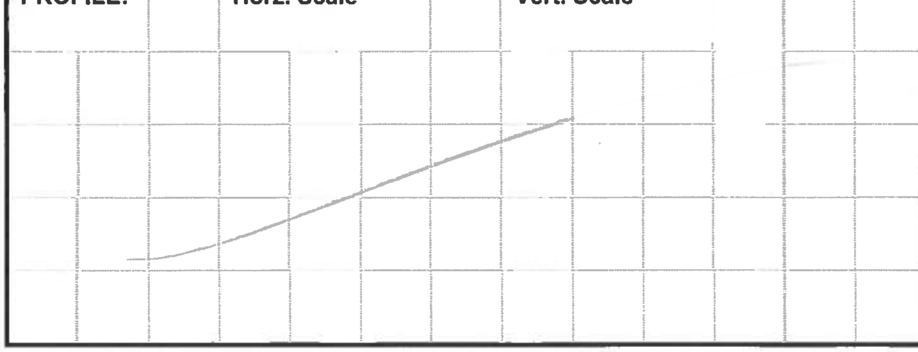
DATE: DD-MMM-YY 09-June-2022

LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▮ Island/Bar
░ Fine Substrate
Gravel Substrate
oOooO Cobble /Boulder
*** * *** Debris
CT Cattail
SV/FV Submerg/Float Veg
EV Emergent Vegetation
W Watercress
Fe Iron Staining
/////// Eroded Bank
XXX Riprap / Other Stabilization
Instream Log/Tree
^^^ Dam/Weir/Obstruction
® Riparian Tree
├▶ Seep/Spring
-------- Undercut Bank
— Barrier to Fish Movement
-S- Seasonal Barrier
-x--x- Fence line
└─┘ Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C10-A-5		100m	

PROJECT #: Bradford Bypass

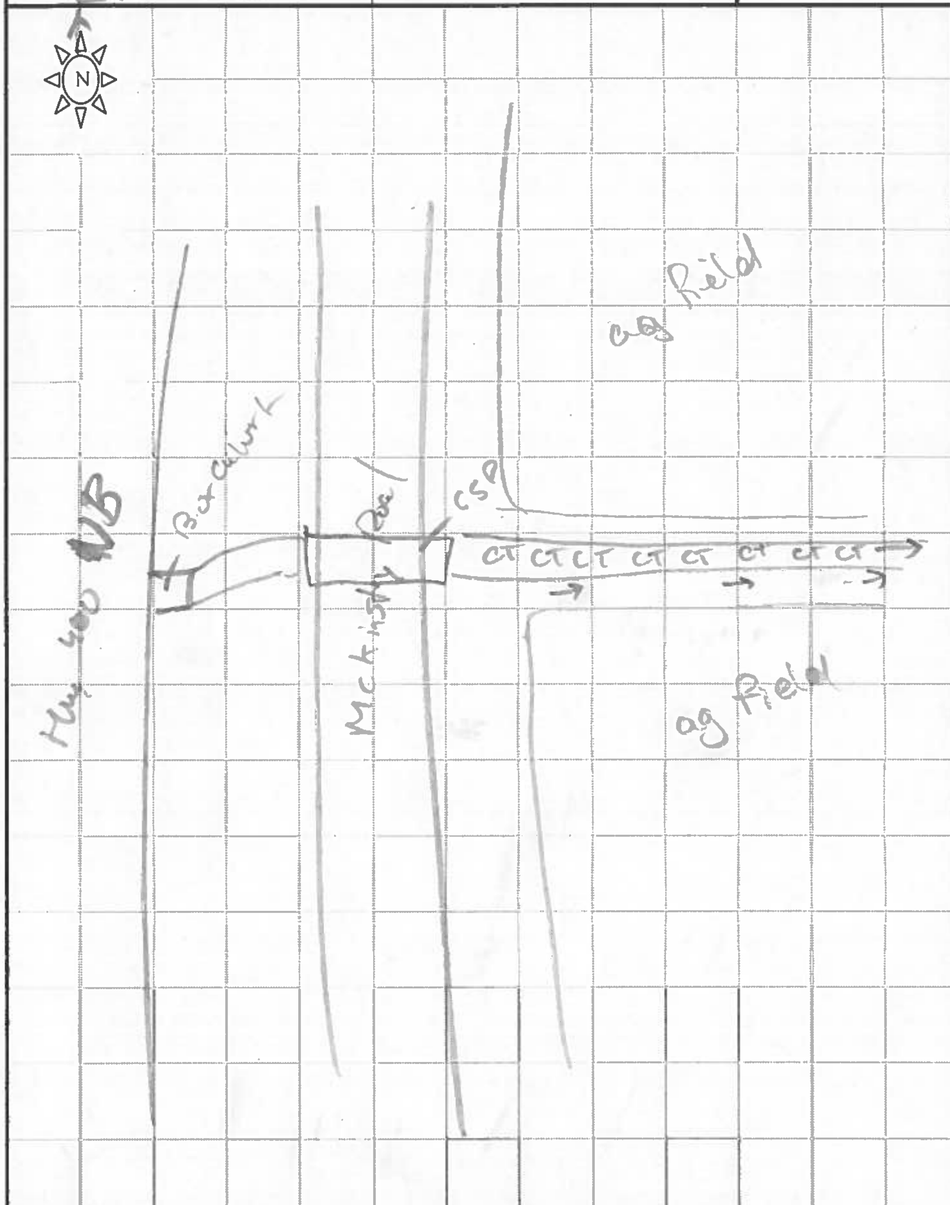
MAPPER: R Holmes

NAME OF WATERBODY: Unknown

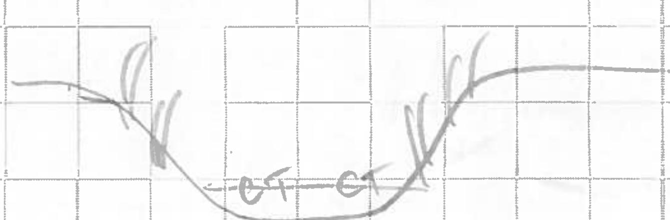
CROSSING #: C10-A-5

STATION #:

DATE: DD-MMM-YY 09-June-2022



PROFILE: **Horz. Scale** **Vert. Scale**



LEGEND

- **10d** depth (cm)
- **6w** width
- ➡ Riffle
- ⇨ Run/Glide
- ⬭ Pool
- ▓ Island/Bar
- ░ Fine Substrate
- ### Gravel Substrate
- oOooO Cobble /Boulder
- * * * Debris
- **CT** Cattail
- **SV/FV** Submerg/Float Veg
- **EV** Emergent Vegetation
- **W** Watercress
- **Fe** Iron Staining
- /////// Eroded Bank
- **XXX** Riprap / Other Stabilization
- Instream Log/Tree
- ^^^ Dam/Weir/Obstruction
- ® Riparian Tree
- ├► Seep/Spring
- -------- Undercut Bank
- ▬ Barrier to Fish Movement
- -S- Seasonal Barrier
- -x--x- Fence line
- └┘ Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C10-A-A		50m	

PROJECT #: Bradford Bypass

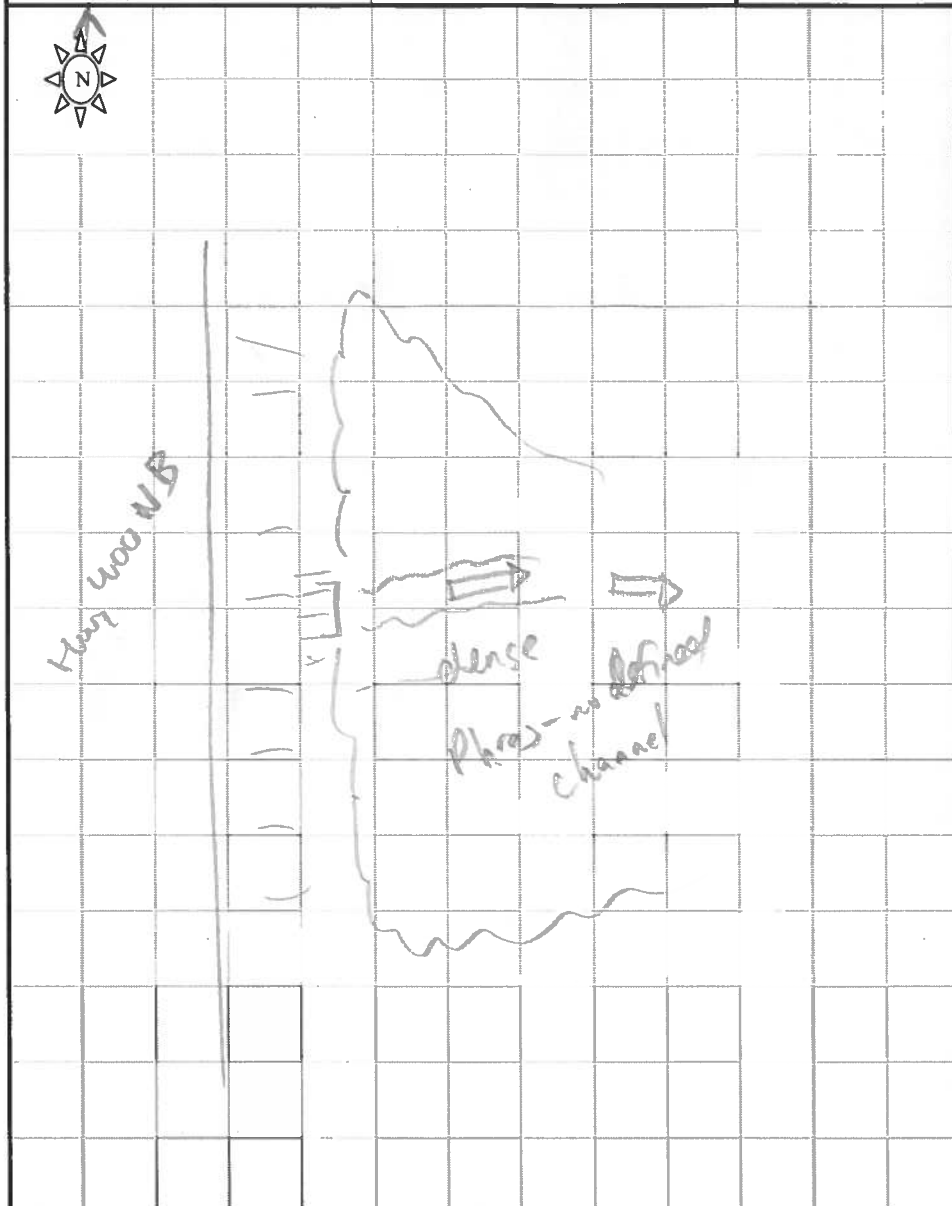
MAPPER: R. Holmes

NAME OF WATERBODY: Unknown

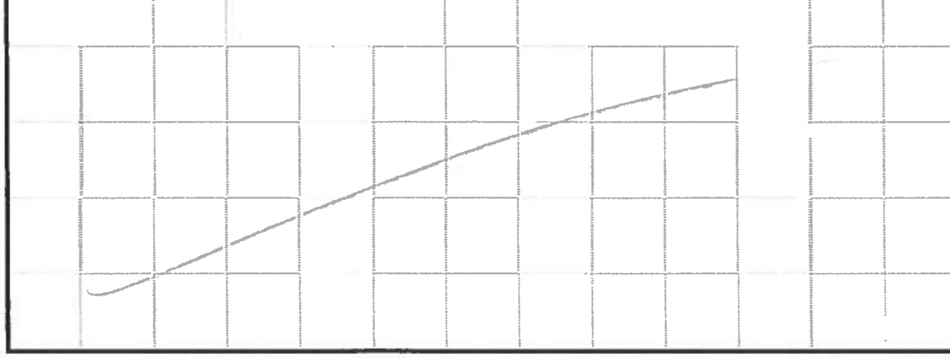
CROSSING #:

STATION #:

DATE: DD-MMM-YY 09-June-2022



PROFILE: **Horz. Scale** **Vert. Scale**



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
Pool
Island/Bar

Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

® Riparian Tree

Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x–x- Fence line
Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C10-4-B		70 M	

PROJECT #: Bradford Bypass

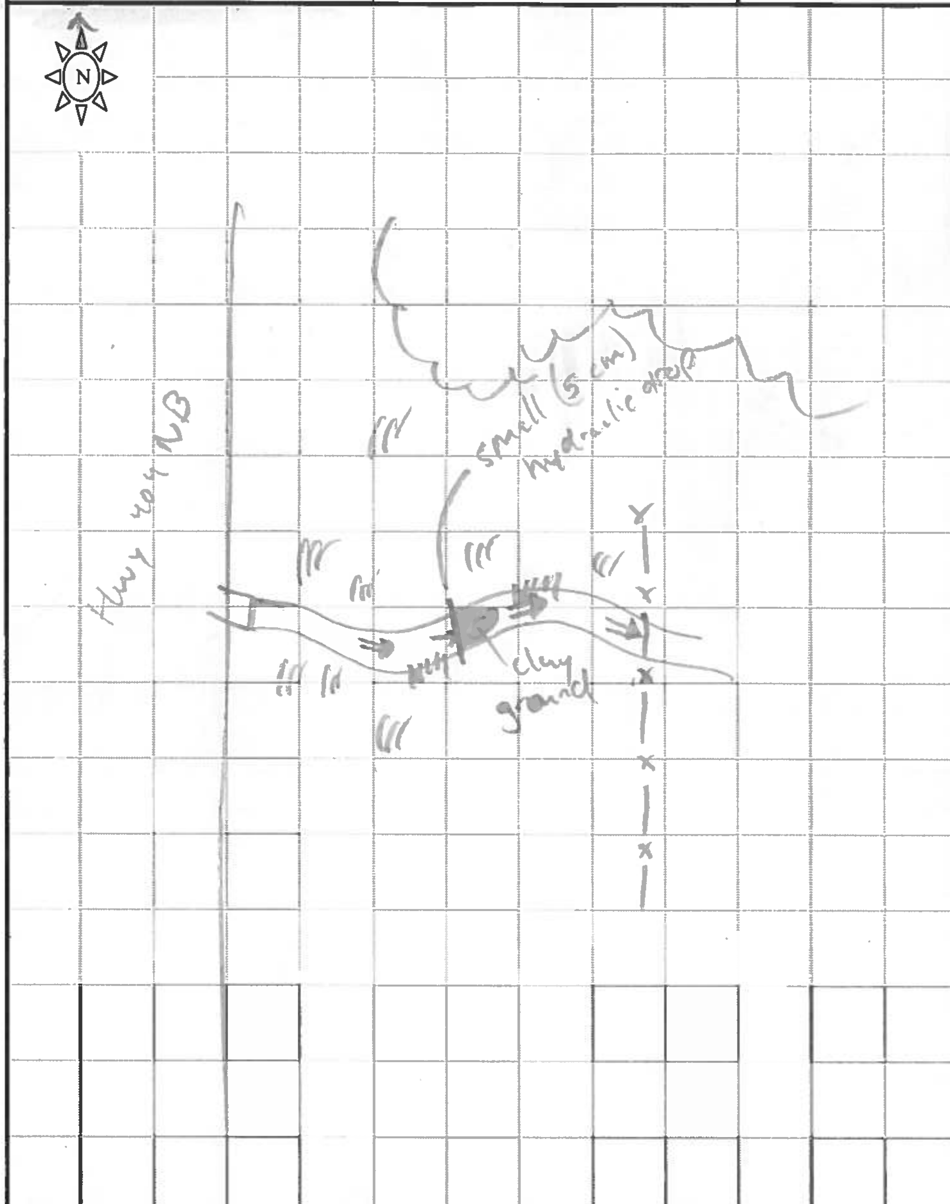
MAPPER: R. Holmes

NAME OF WATERBODY: unknown

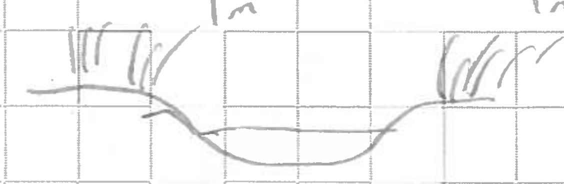
CROSSING #:

STATION #:

DATE: DD-MMM-YY 09-June-22



PROFILE: Run **Horz. Scale** 1m **Vert. Scale** 1m



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▮ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

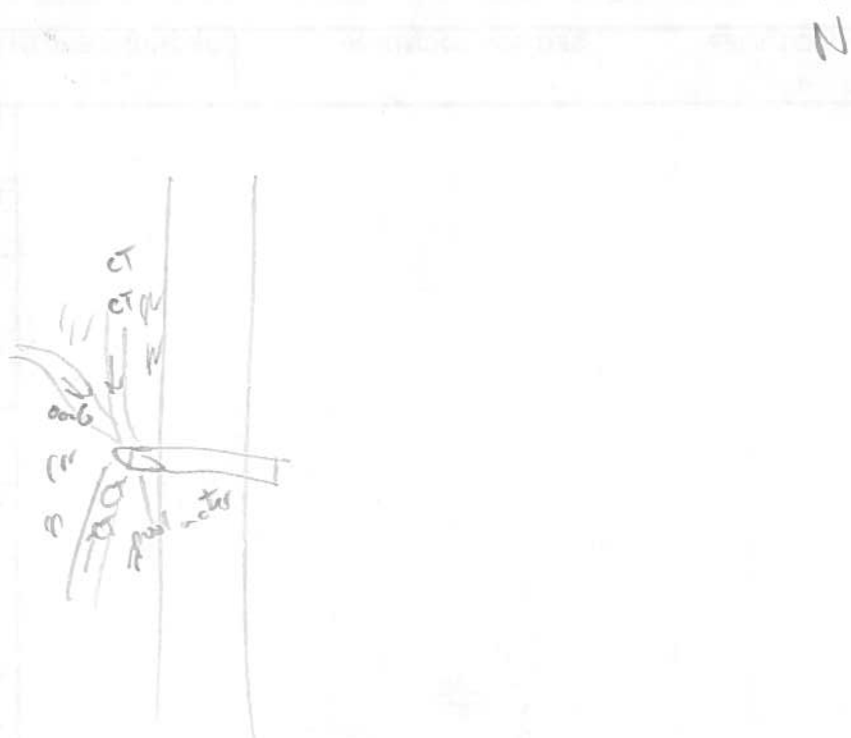
Instream Log/Tree
^^^ Dam/Weir/Obstruction

® Riparian Tree

Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
Culvert


N
CT
CT

GENERAL INFORMATION

PROJECT #:	PROJECT DESCRIPTION:	DAY:	MONTH:	YEAR:
	Bradford Bypass			

Is STREAM REALIGNMENT required for this section:

O Yes O No ☒ Unknown

COLLECTORS:	WEATHER CONDITIONS:	TIME STARTED:	TIME FINISHED:
RH, KC	Overcast	1015	1030

AIR TEMP:	WATER TEMP:	CONDUCTIVITY (µS/cm):
15°C		

PHOTO NUMBERS AND DESCRIPTIONS:

LOCATION

NAME OF WATERBODY:	DRAINAGE SYSTEM:	CROSSING #:	STATION #:
		C10-A-5	

LOCATION OF CROSSING: East of Hwy 400 @ McKinstry Road ≥ 150 m south of 8th Line

GPS COORDINATES:	MTO CHAINAGE:
44.110519, -79.632596	
TOWNSHIP:	**MNR DISTRICT:**

LAND USE AND POLLUTION

SURROUNDING LAND USE:	SOURCES OF POLLUTION:
Row + ag field	Hwy + farm field runoff

EXISTING STRUCTURE TYPE

Bridge O	Box Culvert O	Open Foot Culvert O	CSP ☒	N/A O

Other O Describe: Size (w x h) m^2

SECTION TYPE AND MORPHOLOGY

SECTION IDENTIFIER:	SECTION LOCATION: (include on habitat map)

TYPE:	Stream / river	Channelized	Permanent	Intermittent	Ephemeral	ASSOCIATED WETLAND:
	O	O	O	☒	O	

TOTAL SECTION LENGTH (m):	CURRENT VELOCITY (m/s):

SUB-SECTION(S)	Run ☒	Pool O	Riffle O	Flats O	Inside culvert O	Other
Percentage of area	100					
Mean depth wetted (m)	0.8					
Mean width wetted (m)	0.03					
Mean bankfull width (m)	1.2					
Mean bankfull depth(m)	2					
Substrate	Si, Sa, Mu					

Bedrock	Boulder	Cobble	Gravel	Sand	Silt	Clay	Muck	Detritus
Br	Bo	Co	Gr	Sa	Si	Cl	Mu	D

GENERAL INFORMATION

PROJECT #:	PROJECT DESCRIPTION: Bradford Bypass	DAY: 09	MONTH: June	YEAR: 2022

Is STREAM REALIGNMENT required for this section:

O Yes O No Ø Unknown

COLLECTORS: RY RC	WEATHER CONDITIONS: overcast	TIME STARTED: 9:30	TIME FINISHED: 9:45

AIR TEMP: 14°C	WATER TEMP:	CONDUCTIVITY (µS/cm):

PHOTO NUMBERS AND DESCRIPTIONS:

LOCATION

NAME OF WATERBODY: unknown	DRAINAGE SYSTEM:	CROSSING #: C10-A-13	STATION #:

LOCATION OF CROSSING: east side of Hwy 400 north of 88

GPS COORDINATES: 44.129279, -79.6372710	MTO CHAINAGE:
TOWNSHIP:	MNR DISTRICT:

LAND USE AND POLLUTION

SURROUNDING LAND USE: Hwy ROW	SOURCES OF POLLUTION: Hwy runoff

EXISTING STRUCTURE TYPE

Bridge O	Box Culvert Ø	Open Foot Culvert O	CSP O	N/A O

Other O Describe: | Size (w x h) m^2 1.2×0.8m

SECTION TYPE AND MORPHOLOGY

SECTION IDENTIFIER: entire Row	SECTION LOCATION: (include on habitat map)

TYPE:	Stream / river	Channelized	Permanent	Intermittent	Ephemeral	ASSOCIATED WETLAND:
	O	O	Ø	O	O	

TOTAL SECTION LENGTH (m):	CURRENT VELOCITY (m/s):

SUB-SECTION(S)	Run Ø	Pool O	Riffle Ø	Flats O	Inside culvert O	Other
Percentage of area	90		10			
Mean depth wetted (m)	0.07		0.03			
Mean width wetted (m)	0.6		0.8			
Mean bankfull width (m)	1.2		1.2			
Mean bankfull depth(m)	1.0		1.0			
Substrate	Si, Sa, Cl		Si, Sa, Cl			

Bedrock Br	Boulder Bo	Cobble Co	Gravel Gr	Sand Sa	Silt Si	Clay Cl	Muck Mu	Detritus D

GENERAL INFORMATION

PROJECT #:	PROJECT DESCRIPTION:	DAY:	MONTH:	YEAR:
	Bradford Bypass	09	June	2022

Is STREAM REALIGNMENT required for this section:
O Yes O No O Unknown

COLLECTORS:	WEATHER CONDITIONS:	TIME STARTED:	TIME FINISHED:
RH KC	Overcast	9:45	1000

AIR TEMP:	WATER TEMP:	CONDUCTIVITY (µS/cm):
14°C		

PHOTO NUMBERS AND DESCRIPTIONS:

LOCATION

NAME OF WATERBODY:	DRAINAGE SYSTEM:	CROSSING #:	STATION #:
Unknown		C10-A-A	

LOCATION OF CROSSING:
East side of hwy here

GPS COORDINATES:	MTO CHAINAGE:
44.133522, -79.638587	
TOWNSHIP:	**MNR DISTRICT:**

LAND USE AND POLLUTION

SURROUNDING LAND USE:	SOURCES OF POLLUTION:
Hwy + ag field.	Ag field, hwy runoff

EXISTING STRUCTURE TYPE

Bridge O	Box Culvert O	Open Foot Culvert O	CSP O	N/A O

Other O Describe: Size (w x h) m^2

SECTION TYPE AND MORPHOLOGY

SECTION IDENTIFIER:	SECTION LOCATION: (include on habitat map)

TYPE:	Stream / river	Channelized	Permanent	Intermittent	Ephemeral	ASSOCIATED WETLAND:
	O	O	O	O	O	

TOTAL SECTION LENGTH (m):	CURRENT VELOCITY (m/s):

SUB-SECTION(S)	Run O	Pool O	Riffle O	Flats O	Inside culvert O	Other
Percentage of area						
Mean depth wetted (m)						
Mean width wetted (m)						
Mean bankfull width (m)						
Mean bankfull depth(m)						
Substrate						

Bedrock Br	Boulder Bo	Cobble Co	Gravel Gr	Sand Sa	Silt Si	Clay Cl	Muck Mu	Detritus D

GENERAL INFORMATION

PROJECT #:	PROJECT DESCRIPTION:	DAY:	MONTH:	YEAR:
Radford Bypass		9	June	2022

Is STREAM REALIGNMENT required for this section:

O Yes ☒ No ☒ Unknown

COLLECTORS:	WEATHER CONDITIONS:	TIME STARTED:	TIME FINISHED:
RM, RC	overcast, windy, light showers		

AIR TEMP:	WATER TEMP:	CONDUCTIVITY (μS/cm):
14°C		

PHOTO NUMBERS AND DESCRIPTIONS:

LOCATION

NAME OF WATERBODY:	DRAINAGE SYSTEM:	CROSSING #:	STATION #:
Unknown		C10-A-C	

LOCATION OF CROSSING: north of 9th Line on private lands, 50-100 m east of Hwy 400

GPS COORDINATES:	MTO CHAINAGE:
44.12536441, -79.6352996	
TOWNSHIP:	**MNR DISTRICT:** Aurora

LAND USE AND POLLUTION

SURROUNDING LAND USE:	SOURCES OF POLLUTION:

EXISTING STRUCTURE TYPE

Bridge O	Box Culvert O	Open Foot Culvert O	CSP O	N/A O

Other O Describe: Size (w x h) m^2

SECTION TYPE AND MORPHOLOGY

SECTION IDENTIFIER:	SECTION LOCATION: (include on habitat map)
Mid section	

TYPE:	Stream / river	Channelized	Permanent	Intermittent	Ephemeral	ASSOCIATED WETLAND:
	☒	O	☒	O	O	

TOTAL SECTION LENGTH (m):	CURRENT VELOCITY (m/s):

SUB-SECTION(S)	Run	Pool	Riffle	Flats	Inside culvert	Other
	☒	☒	☒	O	O	Diffuse flow @ u/s end
Percentage of area	35		~~20~~ 15			50
Mean depth wetted (m)	0.2		0.15			~~3.0~~ 0.2
Mean width wetted (m)	0.4		0.5			3.0
Mean bankfull width (m)	1.0		1.5			5.0
Mean bankfull depth(m)	0.8		0.6			1.0
Substrate	Sa, Si, Mu		Co, Gr, Si			Mu, D.

Bedrock	Boulder	Cobble	Gravel	Sand	Silt	Clay	Muck	Detritus
Br	Bo	Co	Gr	Sa	Si	Cl	Mu	D

POTENTIAL CRITICAL HABITAT

POTENTIAL ENHANCEMENT OPPORTUNITIES

-riparian plantings + grasses

ADDITIONAL COMMENTS

- no inflow from u/s end, poorly defined channel u/s, no substrate sorting or banks.
- abundance of sub. veg w floating algae.
- d/s channel poorly defined, trickle flows, minimal sub. sorting
- soft muck bottom, difficult to walk out w seine
- 3 seine pulls → caught only Fathead minnows (12 total)

Additional Notes Appended? O No O Yes Number of Pages ___________

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
Entire ROW	-		

PROJECT #: Bradford Bypass

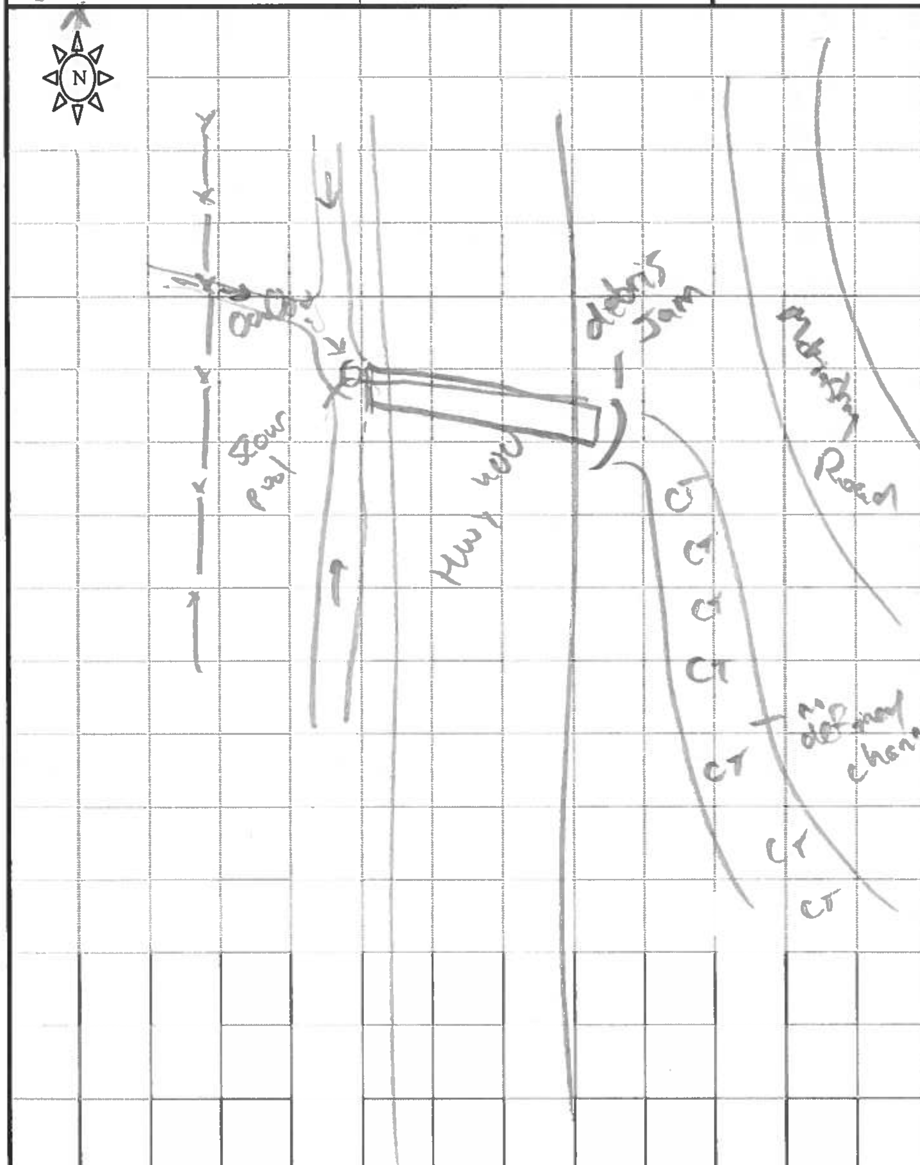
MAPPER: R. Holmes

NAME OF WATERBODY: Unknown

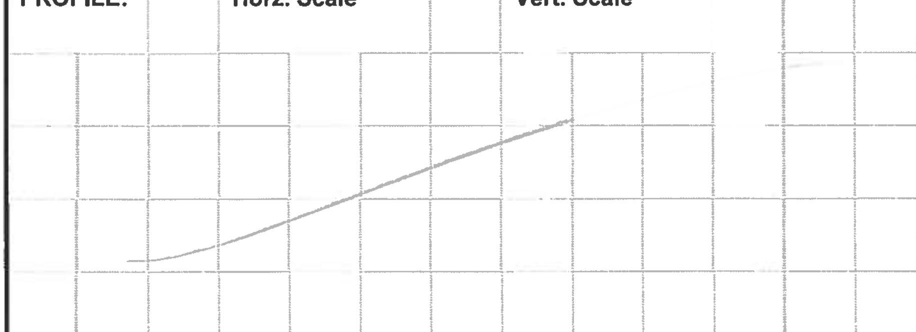
CROSSING #: C10-A-6

STATION #:

DATE: DD-MMM-YY 09-June-2022



PROFILE: **Horz. Scale** **Vert. Scale**



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▮ Island/Bar
░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

® Riparian Tree

Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
Culvert

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C10-A-5		100m	

PROJECT #: Bradford Bypass

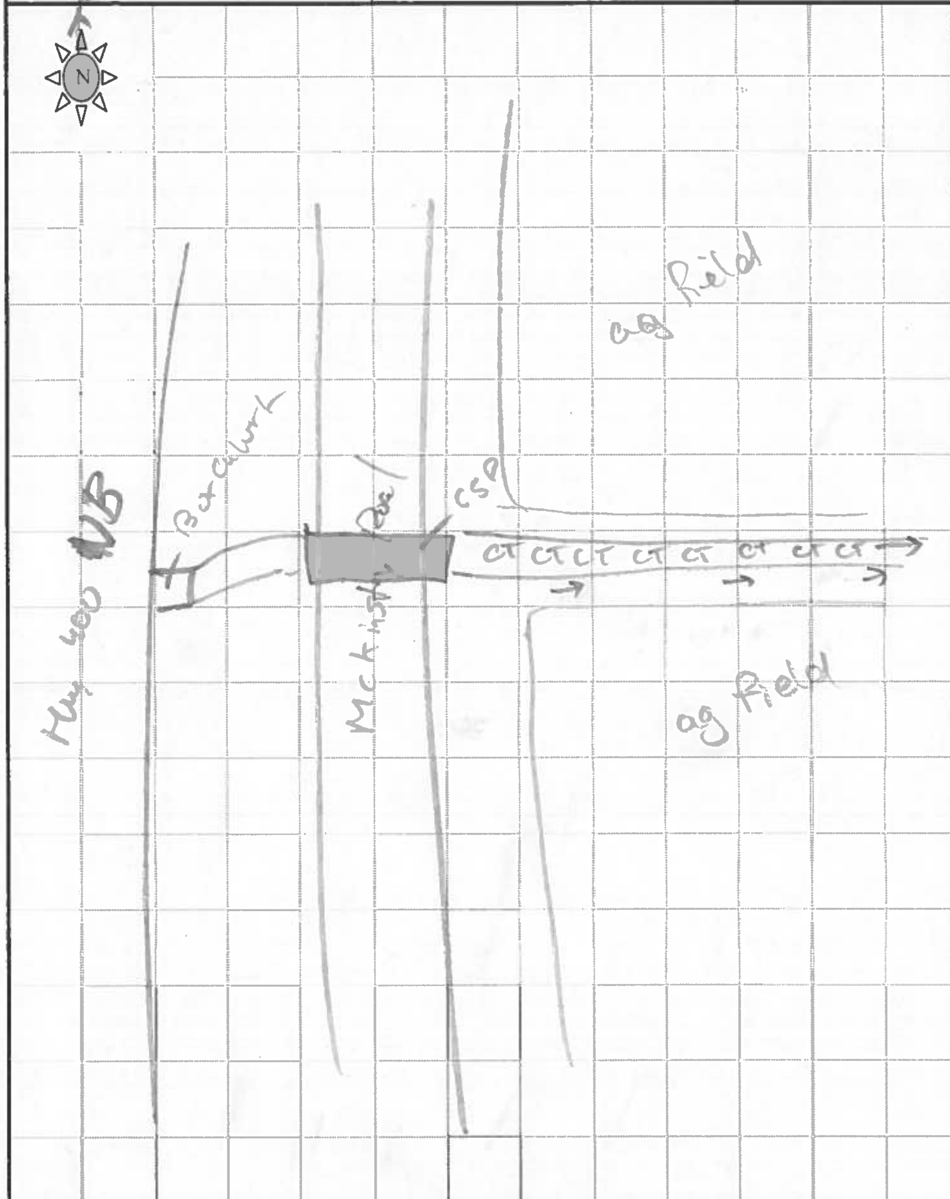
MAPPER: R Holmes

NAME OF WATERBODY: Unknown

CROSSING #: C10-A-5

STATION #:

DATE: DD-MMM-YY 09-June-2022



LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▓ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

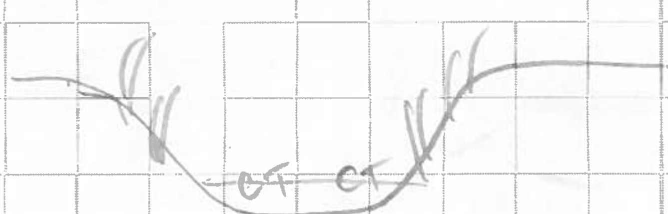
® Riparian Tree

Seep/Spring
-------- Undercut Bank

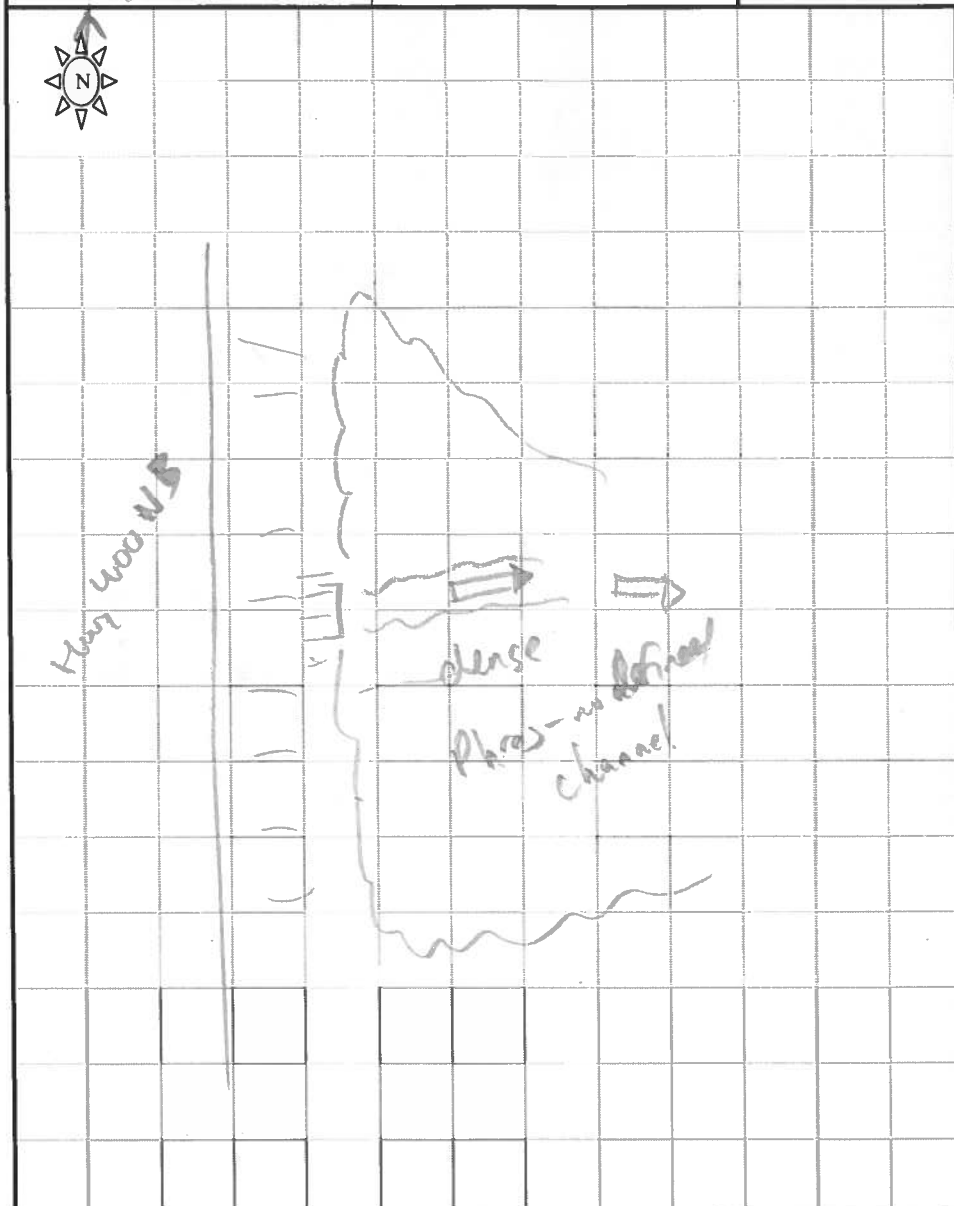
— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C10-A-A		50m	



PROJECT #: Bradford Bypass

MAPPER: R. Holmes

NAME OF WATERBODY: Unknown

CROSSING #:

STATION #:

DATE: DD-MMM-YY 09-June-2022

LEGEND

10d depth (cm)
6w width

➡ Riffle
⇨ Run/Glide
⬭ Pool
▮ Island/Bar

░ Fine Substrate
Gravel Substrate

oOooO Cobble /Boulder
*** * *** Debris

CT Cattail
SV/FV Submerg/Float Veg

EV Emergent Vegetation
W Watercress

Fe Iron Staining
/////// Eroded Bank

XXX Riprap / Other Stabilization

Instream Log/Tree
^^^ Dam/Weir/Obstruction

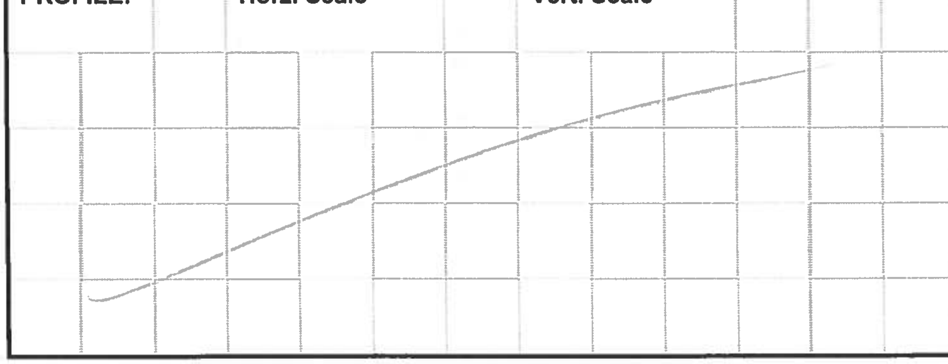
® Riparian Tree

├▶ Seep/Spring
-------- Undercut Bank

— Barrier to Fish Movement
-S- Seasonal Barrier

-x--x- Fence line
Culvert

PROFILE: **Horz. Scale** **Vert. Scale**



SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
C10-4-B		70 M	

PROJECT #: Bradford Bypass

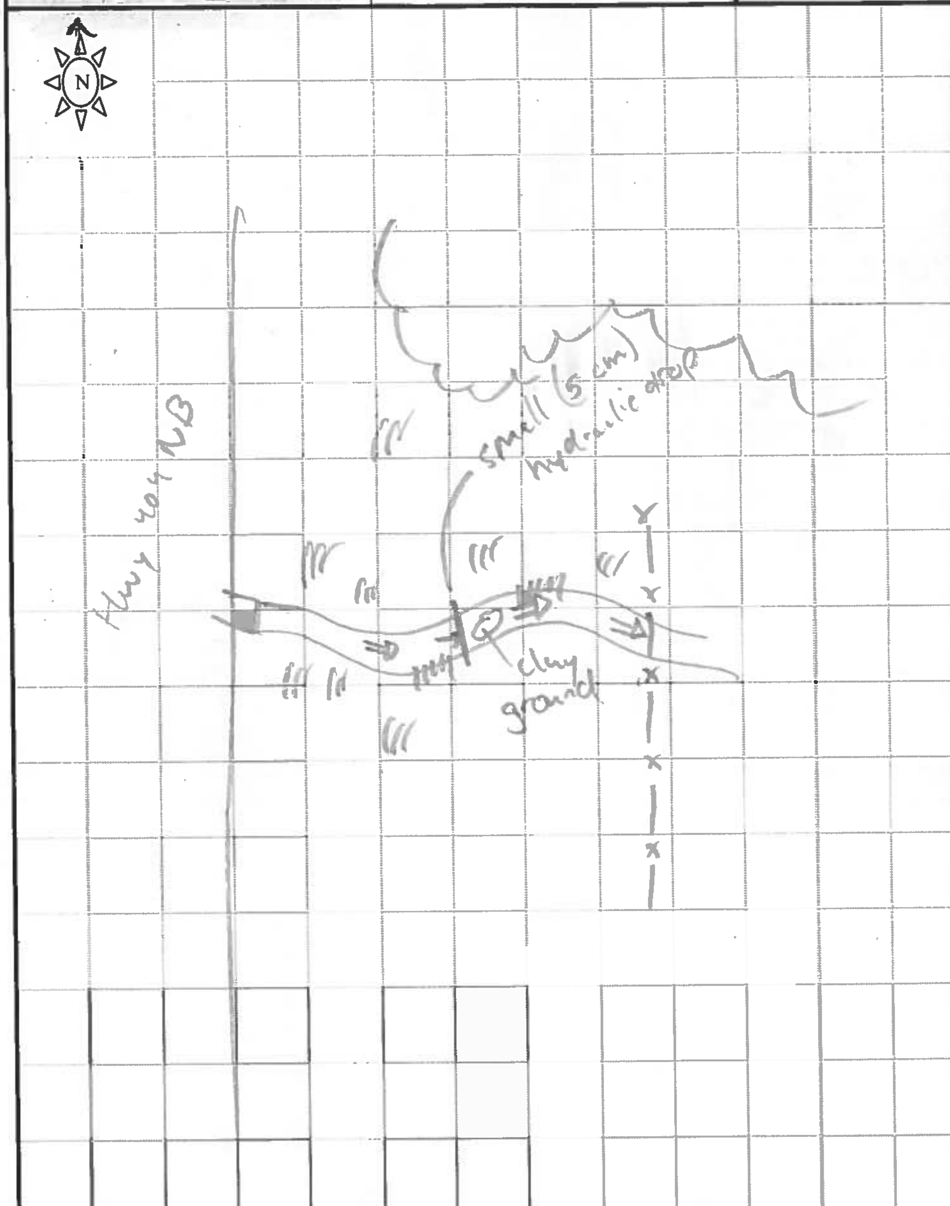
MAPPER: R. Holmes

NAME OF WATERBODY: unknown

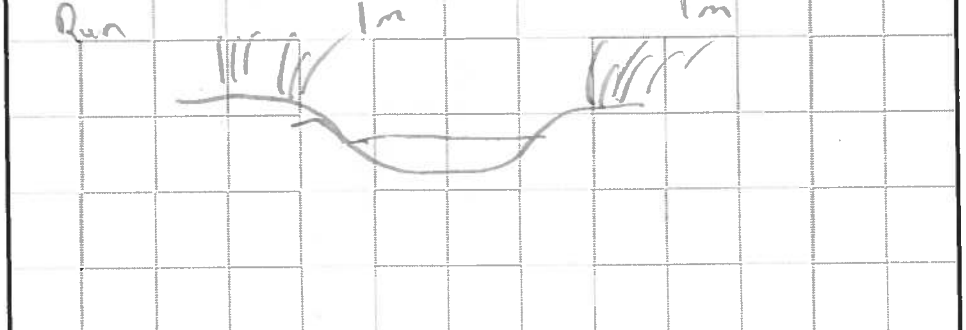
CROSSING #:

STATION #:

DATE: DD-MMM-YY 09-June-22



PROFILE: Run **Horz. Scale** 1m **Vert. Scale** 1m



LEGEND

- **10d** depth (cm)
- **6w** width
- ➡ Riffle
- ⇨ Run/Glide
- ⬭ Pool
- ▮ Island/Bar
- ░ Fine Substrate
- **###** Gravel Substrate
- **oOooO** Cobble /Boulder
- *** Debris
- **CT** Cattail
- **SV/FV** Submerg/Float Veg
- **EV** Emergent Vegetation
- **W** Watercress
- **Fe** Iron Staining
- ***///////*** Eroded Bank
- **XXX** Riprap / Other Stabilization
- Instream Log/Tree
- **^^^** Dam/Weir/Obstruction
- ® Riparian Tree
- ├▶ Seep/Spring
- -------- Undercut Bank
- ▬ Barrier to Fish Movement
- **-S-** Seasonal Barrier
- **-x--x-** Fence line
- └┘ Culvert

Appendix E

Aquatic Effects Assessment Table (Template D3)

Ontario

Ministry of Transportation

TEMPLATE D3: AQUATIC EFFECTS ASSESSMENT SUMMARY TABLE

Table 1: New Culvert Installations

Waterbody/ Water crossing	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1 Indirect fish habitat: C12-A-1, C16-A-4	B2-Use of industrial equipment	▪ Use of mobile industrial equipment may promote changes to bank stability/exposed soils, re-suspension and entrainment of sediment and oil/grease/fuel leaks that can result in: – potential for mortality of fish/egg/ova from equipment. – change in sediment concentration; and – change in contaminant concentration.	▪ **O-1 – Access** o Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of banks or shorelines o Limit machinery fording of the watercourse to a one-time event (i.e., over, and back), and only if no alternative crossing method is available. o If repeated crossings of the watercourse are required, construct a temporary crossing structure. o Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. o For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording. ▪ **O-3 – Timing of In-water works** o Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish o additional timing considerations: ▪ Minimize duration of in-water work ▪ Conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ Schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ▪ **M-2 – Dewatering Discharge** o Manage and treat dewatering (or other) discharge water to prevent erosion and/or release of sediment-laden or contaminated water to the waterbody. o Considerations: ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. such as sediment is filtered out prior to the water entering a waterbody	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1, C12-A-1, C16-A-4 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			▪ Use of energy dissipation measures to prevent bank or bed erosion. ▪ **M-3 – Equipment** o Whenever possible, operate machinery on land above the high-water level, on ice, or from floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody o Operate, store, and maintain (e.g., refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the water o Any part of equipment entering the water or operating on the bank shall be free of fluid leaks, invasive species and noxious weeds and externally cleaned/degreased to prevent any deleterious substance from entering the water ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-9 – Spills** o Ensure Spill Management Plan (including spill kit materials, instructions regarding their use, education of contract personnel, emergency contact numbers) on-site at all times for immediate implementation in event of accidental spill. ▪ **M-10 - Temporary Flow** o Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should:	

			▪ Use only clean materials free of particulate matter for temporary coffer dams ▪ Situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ Ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ Remove fish from the isolated in-water work zones if necessary ▪ See: management – Fish Screens and Management – Fish Transfer for managing fish. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation.	

Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1 Indirect fish habitat: C12-A-1, C16-A-4	L1-Vegetation Clearing	▪ Alteration of riparian vegetation, changes in shading, and changes to bank stability/exposed soils and the addition or removal of in-stream organic structure can result in: – changes in habitat structure and cover; – change in water temperature; – changes in sediment concentration; – changes in food supply; and – changes in nutrient concentrations.	▪ **M-11 – Vegetation** o Use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction o Clearing of riparian vegetation should be kept to a minimum and if removal is necessary use proper clearing techniques and protect retained vegetation. When practical, prune or top the vegetation instead of grubbing/uprooting o Selective or phased vegetation removal or species management to maintain or reduce shade may be desirable for the management of certain species and/or to provide specialized riparian communities or habitat, such as for warmwater species at risk or coldwater species. o Salvage and re-instate of seedbank materials or root mats may be appropriate for certain vegetation communities such as wetlands and/or to expedite re-establishment of vegetation cover. ▪ **M-1 – Chemicals** o Use only specified amounts and types of fertilizer in areas draining to waterbodies o Avoid use of chemical dust suppressants, pesticides, and herbicides in areas near or draining waterbodies o Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs.	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1, C12-A-1, C16-A-4 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction ▪ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	

			▪ **R-5 – Riparian Vegetation Plantings** o Design and implement vegetation rehabilitation plan following construction to replant riparian vegetation to pre-construction or better condition (e.g., trees for shade to cool water and provide overhead cover). o Considerations: ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank and bed profile. ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium. ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g., live stakes, cuttings) techniques. ▪ Use native species compatible with site conditions. ▪ Integrate provision of fish cover where feasible. ▪ Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized.	
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1,	L2-Grading	▪ Alteration to bank stability/ exposed soils and slope that can change landscape patterns,	▪ **O-1 – Access** o Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of banks or shorelines o Limit machinery fording of the watercourse to a one-time event (i.e., over, and back), and only if no alternative crossing method is available.	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1,

C18-G-1, C18-H-1 Indirect fish habitat: C12-A-1, C16-A-4		increase erosion potential and sediment deposition that can result in: – change in habitat cover and structure; – change in slope and land drainage patterns; and – change in sediment concentrations.	o If repeated crossings of the watercourse are required, construct a temporary crossing structure. o Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. o For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording. ▪ **D-2 – Drainage System** o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not divert across waterbody boundaries). ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders).	C18-H-1, C12-A-1, C16-A-4 no residual effects are expected with the proper implementation, monitoring, and maintenance..

			▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction o This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1	L3 - Excavation	▪ Change in base flow ▪ Change in water temperature ▪ Change in sediment concentrations	▪ **D-2 – Drainage System** o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not divert across waterbody boundaries). ▪ **D-4 – Site Selection** o Design and plan activities and works in waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided o Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1, C12-A-1, C16-A-4 no residual effects are expected with

Indirect fish habitat: C12-A-1, C16-A-4			vegetation and select narrow, straight channel sections to minimize requirements for abutment fills. ▪ **M-2 – Dewatering Discharge** o Manage and treat dewatering (or other) discharge water to prevent erosion and/or release of sediment-laden or contaminated water to the waterbody. o Considerations: ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. such as sediment is filtered out prior to the water entering a waterbody ▪ Use of energy dissipation measures to prevent bank or bed erosion. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-5 – Excess Materials** o Temporarily store, handle and dispose of all materials used or generated (e.g. organics, soils, uprooted or cut aquatic plants, woody debris, dredging spoils, commercial logging waste, temporary stockpiles, construction waste and materials such as concrete, sheet pile, wood forms etc.) during site preparation, construction and clean-up in a manner that prevents their entry to the waterbody, including temporarily storing and stockpiling materials a safe distance from the waterbody and stabilizing/ containing them. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody	the proper implementation, monitoring, and maintenance.

			o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation.	
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1 Indirect fish habitat: C12-A-1, C16-A-4	W1- Placement of material or structures in water	▪ Changes in channel or shoreline morphology, hydraulics, aquatic macrophytes, and substrate composition can result in: – change in sediment concentrations; – change in habitat structure and cover;	▪ **D-1 –Culvert, or other in-water structures** o Reduce or eliminate constriction of flow through structure design. Design and site structures to avoid or otherwise minimize encroachment into waterbody and avoid sensitive habitats. Design structure to avoid or minimize effects on existing or natural flow regimes. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains, or any other area that is inherently unstable and may result in erosion and scouring of the waterbody bed or the built structures o Additional considerations for culverts: ▪ Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation ▪ Consider access requirements in siting structures (e.g., need to access floodplain of deep pristine valley for construction).	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1, C12-A-1, C16-A-4 negative residual effects are expected including change in habitat structure and cover, change

		– change in food supply; and – change in nutrient concentration.	▪ Design and install culverts to prevent creation of barriers to fish movement, and maintain bankfull channel functions and habitat functions to the extent possible, including proper sizing, embedment, re-instatement of low flow channel and properly designed and sized substrates to stay in-place under full range of flow conditions, compatible with existing native substrate, maintaining channel slope, etc. ▪ **M-10 - Temporary Flow** o Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: ▪ Use only clean materials free of particulate matter for temporary coffer dams ▪ Situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ Ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ Remove fish from the isolated in-water work zones if necessary o See: management – Fish Screens and Management – Fish Transfer for managing fish. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-2 – Waterbody Bed and Substrate**	in food supply, and change in nutrient concentrations.

			o Restore and re-stabilize any portion of the waterbody bed disturbed during construction to pre-construction (or better) condition, including: ▪ Restoration of the original contour and gradient ▪ Morphological elements, e.g., pools and riffles ▪ Substrates, which may include salvage and re-instatement of native materials ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction o This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1 Indirect fish habitat: C12-A-1, C16-A-4	W6 - Fish passage issues	▪ Change in access to habitats ▪ Incidental entertainment, impingement, or mortality	▪ **D-1 –Culvert, or other in-water structures** o Reduce or eliminate constriction of flow through structure design. Design structures to avoid or otherwise minimize encroachment into waterbody and avoid sensitive habitats. Design structures to avoid or minimize effects on existing or natural flow regimes. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains, or any other area that is inherently unstable and may result in erosion and scouring of the waterbody bed or the built structures o Additional considerations for culverts: ▪ Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation ▪ Consider access requirements in siting structures (e.g., need to access floodplain of deep pristine valley for construction). ▪ Design and install culverts to prevent creation of barriers to fish movement, and maintain bankfull channel functions and habitat functions to the extent possible, including proper sizing, embedment, re-instatement of low flow channel and properly designed and sized substrates to stay in-place under full range of flow conditions, compatible with existing native substrate, maintaining channel slope, etc. ▪ **D-2 – Drainage System**	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1, C12-A-1, C16-A-4 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not across watershed boundaries). ▪ **D-3 – Fish Passage** o Design to maintain fish passage and minimize risk for fish passing upstream or downstream of an obstruction (e.g., downstream migration diversion methods, upstream migration via fish ladders, bypass channels). ▪ **D-5 – Stormwater Management Measures** o Design stormwater management (SWM) measures to manage runoff to waterbody considering discharge (e.g., velocities to avoid erosion) as well as quality (e.g., formal SWM ponds, enhanced ditches, and filtration). ▪ **O-3 – Timing of In-water works** o Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish o Additional timing considerations: ▪ Minimize duration of in-water work ▪ Conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ Schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ▪ **M-6 - Fish Screens** o Use fish screens to avoid entrainment and impingement of fish at water intakes. o Refer to DFO fish protection measures for design, installation, and operation of fish screens https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html ▪ **M-10 - Temporary Flow** o Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: ▪ Use only clean materials free of particulate matter for temporary coffer dams ▪ Situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ Ensure the work zone is stabilized against the impacts of high flow events during the work period	

			▪ Remove fish from the isolated in-water work zones if necessary o See: management – Fish Screens and Management – Fish Transfer for managing fish. ▪ **M-12 – Water Flow** o Flow management (e.g., minimum flows, seasonal flow augmentation, flushing flows) for specific aquatic habitat management goals or to mitigate other effects of flow management (e.g., fish passage, fish stranding).	
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1 Indirect fish habitat: C12-A-1, C16-A-4	L4-Riparian Planting	▪ Change in sediment concentrations ▪ Change in contaminant concentrations ▪ Change in water temperature ▪ Change in habitat structure and cover ▪ Change in food supply	▪ **M-1 – Chemicals** o Use only specified amounts and types of fertilizer in areas draining to waterbodies o Avoid use of chemical dust suppressants, pesticides, and herbicides in areas near or draining to waterbodies o Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls)	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1, C12-A-1, C16-A-4 positive residual effects are expected including positive changes in nutrient concentrations and changes in water temperature.

			▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-5 – Riparian Vegetation Plantings** o Design and implement vegetation rehabilitation plan following construction to re-plant riparian vegetation to pre-construction or better condition (e.g., trees for shade to cool water and provide overhead cover) o Considerations: ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank/bed profiles ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g., live stakes, cuttings) techniques ▪ Use native species compatible with site conditions ▪ Integrate provision of fish cover where feasible ▪ Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established	

Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1 Indirect fish habitat: C12-A-1, C16-A-4	W3-Organic Debris Management	▪ Change in contaminant concentrations ▪ Change in sediment concentrations ▪ Change in habitat structure and cover ▪ Change in nutrient concentrations ▪ Change in food supply	▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-2 – Waterbody Bed and Substrate** o Restore and re-stabilize any portion of the waterbody bed disturbed during construction to pre-construction (or better) condition, including: ▪ Restoration of the original contour and gradient ▪ Morphological elements, e.g., pools and riffles ▪ Substrates, which may include salvage and re-instatement of native materials ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1, C12-A-1, C16-A-4 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction ▪ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-G-1, C18-H-1 Indirect fish habitat: C12-A-1, C16-A-4	W4-Addition or Removal of Aquatic Vegetation	▪ Change in water temperature ▪ Change in dissolved oxygen ▪ Change in food supply ▪ Change in nutrient concentrations ▪ Change in habitat structure and cover ▪ Change in contaminant concentrations ▪ Change in sediment concentrations	▪ **M-3 – Equipment** o Whenever possible, operate machinery on land above the high-water level, on ice, or from floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody o Operate, store, and maintain (e.g., refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the water o Any part of equipment entering the water or operating on the bank shall be free of fluid leaks, invasive species and noxious weeds and externally cleaned/degreased to prevent any deleterious substance from entering the water ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-8 – In-water Turbidity Curtains or Other Appropriate Measures** o Use properly sized, anchored, and maintained in-water silt boom, turbidity curtains or other effective measures to contain suspended sediments. ▪ **R-3 – Exposed Soils/ Surfaces**	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-F-1, C18-G-1, C18-H-1, C12-A-1, C16-A-4 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction ▪ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	

Table 2: Culvert Replacements with Extension

Waterbody/ Water crossing	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
Direct fish habitat: C16-A-1	B2-Use of industrial equipment	▪ Use of mobile industrial equipment may promote changes to bank stability/exposed soils, re-suspension and entrainment of sediment and oil/grease/fuel leaks that can result in: – potential for mortality of	▪ **O-1 – Access** o Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of banks or shorelines o Limit machinery fording of the watercourse to a one-time event (i.e., over, and back), and only if no alternative crossing method is available. o If repeated crossings of the watercourse are required, construct a temporary crossing structure. o Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. o For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording.	▪ For culvert C16-A-1 no residual effects are expected with the proper implementation, monitoring, and maintenance.

		fish/egg/ova from equipment. – change in sediment concentration; and – change in contaminant concentration.	▪ **O-3 – Timing of In-water works** o Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish o additional timing considerations: ▪ Minimize duration of in-water work ▪ Conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ Schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ▪ **M-2 – Dewatering Discharge** o Manage and treat dewatering (or other) discharge water to prevent erosion and/or release of sediment-laden or contaminated water to the waterbody. o Considerations: ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. such as sediment is filtered out prior to the water entering a waterbody ▪ Use of energy dissipation measures to prevent bank or bed erosion. ▪ **M-3 – Equipment** o Whenever possible, operate machinery on land above the high-water level, on ice, or from floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody o Operate, store, and maintain (e.g., refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the water o Any part of equipment entering the water or operating on the bank shall be free of fluid leaks, invasive species and noxious weeds and externally cleaned/degreased to prevent any deleterious substance from entering the water ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include:	

			▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-9 – Spills** o Ensure Spill Management Plan (including spill kit materials, instructions regarding their use, education of contract personnel, emergency contact numbers) on-site at all times for immediate implementation in event of accidental spill. ▪ **M-10 - Temporary Flow** o Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: ▪ Use only clean materials free of particulate matter for temporary coffer dams ▪ Situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ Ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ Remove fish from the isolated in-water work zones if necessary o See: management – Fish Screens and Management – Fish Transfer for managing fish. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural	

			bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. • Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation.	
Direct fish habitat: C16-A-1	L1- Vegetation Clearing	▪ Alteration of riparian vegetation, changes in shading, and changes to bank stability/exposed soils and the addition or removal of in-stream organic structure can result in: – changes in habitat structure and cover; – change in water temperature; – changes in sediment concentration; – changes in food supply; and – changes in nutrient concentrations.	▪ **M-11 – Vegetation** o Use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction o Clearing of riparian vegetation should be kept to a minimum and if removal is necessary use proper clearing techniques and protect retained vegetation. When practical, prune or top the vegetation instead of grubbing/uprooting o Selective or phased vegetation removal or species management to maintain or reduce shade may be desirable for the management of certain species and/or to provide specialized riparian communities or habitat, such as for warmwater species at risk or coldwater species. o Salvage and re-instate of seedbank materials or root mats may be appropriate for certain vegetation communities such as wetlands and/or to expedite re-establishment of vegetation cover. ▪ **M-1 – Chemicals** o Use only specified amounts and types of fertilizer in areas draining to waterbodies o Avoid use of chemical dust suppressants, pesticides, and herbicides in areas near or draining waterbodies o Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish ▪ **M-4 – Erosion and Sediment Controls**	▪ For culvert C16-A-1 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc.	

			▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction ▪ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation ▪ **R-5 – Riparian Vegetation Plantings** o Design and implement vegetation rehabilitation plan following construction to replant riparian vegetation to pre-construction or better condition (e.g., trees for shade to cool water and provide overhead cover). o Considerations: ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank and bed profile. ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium. ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g., live stakes, cuttings) techniques. ▪ Use native species compatible with site conditions. ▪ Integrate provision o fish cover where feasible. Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment	

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Direct fish habitat: C16-A-1	L2-Grading	▪ Alteration to bank stability/ exposed soils and slope that can change landscape patterns, increase erosion potential and sediment deposition that can result in: – change in habitat cover and structure; – change in slope and land drainage patterns; and – change in sediment concentrations.	▪ **O-1 – Access** o Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of banks or shorelines o Limit machinery fording of the watercourse to a one-time event (i.e., over, and back), and only if no alternative crossing method is available. o If repeated crossings of the watercourse are required, construct a temporary crossing structure. o Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. o For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording. ▪ **D-2 – Drainage System** o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not divert across waterbody boundaries). ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody	▪ For culvert C16-A-1 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to	

			hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction o This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C16-A-1	L3 - Excavation	▪ Change in base flow ▪ Change in water temperature ▪ Change in sediment concentrations	▪ **D-2 – Drainage System** o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not divert across waterbody boundaries). ▪ **D-4 – Site Selection** o Design and plan activities and works in waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided o Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation and select narrow, straight channel sections to minimize requirements for piers and/or abutment fills. ▪ **M-2 – Dewatering Discharge** o Manage and treat dewatering (or other) discharge water to prevent erosion and/or release of sediment-laden or contaminated water to the waterbody. o Considerations: ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. such as sediment is filtered out prior to the water entering a waterbody ▪ Use of energy dissipation measures to prevent bank or bed erosion. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction.	▪ For culvert C16-A-1 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-5 – Excess Materials** o Temporarily store, handle and dispose of all materials used or generated (e.g. organics, soils, uprooted or cut aquatic plants, woody debris, dredging spoils, commercial logging waste, temporary stockpiles, construction waste and materials such as concrete, sheet pile, wood forms etc.) during site preparation, construction and clean-up in a manner that prevents their entry to the waterbody, including temporarily storing and stockpiling materials a safe distance from the waterbody and stabilizing/ containing them. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation.	

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<td>Direct fish habitat: C16-A-1</td>
<td>W1- Placement of material or structures in water</td>
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Changes in channel or shoreline morphology, hydraulics, aquatic macrophytes, and substrate composition can result in:
– change in sediment concentrations;
– change in habitat structure and cover;
– change in food supply; and
– change in nutrient concentration.

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D-1 –Culvert, or other in-water structures

Reduce or eliminate constriction of flow through structure design. Design structures to avoid or otherwise minimize encroachment into waterbody and avoid sensitive habitats. Design structure to avoid or minimize effects on existing or natural flow regimes. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains, or any other area that is inherently unstable and may result in erosion and scouring of the waterbody bed or the built structures
Additional considerations for culverts:

Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation
Consider access requirements in siting structures (e.g., need to access floodplain of deep pristine valley for construction).
Design and install culverts to prevent creation of barriers to fish movement, and maintain bankfull channel functions and habitat functions to the extent possible, including proper sizing, embedment, re-instatement of low flow channel and properly designed and sized substrates to stay in-place under full range of flow conditions, compatible with existing native substrate, maintaining channel slope, etc.

M-10 - Temporary Flow

Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should:

use only clean materials free of particulate matter for temporary coffer dams
situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody
ensure the work zone is stabilized against the impacts of high flow events during the work period
remove fish from the isolated in-water work zones if necessary

see: management – Fish Screens and Management – Fish Transfer for managing fish.

R-1 – Waterbody Bank

Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody

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For culverts C16-A-1 negative residual effects are expected including change in habitat structure and cover, change in food supply, and change in nutrient concentrations.

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			o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-2 – Waterbody Bed and Substrate** o Restore and re-stabilize any portion of the waterbody bed disturbed during construction to pre-construction (or better) condition, including: ▪ Restoration of the original contour and gradient ▪ Morphological elements, e.g., pools and riffles ▪ Substrates, which may include salvage and re-instatement of native materials ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction o This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C16-A-1	W6 - Fish passage issues	▪ Change in access to habitats ▪ Incidental entertainment, impingement, or mortality	▪ **D-1 –Culvert, or other in-water structures** ▪ Reduce or eliminate constriction of flow through structure design. Design structures to avoid or otherwise minimize encroachment into waterbody and avoid sensitive habitats. Design structure to avoid or minimize effects on existing or natural flow regimes. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains, or any other area that is inherently unstable and may result in erosion and scouring of the waterbody bed or the built structures ▪ Additional considerations for culverts:	▪ For culvert C16-A-1 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			▪ Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation ▪ Consider access requirements in siting structures (e.g., need to access floodplain of deep pristine valley for construction). ▪ Design and install culverts to prevent creation of barriers to fish movement, and maintain bankfull channel functions and habitat functions to the extent possible, including proper sizing, embedment, re-instatement of low flow channel and properly designed and sized substrates to stay in-place under full range of flow conditions, compatible with existing native substrate, maintaining channel slope, etc.**D-2 – Drainage System** ▪ Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not across watershed boundaries).**D-3 – Fish Passage** ▪ Design to maintain fish passage and minimize risk for fish passing upstream or downstream of an obstruction (e.g., downstream migration diversion methods, upstream migration via fish ladders, bypass channels).**D-5 – Stormwater Management Measures** ▪ Design stormwater management (SWM) measures to manage runoff to waterbody considering discharge (e.g., velocities to avoid erosion) as well as quality (e.g., formal SWM ponds, enhanced ditches, and filtration). ▪ **O-3 – Timing of In-water works** ▪ Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish ▪ Additional timing considerations: ▪ Minimize duration of in-water work ▪ Conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ Schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ▪ **M-6 - Fish Screens** ▪ Use fish screens to avoid entrainment and impingement of fish at water intakes. ▪ Refer to DFO fish protection measures for design, installation, and operation of fish screens https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html	

			▪ **M-10 - Temporary Flow** ▪ Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: ▪ Use only clean materials free of particulate matter for temporary coffer dams ▪ Situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ Ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ Remove fish from the isolated in-water work zones if necessary ▪ see: management – Fish Screens and Management – Fish Transfer for managing fish.**M-12 – Water Flow** ▪ Flow management (e.g., minimum flows, seasonal flow augmentation, flushing flows) for specific aquatic habitat management goals or to mitigate other effects of flow management (e.g., fish passage, fish stranding).	
Direct fish habitat: C16-A-1	L4-Riparian Planting	▪ Change in sediment concentrations ▪ Change in contaminant concentrations ▪ Change in water temperature ▪ Change in habitat structure and cover ▪ Change in food supply	▪ **M-1 – Chemicals** o Use only specified amounts and types of fertilizer in areas draining to waterbodies o Avoid use of chemical dust suppressants, pesticides, and herbicides in areas near or draining to waterbodies o Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody	▪ For culvert C16-A-1 positive residual effects are expected including positive changes in nutrient concentrations and changes in water temperature.

			▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-5 – Riparian Vegetation Plantings** o Design and implement vegetation rehabilitation plan following construction to re-plant riparian vegetation to pre-construction or better condition (e.g., trees for shade to cool water and provide overhead cover) o Considerations:	

			▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank/bed profiles ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g., live stakes, cuttings) techniques ▪ Use native species compatible with site conditions ▪ Integrate provision of fish cover where feasible ■ Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established	
Direct fish habitat: C16-A-1	W3-Organic Debris Management	■ Change in contaminant concentrations ■ Change in sediment concentrations ■ Change in habitat structure and cover ■ Change in nutrient concentrations ■ Change in food supply	■ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ■ **R-2 – Waterbody Bed and Substrate** o Restore and re-stabilize any portion of the waterbody bed disturbed during construction to pre-construction (or better) condition, including: ▪ Restoration of the original contour and gradient ▪ Morphological elements, e.g., pools and riffles ▪ Substrates, which may include salvage and re-instatement of native materials ■ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using:	■ For culvert C16-A-1 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction ▪ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C16-A-1	W4-Addition or Removal of Aquatic Vegetation	▪ Change in water temperature ▪ Change in dissolved oxygen ▪ Change in food supply ▪ Change in nutrient concentrations ▪ Change in habitat structure and cover ▪ Change in contaminant concentrations ▪ Change in sediment concentrations	▪ **M-3 – Equipment** o Whenever possible, operate machinery on land above the high-water level, on ice, or from floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody o Operate, store, and maintain (e.g., refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the water o Any part of equipment entering the water or operating on the bank shall be free of fluid leaks, invasive species and noxious weeds and externally cleaned/degreased to prevent any deleterious substance from entering the water ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody	▪ For culvert C16-A-1 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-8 – In-water Turbidity Curtains or Other Appropriate Measures** o Use properly sized, anchored, and maintained in-water silt boom, turbidity curtains or other effective measures to contain suspended sediments. ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction ▪ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	

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Table 3: Channel Realignment

Waterbody/ Water crossing	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-A-1, C27-A-1 Indirect fish habitat: C12-A-1, C16-A-4, C25-A-1, C25-A-2	B2-Use of industrial equipment	▪ Use of mobile industrial equipment may promote changes to bank stability/exposed soils, re-suspension and entrainment of sediment and oil/grease/fuel leaks that can result in: – potential for mortality of fish/egg/ova from equipment. – change in sediment concentration; and – change in contaminant concentration.	▪ **O-1 – Access** o Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of banks or shorelines o Limit machinery fording of the watercourse to a one-time event (i.e., over, and back), and only if no alternative crossing method is available. o If repeated crossings of the watercourse are required, construct a temporary crossing structure. o Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. o For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording. ▪ **O-3 – Timing of In-water works** o Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish o Additional timing considerations: ▪ Minimize duration of in-water work ▪ Conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ Schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ▪ **M-2 – Dewatering Discharge** o Manage and treat dewatering (or other) discharge water to prevent erosion and/or release of sediment-laden or contaminated water to the waterbody. o Considerations: ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. such as sediment is filtered out prior to the water entering a waterbody ▪ Use of energy dissipation measures to prevent bank or bed erosion.	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-A-1, C27-A-1, C12-A-1, C16-A-4, C25-A-1, C25-A-2 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			▪ **M-3 – Equipment** o Whenever possible, operate machinery on land above the high-water level, on ice, or from floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody o Operate, store, and maintain (e.g., refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the water o Any part of equipment entering the water or operating on the bank shall be free of fluid leaks, invasive species and noxious weeds and externally cleaned/degreased to prevent any deleterious substance from entering the water ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-9 – Spills** o Ensure Spill Management Plan (including spill kit materials, instructions regarding their use, education of contract personnel, emergency contact numbers) on-site at all times for immediate implementation in event of accidental spill. ▪ **M-10 - Temporary Flow** o Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should:	

			▪ Use only clean materials free of particulate matter for temporary coffer dams ▪ Situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ Ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ Remove fish from the isolated in-water work zones if necessary ▪ See: management – Fish Screens and Management – Fish Transfer for managing fish. ■ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ■ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. o Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation.	

Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C27-A-1 Indirect fish habitat: C12-A-1, C16-A-4, C25-A-1, C25-A-1, C25-A-2	L1-Vegetation Clearing	▪ Alteration of riparian vegetation, changes in shading, and changes to bank stability/exposed soils and the addition or removal of in-stream organic structure can result in: – changes in habitat structure and cover; – change in water temperature; – changes in sediment concentration; – changes in food supply; and – changes in nutrient concentrations.	▪ **M-11 – Vegetation** o Use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction o Clearing of riparian vegetation should be kept to a minimum and if removal is necessary use proper clearing techniques and protect retained vegetation. When practical, prune or top the vegetation instead of grubbing/uprooting o Selective or phased vegetation removal or species management to maintain or reduce shade may be desirable for the management of certain species and/or to provide specialized riparian communities or habitat, such as for warmwater species at risk or coldwater species. o Salvage and re-instate of seedbank materials or root mats may be appropriate for certain vegetation communities such as wetlands and/or to expedite re-establishment of vegetation cover. ▪ **M-1 – Chemicals** o Use only specified amounts and types of fertilizer in areas draining to waterbodies o Avoid use of chemical dust suppressants, pesticides, and herbicides in areas near or draining waterbodies o Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs.	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-A-1, C27-A-1, C12-A-1, C16-A-4, C25-A-1, C25-A-2 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction ▪ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	

			▪ **R-5 – Riparian Vegetation Plantings** o Design and implement vegetation rehabilitation plan following construction to replant riparian vegetation to pre-construction or better condition (e.g., trees for shade to cool water and provide overhead cover). o Considerations: ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank and bed profile. ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium. ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g., live stakes, cuttings) techniques. ▪ Use native species compatible with site conditions. ▪ Integrate provision o fish cover where feasible. ▪ Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized.	
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-	L2-Grading	▪ Alteration to bank stability/ exposed soils and slope that can change landscape patterns,	▪ **O-1 – Access** o Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of banks or shorelines o Limit machinery fording of the watercourse to a one-time event (i.e., over, and back), and only if no alternative crossing method is available.	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1,

1, C18-G-1, C18-H-1, C22-A-1, C25-A-1, C27-A-1 Indirect fish habitat: C12-A-1, C16-A-4, C25-A-1, C25-A-2		increase erosion potential and sediment deposition that can result in: – change in habitat cover and structure; – change in slope and land drainage patterns; and – change in sediment concentrations.	o If repeated crossings of the watercourse are required, construct a temporary crossing structure. o Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. o For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording. ▪ **D-2 – Drainage System** o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not divert across waterbody boundaries). ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders).	C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-A-1, C27-A-1, C12-A-1, C16-A-4, C25-A-1, C25-A-2 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction o This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C27-A-1 Indirect fish habitat: C12-A-1,	L3 - Excavation	▪ Change in base flow ▪ Change in water temperature ▪ Change in sediment concentrations	▪ **D-2 – Drainage System** o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not divert across waterbody boundaries). ▪ **D-4 – Site Selection** o Design and plan activate and works in waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided o Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-A-1, C27-A-1, C12-A-1, C16-A-4, C25-A-1,

C16-A-4, C25-A-1, C25-A-1, C25-A-2			vegetation and select narrow, straight channel sections to minimize requirements for piers and/or abutment fills. ▪ **M-2 – Dewatering Discharge** o manage and treat dewatering (or other) discharge water to prevent erosion and/or release of sediment-laden or contaminated water to the waterbody. o Considerations: ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. such as sediment is filtered out prior to the water entering a waterbody ▪ Use of energy dissipation measures to prevent bank or bed erosion. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-5 – Excess Materials** o Temporarily store, handle and dispose of all materials used or generated (e.g. organics, soils, uprooted or cut aquatic plants, woody debris, dredging spoils, commercial logging waste, temporary stockpiles, construction waste and materials such as concrete, sheet pile, wood forms etc.) during site preparation, construction and clean-up in a manner that prevents their entry to the waterbody, including temporarily storing and stockpiling materials a safe distance from the waterbody and stabilizing/ containing them. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody	C25-A-2 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. o Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation.	
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C27-A-1 Indirect fish habitat: C12-A-1, C16-A-4, C25-A-1, C25-A-1, C25-A-2	W6 - Fish passage issues	▪ Change in access to habitats ▪ Incidental entertainment, impingement, or mortality	▪ **D-1 –other in-water structures** o Reduce or eliminate constriction of flow through structure design. Design and site structures to avoid or otherwise minimize encroachment into waterbody and avoid sensitive habitats. Design structure to avoid or minimize effects on existing or natural flow regimes. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains, or any other area that is inherently unstable and may result in erosion and scouring of the waterbody bed or the built structures ▪ **D-2 – Drainage System** o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not across watershed boundaries). ▪ **D-3 – Fish Passage**	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-A-1, C27-A-1, C12-A-1, C16-A-4, C25-A-1, C25-A-2 no residual effects are expected with the proper

			o Design to maintain fish passage and minimize risk for fish passing upstream or downstream of an obstruction (e.g., downstream migration diversion methods, upstream migration via fish ladders, bypass channels). ▪ **D-5 – Stormwater Management Measures** o Design stormwater management (SWM) measures to manage runoff to waterbody considering discharge (e.g., velocities to avoid erosion) as well as quality (e.g., formal SWM ponds, enhanced ditches, and filtration). ▪ **O-3 – Timing of In-water works** o Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish o additional timing considerations: ▪ Minimize duration of in-water work ▪ Conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ Schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ▪ **M-6 - Fish Screens** o Use fish screens to avoid entrainment and impingement of fish at water intakes. o Refer to DFO fish protection measures for design, installation, and operation of fish screens https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html ▪ **M-10 - Temporary Flow** o Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: ▪ Use only clean materials free of particulate matter for temporary coffer dams ▪ Situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ Ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ Remove fish from the isolated in-water work zones if necessary o See: management – Fish Screens and Management – Fish Transfer for managing fish.	implementation, monitoring, and maintenance.

			▪ **M-12 – Water Flow** o Flow management (e.g., minimum flows, seasonal flow augmentation, flushing flows) for specific aquatic habitat management goals or to mitigate other effects of flow management (e.g., fish passage, fish stranding).	
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C27-A-1 Indirect fish habitat: C12-A-1, C16-A-4, C25-A-1, C25-A-1, C25-A-2	W1-Placement of material or structures in water	▪ Changes in channel or shoreline morphology, hydraulics, aquatic macrophytes, and substrate composition can result in: – change in sediment concentrations; – change in habitat structure and cover; – change in food supply; and ▪ change in nutrient concentration.	▪ **D-1 –other in-water structures** o Reduce or eliminate constriction of flow through structure design. Design and site structures to avoid or otherwise minimize encroachment into waterbody and avoid sensitive habitats. Design structure to avoid or minimize effects on existing or natural flow regimes. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains, or any other area that is inherently unstable and may result in erosion and scouring of the waterbody bed or the built structures ▪ **M-10 - Temporary Flow** o Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: ▪ Use only clean materials free of particulate matter for temporary coffer dams ▪ Situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ Ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ Remove fish from the isolated in-water work zones if necessary o see: management – Fish Screens and Management – Fish Transfer for managing fish. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-A-1, C27-A-1, C12-A-1, C16-A-4, C25-A-1, C25-A-2 negative residual effects are expected including change in habitat structure and cover, change in food supply, and change in nutrient concentrations.

			bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-2 – Waterbody Bed and Substrate** o Restore and re-stabilize any portion of the waterbody bed disturbed during construction to pre-construction (or better) condition, including: ▪ Restoration of the original contour and gradient ▪ Morphological elements, e.g., pools and riffles ▪ Substrates, which may include salvage and re-instatement of native materials ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction o This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C27-A-1 Indirect fish habitat: C12-A-1, C16-A-4, C25-A-1, C25-A-1, C25-A-2	L4-Riparian Planting	▪ Change in sediment concentrations ▪ Change in contaminant concentrations ▪ Change in water temperature ▪ Change in habitat structure and cover ▪ Change in food supply	▪ **M-1 – Chemicals** o Use only specified amounts and types of fertilizer in areas draining to waterbodies o Avoid use of chemical dust suppressants, pesticides, and herbicides in areas near or draining to waterbodies o Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-A-1, C27-A-1, C12-A-1, C16-A-4, C25-A-1, C25-A-2 no residual effects are expected with the proper implementation,

			has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation.	monitoring, and maintenance.

			▪ **R-5 – Riparian Vegetation Plantings** o Design and implement vegetation rehabilitation plan following construction to re-plant riparian vegetation to pre-construction or better condition (e.g., trees for shade to cool water and provide overhead cover) o Considerations: ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank/bed profiles ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g., live stakes, cuttings) techniques ▪ Use native species compatible with site conditions ▪ Integrate provision of fish cover where feasible o Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established	
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C27-A-1 Indirect fish habitat: C12-A-1, C16-A-4, C25-A-1, C25-A-1, C25-A-2	W3-Organic Debris Management	▪ Change in contaminant concentrations ▪ Change in sediment concentrations ▪ Change in habitat structure and cover ▪ Change in nutrient concentrations ▪ Change in food supply	▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-2 – Waterbody Bed and Substrate** o Restore and re-stabilize any portion of the waterbody bed disturbed during construction to pre-construction (or better) condition, including: ▪ Restoration of the original contour and gradient ▪ Morphological elements, e.g., pools and riffles	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-A-1, C27-A-1, C12-A-1, C16-A-4, C25-A-1, C25-A-2 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			▪ Substrates, which may include salvage and re-instatement of native materials ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction • This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-G-1, C18-H-1, C22-A-1, C27-A-1 Indirect fish habitat: C12-A-1, C16-A-4, C25-A-1, C25-A-1, C25-A-2	W4-Addition or Removal of Aquatic Vegetation	▪ Change in water temperature ▪ Change in dissolved oxygen ▪ Change in food supply ▪ Change in nutrient concentrations ▪ Change in habitat structure and cover ▪ Change in contaminant concentrations ▪ Change in sediment concentrations	▪ **M-3 – Equipment** o Whenever possible, operate machinery on land above the high-water level, on ice, or from floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody o Operate, store, and maintain (e.g., refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the water o Any part of equipment entering the water or operating on the bank shall be free of fluid leaks, invasive species and noxious weeds and externally cleaned/degreased to prevent any deleterious substance from entering the water ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of	▪ For culverts C10-C-1, C10-C-2, C11-A-1, C13-A-1, C18-D-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-A-1, C27-A-1, C12-A-1, C16-A-4, C25-A-1, C25-A-2 no residual effects are expected with the proper

			exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-8 – In-water Turbidity Curtains or Other Appropriate Measures** o Use properly sized, anchored, and maintained in-water silt boom, turbidity curtains or other effective measures to contain suspended sediments. ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction • This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	implementation, monitoring, and maintenance.

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Table 4: New Bridge Installations

Waterbody/ Water crossing	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
Direct fish habitat: C17-A-1, C20-A-1 Indirect fish habitat: C25-A-2	B2-Use of industrial equipment	▪ Use of mobile industrial equipment may promote changes to bank stability/exposed soils, re-suspension and entrainment of sediment and oil/grease/fuel leaks that can result in: – potential for mortality of fish/egg/ova from equipment. – change in sediment concentration; and – change in contaminant concentration.	▪ **O-1 – Access** o Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of banks or shorelines o Limit machinery fording of the watercourse to a one-time event (i.e., over, and back), and only if no alternative crossing method is available. o If repeated crossings of the watercourse are required, construct a temporary crossing structure. o Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. o For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording. ▪ **O-3 – Timing of In-water works** o Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish o additional timing considerations: ▪ minimize duration of in-water work ▪ conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ▪ **M-2 – Dewatering Discharge** o Manage and treat dewatering (or other) discharge water to prevent erosion and/or release of sediment-laden or contaminated water to the waterbody. o Considerations: ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. such as sediment is filtered out prior to the water entering a waterbody ▪ Use of energy dissipation measures to prevent bank or bed erosion. ▪ **M-3 – Equipment**	▪ For bridges C17-A-1, C20-A-1, C25-A-2 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			o Whenever possible, operate machinery on land above the high-water level, on ice, or from floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody o Operate, store, and maintain (e.g., refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the water o Any part of equipment entering the water or operating on the bank shall be free of fluid leaks, invasive species and noxious weeds and externally cleaned/degreased to prevent any deleterious substance from entering the water ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-9 – Spills** o Ensure Spill Management Plan (including spill kit materials, instructions regarding their use, education of contract personnel, emergency contact numbers) on-site at all times for immediate implementation in event of accidental spill. ▪ **M-10 - Temporary Flow** o Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: ▪ Use only clean materials free of particulate matter for temporary coffer dams	

			▪ Situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ Ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ Remove fish from the isolated in-water work zones if necessary o See: management – Fish Screens and Management – Fish Transfer for managing fish. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. • Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation.	
Direct fish habitat: C17-A-1, C20-A-1	L1-Vegetation Clearing	▪ Alteration of riparian vegetation, changes in shading, and changes to bank	▪ **M-11 – Vegetation** o Use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction	▪ For bridges C17-A-1, C20-A-1, C25-A-2 no residual

Indirect fish habitat: C25-A-2		stability/exposed soils and the addition or removal of in-stream organic structure can result in: – changes in habitat structure and cover; – change in water temperature; – changes in sediment concentration; – changes in food supply; and – changes in nutrient concentrations.	o Clearing of riparian vegetation should be kept to a minimum and if removal is necessary use proper clearing techniques and protect retained vegetation. When practical, prune or top the vegetation instead of grubbing/uprooting o Selective or phased vegetation removal or species management to maintain or reduce shade may be desirable for the management of certain species and/or to provide specialized riparian communities or habitat, such as for warmwater species at risk or coldwater species. o Salvage and re-instate of seedbank materials or root mats may be appropriate for certain vegetation communities such as wetlands and/or to expedite re-establishment of vegetation cover. ▪ **M-1 – Chemicals** o Use only specified amounts and types of fertilizer in areas draining to waterbodies o Avoid use of chemical dust suppressants, pesticides, and herbicides in areas near or draining waterbodies o Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank**	effects are expected with the proper implementation, monitoring, and maintenance.

			o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction ▪ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation ▪ **R-5 – Riparian Vegetation Plantings**	

			o Design and implement vegetation rehabilitation plan following construction to replant riparian vegetation to pre-construction or better condition (e.g., trees for shade to cool water and provide overhead cover). o Considerations: ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank and bed profile. ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium. ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g., live stakes, cuttings) techniques. ▪ Use native species compatible with site conditions. ▪ Integrate provision o fish cover where feasible. ▪ Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized.	
Direct fish habitat: C17-A-1, C20-A-1 Indirect fish habitat: C25-A-2	L2-Grading	▪ Alteration to bank stability/ exposed soils and slope that can change landscape patterns, increase erosion	▪ **O-1 – Access** o Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of banks or shorelines o Limit machinery fording of the watercourse to a one-time event (i.e., over, and back), and only if no alternative crossing method is available.	▪ For bridges C17-A-1, C20-A-1, C25-A-2 no residual effects are expected with

		potential and sediment deposition that can result in: – change in habitat cover and structure; – change in slope and land drainage patterns; and – change in sediment concentrations.	o If repeated crossings of the watercourse are required, construct a temporary crossing structure. o Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. o For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording. ▪ **D-2 – Drainage System** o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not divert across waterbody boundaries). ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders).	the proper implementation, monitoring, and maintenance.

			▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction o This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C17-A-1, C20-A-1 Indirect fish habitat: C25-A-2	L3 - Excavation	▪ Change in base flow ▪ Change in water temperature ▪ Change in sediment concentrations	▪ **D-2 – Drainage System** o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not divert across waterbody boundaries). ▪ **D-4 – Site Selection** o Design and plan activities and works in waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided o Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian	▪ For bridges C17-A-1, C20-A-1, C25-A-2 no residual effects are expected with the proper implementation, monitoring, and maintenance.

			vegetation and select narrow, straight channel sections to minimize requirements for piers and/or abutment fills. ▪ **M-2 – Dewatering Discharge** o Manage and treat dewatering (or other) discharge water to prevent erosion and/or release of sediment-laden or contaminated water to the waterbody. o Considerations: ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. such as sediment is filtered out prior to the water entering a waterbody ▪ Use of energy dissipation measures to prevent bank or bed erosion. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-5 – Excess Materials** o Temporarily store, handle and dispose of all materials used or generated (e.g. organics, soils, uprooted or cut aquatic plants, woody debris, dredging spoils, commercial logging waste, temporary stockpiles, construction waste and materials such as concrete, sheet pile, wood forms etc.) during site preparation, construction and clean-up in a manner that prevents their entry to the waterbody, including temporarily storing and stockpiling materials a safe distance from the waterbody and stabilizing/ containing them. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody	

			o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. • Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation.	
Direct fish habitat: C17-A-1, C20-A-1 Indirect fish habitat: C25-A-2	W1- Placement of material or structures in water	▪ Changes in channel or shoreline morphology, hydraulics, aquatic macrophytes, and substrate composition can result in: – change in sediment concentrations; – change in habitat structure and cover;	▪ **D-1 – Bridgeor other in-water structures** o Reduce or eliminate constriction of flow through structure design. Design and site piers, abutments, and other structures to avoid or otherwise minimize encroachment into waterbody and avoid sensitive habitats. Design structure to avoid or minimize effects on existing or natural flow regimes. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains, or any other area that is inherently unstable and may result in erosion and scouring of the waterbody bed or the built structures o Additional considerations for bridges: ▪ Design deck drainage to avoid direct discharge into the waterbody ▪ Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation	▪ For bridges C17-A-1, C20-A-1, C25-A-2 negative residual effects are expected including change in habitat structure and cover, change in food supply, and change in nutrient concentrations.

		– change in food supply; and – change in nutrient concentration.	▪ Consider access requirements in stting structures (e.g., need to access floodplain of deep pristine valley for construction). ▪ **M-10 - Temporary Flow** o Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: ▪ Use only clean materials free of particulate matter for temporary coffer dams ▪ Situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ Ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ Remove fish from the isolated in-water work zones if necessary o See: management – Fish Screens and Management – Fish Transfer for managing fish. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-2 – Waterbody Bed and Substrate** o Restore and re-stabilize any portion of the waterbody bed disturbed during construction to pre-construction (or better) condition, including: ▪ Restoration of the original contour and gradient ▪ Morphological elements, e.g., pools and riffles	

			▪ Substrates, which may include salvage and re-instatement of native materials ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction o This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C17-A-1, C20-A-1 Indirect fish habitat: C25-A-2	W6 - Fish passage issues	▪ Change in access to habitats ▪ Incidental entertainment, impingement, or mortality	▪ **D-1 – Bridge,or other in-water structures** o Reduce or eliminate constriction of flow through structure design. Design and site piers, abutments, and other structures to avoid or otherwise minimize encroachment into waterbody and avoid sensitive habitats. Design structure to avoid or minimize effects on existing or natural flow regimes. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains, or any other area that is inherently unstable and may result in erosion and scouring of the waterbody bed or the built structures o Additional considerations for bridges: ▪ Design deck drainage to avoid direct discharge into the waterbody ▪ Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation ▪ Consider access requirements in sitting structures (e.g., need to access floodplain of deep pristine valley for construction). ▪ **D-2 – Drainage System** o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not across watershed boundaries). ▪ **D-3 – Fish Passage** o Design to maintain fish passage and minimize risk for fish passing upstream or downstream of an obstruction (e.g., downstream migration diversion methods, upstream migration via fish ladders, bypass channels). ▪ **D-5 – Stormwater Management Measures**	▪ No residual effects anticipated with implementation of mitigation.

			o Design stormwater management (SWM) measures to manage runoff to waterbody considering discharge (e.g., velocities to avoid erosion) as well as quality (e.g., formal SWM ponds, enhanced ditches, and filtration). ▪ **O-3 – Timing of In-water works** o Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish o Additional timing considerations: ▪ minimize duration of in-water work ▪ conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ▪ **M-6 - Fish Screens** o Use fish screens to avoid entrainment and impingement of fish at water intakes. o Refer to DFO fish protection measures for design, installation, and operation of fish screens https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html ▪ **M-10 - Temporary Flow** o Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: ▪ Use only clean materials free of particulate matter for temporary coffer dams ▪ Situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ Ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ Remove fish from the isolated in-water work zones if necessary o See: management – Fish Screens and Management – Fish Transfer for managing fish. ▪ **M-12 – Water Flow** o Flow management (e.g., minimum flows, seasonal flow augmentation, flushing flows) for specific aquatic habitat management goals or to mitigate other effects of flow management (e.g., fish passage, fish stranding).	

Direct fish habitat: C17-A-1, C20-A-1 Indirect fish habitat: C25-A-2	L4-Riparian Planting	▪ Change in sediment concentrations ▪ Change in contaminant concentrations ▪ Change in water temperature ▪ Change in habitat structure and cover ▪ Change in food supply	▪ **M-1 – Chemicals** o Use only specified amounts and types of fertilizer in areas draining to waterbodies o Avoid use of chemical dust suppressants, pesticides, and herbicides in areas near or draining to waterbodies o Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile.	▪ No residual effects anticipated with implementation of mitigation.

			▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-5 – Riparian Vegetation Plantings** o Design and implement vegetation rehabilitation plan following construction to re-plant riparian vegetation to pre-construction or better condition (e.g., trees for shade to cool water and provide overhead cover) o Considerations: ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank/bed profiles ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g., live stakes, cuttings) techniques ▪ Use native species compatible with site conditions ▪ Integrate provision of fish cover where feasible • Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established	
Direct fish habitat: C17-A-1, C20-A-1 Indirect fish habitat: C25-A-2	W3-Organic Debris Management	▪ Change in contaminant concentrations ▪ Change in sediment concentrations ▪ Change in habitat structure and cover ▪ Change in nutrient concentrations	▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders).	▪ No residual effects anticipated with implementation of mitigation.

		■ Change in food supply	▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ■ **R-2 – Waterbody Bed and Substrate** o Restore and re-stabilize any portion of the waterbody bed disturbed during construction to pre-construction (or better) condition, including: ▪ Restoration of the original contour and gradient ▪ Morphological elements, e.g., pools and riffles ▪ Substrates, which may include salvage and re-instatement of native materials ■ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ■ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction • This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C17-A-1, C20-A-1	W4-Addition or Removal	■ Change in water temperature	■ **M-3 – Equipment**	■ No residual effects anticipated with

	of Aquatic Vegetation	▪ Change in dissolved oxygen ▪ Change in food supply ▪ Change in nutrient concentrations ▪ Change in habitat structure and cover ▪ Change in contaminant concentrations ▪ Change in sediment concentrations	o Whenever possible, operate machinery on land above the high-water level, on ice, or from floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody o Operate, store, and maintain (e.g., refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the water o Any part of equipment entering the water or operating on the bank shall be free of fluid leaks, invasive species and noxious weeds and externally cleaned/degreased to prevent any deleterious substance from entering the water ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. Removal of non-biodegradable erosion and sediment control materials once site is stabilized ▪ **M-8 – In-water Turbidity Curtains or Other Appropriate Measures** o Use properly sized, anchored, and maintained in-water silt boom, turbidity curtains or other effective measures to contain suspended sediments. ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term.	implementation of mitigation.

			Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction • This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	

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Table 5: Ditching

Waterbody/ Water crossing	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
Direct fish habitat: C10-A-1, C10-A-4, C10-C-1, C10-C-2, C11-A-1, C13-A-1, C16-A-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-C-1, C27-A-1. Indirect fish habitat: C12-A-1, C16-A-1, C25-A-1, C25-A-2.	B2-Use of industrial equipment	▪ Use of mobile industrial equipment may promote changes to bank stability/exposed soils, re-suspension and entrainment of sediment and oil/grease/fuel leaks that can result in: – potential for mortality of fish/egg/ova from equipment. – change in sediment concentration; and – change in contaminant concentration.	▪ **O-1 – Access** o Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of banks or shorelines o Limit machinery fording of the watercourse to a one-time event (i.e., over, and back), and only if no alternative crossing method is available. o If repeated crossings of the watercourse are required, construct a temporary crossing structure. o Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. o For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording. ▪ **O-3 – Timing of In-water works** o Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish o additional timing considerations: ▪ minimize duration of in-water work ▪ conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ▪ **M-2 – Dewatering Discharge** o manage and treat dewatering (or other) discharge water to prevent erosion and/or release of sediment-laden or contaminated water to the waterbody. o Considerations: ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. such as sediment is filtered out prior to the water entering a waterbody ▪ Use of energy dissipation measures to prevent bank or bed erosion.	▪ No residual effects anticipated with implementation of mitigation.

			▪ **M-3 – Equipment** o Whenever possible, operate machinery on land above the high-water level, on ice, or from floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody o Operate, store, and maintain (e.g., refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the water o Any part of equipment entering the water or operating on the bank shall be free of fluid leaks, invasive species and noxious weeds and externally cleaned/degreased to prevent any deleterious substance from entering the water ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-9 – Spills** o Ensure Spill Management Plan (including spill kit materials, instructions regarding their use, education of contract personnel, emergency contact numbers) on-site at all times for immediate implementation in event of accidental spill. ▪ **M-10 - Temporary Flow** o Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should:	

			▪ Use only clean materials free of particulate matter for temporary coffer dams ▪ Situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ Ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ Remove fish from the isolated in-water work zones if necessary o see: management – Fish Screens and Management – Fish Transfer for managing fish. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. • Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation.	

Direct fish habitat: C10-A-1, C10-A-4, C10-C-1, C10-C-2, C11-A-1, C13-A-1, C16-A-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-C-1, C27-A-1. Indirect fish habitat: C12-A-1, C16-A-1, C25-A-1, C25-A-2.	L1-Vegetation Clearing	▪ Alteration of riparian vegetation, changes in shading, and changes to bank stability/exposed soils and the addition or removal of in-stream organic structure can result in: – changes in habitat structure and cover; – change in water temperature; – changes in sediment concentration; – changes in food supply; and – changes in nutrient concentrations.	▪ **M-11 – Vegetation** o Use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction o Clearing of riparian vegetation should be kept to a minimum and if removal is necessary use proper clearing techniques and protect retained vegetation. When practical, prune or top the vegetation instead of grubbing/uprooting o Selective or phased vegetation removal or species management to maintain or reduce shade may be desirable for the management of certain species and/or to provide specialized riparian communities or habitat, such as for warmwater species at risk or coldwater species. o Salvage and re-instate of seedbank materials or root mats may be appropriate for certain vegetation communities such as wetlands and/or to expedite re-establishment of vegetation cover. ▪ **M-1 – Chemicals** o Use only specified amounts and types of fertilizer in areas draining to waterbodies o Avoid use of chemical dust suppressants, pesticides, and herbicides in areas near or draining waterbodies o Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs.	▪ No residual effects anticipated with implementation of mitigation.

			▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction ▪ This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	

			▪ **R-5 – Riparian Vegetation Plantings** o Design and implement vegetation rehabilitation plan following construction to replant riparian vegetation to pre-construction or better condition (e.g., trees for shade to cool water and provide overhead cover). o Considerations: ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank and bed profile. ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium. ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g., live stakes, cuttings) techniques. ▪ Use native species compatible with site conditions. ▪ Integrate provision o fish cover where feasible. ▪ Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized.	
Direct fish habitat: C10-A-1, C10-A-4, C10-C-1, C10-C-2, C11-A-1, C13-A-1, C16-A-	L2-Grading	▪ Alteration to bank stability/ exposed soils and slope that can change landscape patterns,	▪ **O-1 – Access** o Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of banks or shorelines o Limit machinery fording of the watercourse to a one-time event (i.e., over, and back), and only if no alternative crossing method is available.	▪ No residual effects anticipated with implementation of mitigation.

1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-C-1, C27-A-1. Indirect fish habitat: C12-A-1, C16-A-1, C25-A-1, C25-A-2.		increase erosion potential and sediment deposition that can result in: – change in habitat cover and structure; – change in slope and land drainage patterns; and – change in sediment concentrations.	o If repeated crossings of the watercourse are required, construct a temporary crossing structure. o Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. o For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording. ▪ **D-2 – Drainage System** o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not divert across waterbody boundaries). ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders).	

			▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction o This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C10-A-1, C10-A-4, C10-C-1, C10-C-2, C11-A-1, C13-A-1, C16-A-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-C-1, C27-A-1.	L3 - Excavation	▪ Change in base flow ▪ Change in water temperature ▪ Change in sediment concentrations	▪ **D-2 – Drainage System** o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not divert across waterbody boundaries). ▪ **D-4 – Site Selection** o Design and plan activities and works in waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided o Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian	▪ No residual effects anticipated with implementation of mitigation.

Indirect fish habitat: C12-A-1, C16-A-1, C25-A-1, C25-A-2.			vegetation and select narrow, straight channel sections to minimize requirements for piers and/or abutment fills. ▪ **M-2 – Dewatering Discharge** o Manage and treat dewatering (or other) discharge water to prevent erosion and/or release of sediment-laden or contaminated water to the waterbody. o Considerations: ▪ Use of appropriately designed and sited temporary settling basin, filter bag, etc. such as sediment is filtered out prior to the water entering a waterbody ▪ Use of energy dissipation measures to prevent bank or bed erosion. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-5 – Excess Materials** o Temporarily store, handle and dispose of all materials used or generated (e.g. organics, soils, uprooted or cut aquatic plants, woody debris, dredging spoils, commercial logging waste, temporary stockpiles, construction waste and materials such as concrete, sheet pile, wood forms etc.) during site preparation, construction and clean-up in a manner that prevents their entry to the waterbody, including temporarily storing and stockpiling materials a safe distance from the waterbody and stabilizing/ containing them. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody	

			o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. • Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation.	
Direct fish habitat: C10-A-1, C10-A-4, C10-C-1, C10-C-2, C11-A-1, C13-A-1, C16-A-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-C-1, C27-A-1. Indirect fish habitat: C12-A-1,	W6 - Fish passage issues	▪ Change in access to habitats ▪ Incidental entertainment, impingement, or mortality	▪ **D-2 – Drainage System** o Design drainage system to avoid diversion of or otherwise minimize changes in drainage to or from a waterbody (do not across watershed boundaries). ▪ **D-3 – Fish Passage** o Design to maintain fish passage and minimize risk for fish passing upstream or downstream of an obstruction (e.g., downstream migration diversion methods, upstream migration via fish ladders, bypass channels). ▪ **D-5 – Stormwater Management Measures** o Design stormwater management (SWM) measures to manage runoff to waterbody considering discharge (e.g., velocities to avoid erosion) as well as quality (e.g., formal SWM ponds, enhanced ditches, and filtration). ▪ **O-3 – Timing of In-water works** o Implement timing restrictions for in-water work to protect sensitive life stages/processes of migratory and resident fish	▪ No residual effects anticipated with implementation of mitigation.

C16-A-1, C25-A-1, C25-A-2.			o Additional timing considerations: ▪ Minimize duration of in-water work ▪ Conduct in-stream work during periods of low flow to allow work in water to be isolated from flows ▪ Schedule work to avoid wet, windy, and rainy periods that may increase erosion and sedimentation and allow for proper re-stabilization and re-vegetation as appropriate prior to winter. ▪ **M-6 - Fish Screens** o Use fish screens to avoid entrainment and impingement of fish at water intakes. Refer to DFO fish protection measures for design, installation, and operation of fish screens https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html ▪ **M-10 - Temporary Flow** o Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: ▪ Use only clean materials free of particulate matter for temporary coffer dams ▪ Situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) to prevent erosion and sediment release to the waterbody ▪ Ensure the work zone is stabilized against the impacts of high flow events during the work period ▪ Remove fish from the isolated in-water work zones if necessary o see: management – Fish Screens and Management – Fish Transfer for managing fish. ▪ **M-12 – Water Flow** o Flow management (e.g., minimum flows, seasonal flow augmentation, flushing flows) for specific aquatic habitat management goals or to mitigate other effects of flow management (e.g., fish passage, fish stranding).	
Direct fish habitat: C10-A-1, C10-A-4, C10-C-1, C10-C-2, C11-A-1, C13-A-1, C16-A-1, C18-E-1, C18-F-1, C18-G-1,	L4-Riparian Planting	▪ Change in sediment concentrations ▪ Change in contaminant concentrations ▪ Change in water temperature	▪ **M-1 – Chemicals** o Use only specified amounts and types of fertilizer in areas draining to waterbodies o Avoid use of chemical dust suppressants, pesticides, and herbicides in areas near or draining to waterbodies	▪ No residual effects anticipated with implementation of mitigation.

C18-H-1, C22-A-1, C25-C-1, C27-A-1. Indirect fish habitat: C12-A-1, C16-A-1, C25-A-1, C25-A-2.		▪ Change in habitat structure and cover ▪ Change in food supply	o Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish. ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile. ▪ May incorporate temporary measures (e.g., biodegradable materials, ‘nurse’-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-3 – Exposed Soils/ Surfaces**	

			o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-5 – Riparian Vegetation Plantings** o Design and implement vegetation rehabilitation plan following construction to re-plant riparian vegetation to pre-construction or better condition (e.g., trees for shade to cool water and provide overhead cover) o Considerations: ▪ Design and install riparian plantings to avoid or minimize encroachment into and/or alteration of bank/bed profiles ▪ Usually includes re-instatement of native soils or replacement with topsoil/suitable planting medium ▪ May include local seed bank or root mass/mat salvage, vegetation transplant or bioengineering (e.g., live stakes, cuttings) techniques ▪ Use native species compatible with site conditions ▪ Integrate provision of fish cover where feasible • Integrate appropriate techniques for interim stabilization measures such as biodegradable blanket, tackifier to maintain soil stability until vegetation becomes established	
Direct fish habitat: C10-A-1, C10-A-4, C10-C-1, C10-C-2, C11-A-1, C13-A-1, C16-A-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-1, C25-C-1, C27-A-1. Indirect fish habitat: C12-A-1,	W3-Organic Debris Management	▪ Change in contaminant concentrations ▪ Change in sediment concentrations ▪ Change in habitat structure and cover ▪ Change in nutrient concentrations ▪ Change in food supply	▪ **R-1 – Waterbody Bank** o Minimize the removal of natural woody debris, rocks, or other materials from below the banks or the shoreline of the waterbody o Stabilize and reinforce banks of waterbody to pre-disturbance condition (or better) using properly designed and installed stabilization measures: ▪ Avoid hard engineering (sheet pile or other vertical walls) ▪ May include vegetation (e.g., tree and shrub plantings, bioengineering), rock/stone material (e.g., riprap, boulders). ▪ If rock reinforcement/armouring is required, ensure that appropriately sized material is used and is installed at a similar slope to the existing, maintains a uniform bank/shoreline and maintains a natural bank/shoreline alignment such that it does not interfere with fish passage or alter the bankfull channel profile.	▪ No residual effects anticipated with implementation of mitigation.

C16-A-1, C25-A-1, C25-A-2.			▪ May incorporate temporary measures (e.g., biodegradable materials, 'nurse'-crop vegetation) to provide interim stabilization until vegetation is fully established ▪ **R-2 – Waterbody Bed and Substrate** o Restore and re-stabilize any portion of the waterbody bed disturbed during construction to pre-construction (or better) condition, including: ▪ Restoration of the original contour and gradient ▪ Morphological elements, e.g., pools and riffles ▪ Substrates, which may include salvage and re-instatement of native materials ▪ **R-3 – Exposed Soils/ Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction • This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	
Direct fish habitat: C10-A-1, C10-A-4, C10-C-1, C10-C-2, C11-A-1, C13-A-1, C16-A-1, C18-E-1, C18-F-1, C18-G-1, C18-H-1, C22-A-	W4-Addition or Removal of Aquatic Vegetation	▪ Change in water temperature ▪ Change in dissolved oxygen ▪ Change in food supply ▪ Change in nutrient concentrations	▪ **M-3 – Equipment** o Whenever possible, operate machinery on land above the high-water level, on ice, or from floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody o Operate, store, and maintain (e.g., refuel, lubricate) all equipment, vehicles and associated materials in a manner that prevents the entry of any deleterious substance from entering the water	▪ No residual effects anticipated with implementation of mitigation.

1, C25-C-1, C27-A-1. Indirect fish habitat: C12-A-1, C16-A-1, C25-A-1, C25-A-2.		▪ Change in habitat structure and cover ▪ Change in contaminant concentrations ▪ Change in sediment concentrations	o Any part of equipment entering the water or operating on the bank shall be free of fluid leaks, invasive species and noxious weeds and externally cleaned/degreased to prevent any deleterious substance from entering the water ▪ **M-4 – Erosion and Sediment Controls** o Design and implement erosion and sediment controls to contain/isolate the construction zone, manage site drainage/runoff and prevent erosion of exposed soils and migration of sediment to adjacent waterbody during all phases of the project. o Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include: ▪ Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the waterbody ▪ Regular inspection and maintenance of erosion and sediment control measures and structures during construction. ▪ Repairs to erosion and sediment control measures and structures if damage occurs. ▪ Removal of non-biodegradable erosion and sediment control materials once site is stabilized. ▪ **M-8 – In-water Turbidity Curtains or Other Appropriate Measures** o Use properly sized, anchored, and maintained in-water silt boom, turbidity curtains or other effective measures to contain suspended sediments. ▪ **R-3 – Exposed Soils/Surfaces** o Stabilize and re-vegetate (or use other materials appropriate to site conditions) all areas of disturbed/exposed soil that drain to a waterbody using: ▪ Targeted planting of appropriate vegetation ▪ Rolled erosion control blankets, topsoil, seed, mulch etc. ▪ Installation of appropriately designed structural materials and vegetation of feasible on steep slopes to maintain slope stability for the long term. Direct drainage away from slopes unless structure provided to take drainage into valley without erosion and risk of sedimentation. ▪ **R-4 – In-stream cover** o Minimize the removal of natural woody debris, rocks, or other materials from below the high-water level	

			o Add/re-establish appropriate in-stream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Where possible, match structure/substrate type with previous or adjacent types removed, altered, or disturbed during construction • This may include salvage and re-instatement of existing in-stream structure such as large woody debris, boulders, or in-stream aquatic vegetation	

Appendix F

Fish and Fish Habitat Impact Documentation (Template D4)

TEMPLATE D4: AQUATIC EFFECTS ASSESSMENT SUMMARY TABLE

Project W.P No	Project Title	Waterbody Name
19-2001	Preliminary Design and Class Environmental Assessment Study for Highway 400 - Highway 404 Link (Bradford Bypass)	- Innisfil Creek Subwatershed - West Holland River Subwatershed - East Holland River Subwatershed - Maskinonge River Subwatershed
Fisheries Assessment Specialist		**Date**
Katie Easterling		**December 13, 2022**

PROPOSED WORKS, ENVIRONMENTAL AND MANAGEMENT CONTEXT	
Proposed Works	- The Bradford Bypass is a new 16.2 km freeway. The proposed highway will extend from Highway 400 between 8th Line and 9th Line in Bradford West Gwillimbury, and will connect to Highway 404 between Queensville Sideroad and Holborn Road in East Gwillimbury. - This project requires the creation of new bridges crossing the east and west branches of the Holland River, and two clear spanning bridges across the Maskinonge river and one of its tributaries. - The installation of new concrete box culverts and corrugated steel pipe culverts is required at 15 indirect/direct fish habitat watercourse crossings. - Three watercourses in indirect or direct fish habitat will require the replacement of culverts. - 14 watercourses in indirect or direct fish habitat will require channel realignment.

Fish and Fish Habitat	- The study area contains multiple crossings at Penville Creek, part of the Innisfil Creek Subwatershed. This is a coolwater community largely of tolerant baitfish species such as Blacknose Dace, Brook Stickleback, Creek Chub, Fathead Minnow, Northern Redbelly Dace, and White Sucker. No SAR, critical, or significant aquatic habitat features were observed during field investigations. Two of three crossings support direct fish habitat. - The West Holland River Subwatershed will have five crossings through direct fish habitat; two culvert crossings at tributaries to Fraser Creek, a new bridge crossing the West Holland River, a culvert crossing at a tributary to West Holland River, and a culvert crossing at an unnamed drain. These all support warmwater fish communities. One crossing a tributary to the West Holland River is known to have Northern Pike Spawning habitat in the downstream wetland feature. The remaining 16 crossings in this subwatershed are intermittent or seasonal swales or undefined channels that are not fish habitat. No SAR habitat was observed at any crossing. - The East Holland River Subwatershed will have two crossings through direct fish habitat; one new bridge over the East Holland River, and a culvert north of an online pond connected to an unnamed drain. These all support warm water fish communities. The East Holland River acts as a migratory corridor for fish to reach high-value upstream spawning habitat and specialized habitats that fish use for spawning and nursery areas and is also confirmed spawning habitat for muskellunge species. Five of the remaining crossings are intermittent or seasonal swales or undefined channels that are not fish habitat. One crossing is an offline pond and therefore not fish habitat. No SAR habitat was observed at any crossing. - The Maskinonge River Subwatershed will have two crossings through direct fish habitat; both being new culverts through the Maskinonge River. The Maskinonge River at these crossings largely supports warm water baitfish communities. The two remaining crossings are tributaries to the Maskinonge River and were classified as indirect fish habitat as they had poorly defined channels and standing water. No SAR, critical, or significant aquatic habitat features were observed during field investigations.

Fish Passage	- There are no negative residual fish passage issues that will be created as a result of the proposed culvert works as they will be countersunk a minimum of 10% to eliminate a perch at the outlet and create a smooth transition at the inlet and outlet by placing appropriate substrate to smoothly tie into the culvert. If possible, the culvert grade will also be reduced to lessen flow velocities throughout the culvert to improve fish passage. However, fish passage will be restricted during the proposed construction. - Field studies identified seasonal (potentially permanent) barriers to fish movement upstream through the culverts C10-C-1 and C10-C-2 due to shallow laminar flows at a tributary to Fraser Creek.
Fisheries Management Objectives (FMO)/In-Water Work Timing Window	- In-water work is permitted for all crossings from from July 16 to March 14, except for those containing muskellunge species spawning habitat identified above which permits in-water works from July 16 to February 28.
RESIDUAL EFFECTS ASSESSMENT	
Negative residual effects:	
1. Change in habitat structure and cover **2.** Change in nutrient concentrations **3.** Change in food supply **4.** Change in dissolved oxygen **5.** Change in base flow	

Spatial Scale	**1.** The habitat structure and cover negatively impacted by works will be localized to construction locations. The extent of this area is not known at this time. **2.** The nutrient concentrations negatively impacted by works will be localized to construction locations and the downstream reach. The extent of this area is not known at this time. **3.** The food supply negatively impacted by works will be localized to construction locations and the downstream reach. The extent of this area is not known at this time. **4.** The water temperature negatively impacted by works will be localized to construction locations and the downstream reach. The extent of this area is not known at this time. **5.** The dissolved oxygen negatively impacted by works will be localized to construction locations and the downstream reach. The extent of this area is not known at this time. **6.** Base flow may be change at the construction locations and the downstream reaches. The extent of this area is not known at this time.
Duration	**1.** The loss of the fish habitat and structure will be permanent. The duration of construction is unknown at this time. **2.** The change in nutrient concentrations will be both temporary and expected to resolve following the completion of construction and riparian planting as well as permanent associated with the overall project's influence on the local environment. The duration of construction is unknown at this time. **3.** The change in food supply will be permanent despite the improvements that will be made as the culverts are colonized by benthic invertebrates following the completion of construction. The duration of construction is unknown at this time. **4.** The change in water temperature is permanent but will decrease with time following riparian planting after the completion of construction. The duration of construction is unknown at this time. **5.** The change in dissolved oxygen will be permanent but will decrease with time following the recolonization of aquatic macrophytes following the completion of construction. The duration of construction is unknown at this time. **6.** The change in base flow will be permanent following the completion of construction.

Intensity	**1.** Given the proposed works will result in the permanent loss of direct fish habitat the intensity is considered high. **2.** The initial change in nutrient concentrations due to dredging and organic debris management will be acute and riparian plantings will mitigate changes in nutrients delivery from overland flow, therefore the intensity is low. **3.** The change in food supply will be restricted to the culvert installation locations which are expected to be colonized by benthic invertebrates following installation. Therefore, the intensity is low. **4.** The change in water temperature will be decreased over time by riparian plantings, and as the culverts inherently shade the water course the intensity of the residual effect is low. **5.** As many locations of proposed works have limited/absent macrophyte communities the change in dissolved oxygen will be low. It is anticipated that aquatic macrophytes will recolonize the watercourse adjacent to the culverts in the year(s) following the completion of construction. **6.** The spatial scale of excavation is minimal and the changes in base flow due to altering groundwater exchange is expected to be low. Therefore, the intensity is low.

DOCUMENTATION OF FISH AND FISH HABITAT IMPACT - Rationale and Conclusions
Considering that the severity (spatial scale, duration, intensity) of all negative residual effects, taken together, are used to determine, provide a brief rationale for why is or is not likely to occur by addressing the following questions below:

1.0 Will the project result in the death of fish? All in-water works are to follow the appropriate BMPs for working in-water, including that all works are to be completed in the dry and that a fish salvage shall occur prior to any in-water work.	**YES** ☐	**NO** ☒

2.0 Will the project result in harmful alteration, disruption or destruction of fish habitat? New culvert installations and channel realignments are proposed for 15 and 14 sites respectively (though 13 of the aforementioned sites require both works). This will result in the permanent alteration, and temporary disruption of direct and indirect fish habitat. Additionally, one site requires the extension of an existing culvert which will similarly result in the permanent alteration, and temporary disruption of direct fish habitat. Many temporary impacts during construction can be mitigated by implementing standard ESC measures and applicable BMPs for working in and near water (i.e., working in the dry, maintain flow around the work area, complete a fish salvage, etc). All crossings will require vegetation removal, one will require like-for-like culvert replacement, and one culvert requires a clean-out. However, provided these activities can follow the associated BMPs, it is anticipated that HADD of fish habitat is unlikely. At this time, it is uncertain if the BMP for Clear Span Bridges is applicable to new bridge installation. Therefore, it is HADD of fish habitat will occur, though it is not anticipated as the piers will not be in the wetted channel.	**YES** ☒	**NO** ☐
Of the 21 sites with direct or indirect fish habitat, 17 require works that may result in the permanent alteration and temporary disruption of fish habitat.		

Fisheries Assessment Specialist Recommendation:
Check one of the boxes based on the summary of findings. ☐ Proceed with project with identified mitigation measures (Complete MTO Project Notification Form) ☒ Recommendation to send project for review by DFO
MTO Review of the Fisheries Assessment Specialist's Recommendation (to be completed by MTO): All projects identified by the Fisheries Assessment Specialist as likely to result in the death of fish or HADD of fish habitat require a review by MTO prior to completion of any forms or submission to DFO. Only once advised by MTO should the Fisheries Assessment Specialist complete a DFO Request for Review Form to submit to MTO for signature and submission to DFO.

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