

## 3.0 Methodology

### 3.1 Desktop Background Information

Information regarding the environmental setting where the Project Area is located was obtained from New Brunswick Department of Resources, Energy and Development (DERD) Ecological Land Classification. Background information regarding the potential fish species, including species of conservation concern, found in the region surrounding the Project Area was obtained through the following sources:

- New Brunswick Department of Energy and Resource Development (NB ERD) *Endangered Species Act*
- Atlantic Salmon Foundations (ASF) Atlas of Salmon Rivers;
- Atlantic Canada Center for Data Conservation Data Request for 5 km Area around Proposed Glennwood to Area Miramichi Bypass. (ACCDC 2016)
- New Brunswick Department of Energy and Resource Development (NB ERD) 2016 Recreational Angling Guide (DERD 2016);
- Department of Fisheries and Oceans (DFO) publications
- Species at Risk Act Public Registry
- Communication with locals.

An assessment of existing mapping was conducted, which included Service New Brunswick (SNB) mapped watercourses (1:10,000 scale), a walkover of the alignment as well as predictive watercourse modeling to determine the location of watercourses and waterbodies crossed by the Project.

Potential watercourses were mapped by a predictive modeling exercise using Digital Elevation Models.

### 3.2 Field Studies

#### 3.2.1 Surface Water Sampling

Surface water samples were collected in watercourses (where depth permitted) for submission to the New Brunswick Analytical Services Laboratory for analysis. Surface water samples were collected using bottles provided by the laboratory from June 22 to 24, 2016. Water samples were collected while the sampler was wearing nitrile gloves and facing upstream. Bottles were triple rinsed prior to collection. Samples were labeled with the date and time of sample, the chainage where the sample was taken (a unique site identifier) and then stored in coolers, on ice, until they were delivered to the laboratory. Samples were analyzed for selected trace metals and nutrients, as well as total organic carbon (TOC), hardness (as CaCO<sub>3</sub>), total suspended solids (TSS) and turbidity (NTU).

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### **3.2.2 Fish Habitat Assessment**

Fish habitat assessments were conducted using modified NBDNR/DFO Stream Habitat Assessment Forms (Hooper et al 1995) from June 20 to 24, 2016 by the NBDTI Aquatic Assessment Team, consisting of an Aquatic Biologist and an Environmental Engineer. Assessments extended 100 m upstream and downstream of the Project Area as well as the Project Area itself. Habitat features of ponds were documented including approximate depth, substrate and riparian habitat. In-situ surface water quality (dissolved oxygen (mg/L), specific conductivity ( $\mu\text{s}/\text{cm}$ ), and temperature ( $^{\circ}\text{C}$ )) were measured using a calibrated YSI Model 20 handheld meter.

Photographs of watercourses were taken and typically consisted of upstream, downstream, left bank and right bank as well as substrate views. Photographs of the ponds/open marsh were taken to illustrate water clarity, substrate, presence and types of macrophytes and riparian vegetation.

### **3.2.3 Fish Presence/Absence Sampling**

Presence/absence sampling for fish was conducted at watercourses and ponds from June 20 to 24, 2014 by NBDTI personnel. Watercourses and wadeable portions of ponds were sampled using a Smith Root LR24 backpack electrofisher. In addition, open water was also sampled using baited standard minnow traps and fyke net sampling. Fish sampling was conducted under DFO Licence No. SG-RHQ-16-073 issued to NBDTI.

Fish sampling for fish presence/absence consisted of electrofishing in a variety of habitats available in the watercourse. Sampling extended up to 100 m upstream and downstream of the Project Area as well as the Project Area itself. In addition, for any watercourse where potential fish habitat was identified, but no fish were observed, an additional 100 m upstream and downstream of the assessment area was assessed. 100 m upstream and downstream was assessed.

### **3.2.4 Navigability Assessment**

#### **Navigation Protection Act**

The Navigation Protection Act (NPA) includes a List of Scheduled Waters that require regulatory approval for works that risk a substantial interference with navigation. Only listed scheduled waterways including selected Oceans and Lakes, Rivers and Riverines across Canada would be subjected to the Act.

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None of the seven watercourses associated with the Glenwood area to Miramichi Bypass are schedule waterways, and therefore approval under the NPA is not required.

The public right of navigation is protected by common law. Safe passage of a vessel must be accommodated whether the waterway is listed on the schedule to the Act or not.

## **4.0 RESULTS**

### **4.1 Desktop Background Information**

#### **4.1.1 Description of the Existing Environment**

The Project is located within the New Brunswick Eastern Lowlands Ecoregion, specifically the Kouchibouguac Ecodistrict. The ecodistrict, as described by NBDNR (2007) encompasses the eastern coastline of the province and extends from Miramichi Bay to Cape Tormentine, with bedrock consisting predominantly of Pennsylvanian grey and red sandstone, mudstone and conglomerate. The landscape is less than 60 m in elevation near the coast and gently rises upwards as it extends west. The watersheds crossed by the Project drain into Miramichi Bay/estuary (Figure 1.1).

The desktop review identified 9 mapped watercourses crossed by the Project Area with two watercourses having multiple crossings. (Figures 1.2A and 1.2B).

#### **4.1.2 Fish Species in the Region Surrounding the Project Area**

##### **4.1.2.1 Species of Conservation Concern**

The Federal *Species at Risk Act* and Provincial *Species at Risk Act* list a number of fish and/or populations, and mollusk species that have the potential to be in the region of the PDA. Where there is more than one population assessed/listed for a single species (ie., Gaspé-Southern Gulf of Saint Lawrence and inner Bay of Fundy populations), only the population that is known to be in the area of the PDA were discussed. Species that are known to be extirpated (Atlantic walrus (*Odobenus rosmarus rosmarus*) and Dwarf Wedgemussel (*Alasmidonta heterodon*) were noted, but are not further discussed. Eight species of fish and three species of mollusk of Conservation Concern were found. These species are discussed below as well as their potential to be present in watercourses crossed by the PDA.

##### **American eel (*Anguilla rostrata*)**

COSEWIC: Threatened; No Schedule or SARA status

- Have the potential to be in all watercourses crossed by the PDA, where suitable habitat exists, although it is more likely they would be in larger watercourses and ponded features.

**Atlantic salmon (*Salmo salar*) Gaspé Southern Gulf of St. Lawrence population**

COSEWIC: Special Concern; No Schedule or SARA status

- Have the potential to be in all cool/cold water watercourses crossed by the PDA with a known population in Napan River.

**Atlantic sturgeon (*Acipenser oxyrinchus*) Maritimes Population**

COSEWIC: Threatened; No Schedule or SARA status

- Have the potential to be within PDA, specifically Napan River as juveniles overwinter in freshwater. However, there are only two confirmed spawning populations. The Saint John River and Mid-Saint Lawrence River, both considerable distances from the PDA so the likely hood of them being present in the PDA is very low.

**Rainbow smelt (*Osmerus mordax*) Lake Utopia**

COSEWIC: Threatened; Schedule 1 and SARA Status for (Small Bodied Population).

- Population is endemic to Lake Utopia which is not within the PDA.

**Shortnose sturgeon (*Acipenser brevirostrum*)**

COSEWIC: Special Concern; Schedule 1, SARA status; Special Concern

- Population is limited to Saint John River which is not within the PDA.

**Striped bass (*Morone saxatilis*) Southern Gulf of Saint Lawrence Population**

COSEWIC: Special Concern; No Schedule or SARA status

- A spawning population is present within the Miramichi River. Juvenile Young of the Year (YOY) striped bass leave the lower Miramichi River and the estuary and disperse throughout the Northumberland Strait. As a result, there is the potential that some juveniles may migrate into the watercourses crossed by the PDA particularly the main stems of Black Brook and Napan River.

**Brook Floater (*Alasmidonta varicose*)**

COSEWIC: Special Concern; SARA Schedule 1

- The population distribution is not within the Project Area so they are not expected to be in watercourses crossed by the project.

**Yellow Lampmussel (*Lampsilis cariosa*)**

COSEWIC: Special Concern; SARA Schedule 1

- Population distribution is not within the PDA so they are not expected to be in watercourses crossed by the project.

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#### 4.1.2.2 Aquatic Species

The Atlas of Salmon Rivers (ASF 2016) records the Napan and Black Rivers as presently having Atlantic salmon populations. However, no mention is made of current or past populations in Black Brook.

The Project Area is within the Miramichi Recreational Fishery Area (NB ERD 2016) in which sport fishing is regulated for:

- trout (brook trout (*Salvelinus fontinalis*), Arctic char (*Salvelinus alpinus*), brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*)
- Atlantic salmon
- Burbot (*Lota lota*)
- American eel (*Anguilla rostrata*)
- Gaspereau (*Alosa* sp.)
- Rainbow smelt (*Osmerus mordax*)
- American shad (*Alosa sapidissima*)
- Striped Bass (*Morone saxilis*)
- Whitefish (*Coregonis clupeaformis*)
- White perch (*Morone americana*)
- Yellow Perch (*Perca flavescens*)

Commercial fish species found in or near the project include:

- gaspereau (*Alosa pseudoharengus* and *Alosa aestivalis*) (DFO 2007<sub>a</sub>);
- rainbow smelt (DFO 2007<sub>b</sub>);
- American eel (DFO 2012);
- American oyster (*Crassostrea virginica*) (DFO 2009), and
- blue mussel (*Mytilus edulis*) (DFO 2003).

Miramichi Bay is also used for molluscan spat collection, including American oysters, for the purposes of stocking aquaculture leases located in other areas (DFO no date).

Locals reported that Napan River salmon run, just prior to freeze up.

#### 4.2 Field Studies

In addition to mapped watercourses, field investigations identified an additional watercourse system crossed by the Project Area. The watercourse consists of the headwaters of a tributary to Black Brook. A Borrow pit, located near the western extent of the Project contains a moderately sized pond as well as three drainages, all of which are crossed by the Project Area (Watercourse Crossing 2, 2A, 2B, 2C, 2D, 2E and 2F), see Figure 1.3 for details. The Borrow Pit

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Pond is a mapped watercourse on the NB Hydrographic Network mapping, but the drainages into it or the watercourse that drain from it are not. It should be noted that based on a comparison of various recent aerial photography and what was observed during the field visits, the drainage within the Borrow Pit as well as the pond have been altered substantially. All of the ponds and drainages within the Borrow Pit are constructed. All other potential watercourses, identified from desktop exercises that did not meet the NB ELG criteria to be a watercourse and therefore are not further discussed. Key habitat characteristics of the watercourses are presented in Table 1 and photographs habitat are presented in Appendix A.

#### **4.2.1 Surface Water Sampling**

Surface water samples were taken at seven crossing locations and the Borrow Pit Pond. The complete results of inorganic chemistry analysis are presented in Appendix B. Water sample results were within the Canadian Council of Ministers on the Environment (CCME) Guidelines for Freshwater Aquatic Life (FWAL) with the exception of one sample (Crossing 6B, chainage 37+325) which exceeded the guideline for lead. The watercourse had a lead level of 1.5 µg/L (because it had a Total Hardness of 11.3 mg/L) which exceeded the guideline of 1.0 µg/L.

#### **4.2.2 Fish Habitat Assessments**

The complete results of the fish and fish habitat assessments are included in Appendix C. Table 1 provides a summary of the key habitat characteristics including substrate of the watercourses and pond and photographs habitat are presented in Appendix A

#### **4.2.3 Fish Presence/Absence Sampling**

Fish were captured at 6 of the 7 watercourse crossing locations. The results of the fish sampling methods and species sampled are presented in Table 2. Fish species sampled were brook trout (*Salvelinus fontinalis*), Brook stickleback (*Culaea inconstans*), ninespine stickleback (*Pungitius pungitius*), golden shiner (*Notemigonus crysoleucas*), finescale dace (*Chrosomus neogaeus*), Atlantic salmon (*Salmo salar*), creek chub (*Semotilus atromaculatus*) were sampled. Gaspereau were observed in Napan River (Watercourse 5). One red spotted newt (*N. v. viridescens*) and two predacious diving beetles were sampled in the Borrow Pit Pond.

A determination of fish habitat is present for watercourses crossed by the Project are presented in Table 3. In addition, a recommendation for providing fish passage or not providing fish passage as well as the area of fish habitat that may be impacted by the Project is also provided. However, the actual footprint may vary from what is identified above in some areas once constructed. The final footprint of the Project will be determined when design drawings are prepared.

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#### **4.2.4 Navigability assessments**

No requirement to be conducted

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**Table 1. Key habitat characteristics of watercourses crossed by Glenwood Area to Miramichi Bypass or within the Project Area.**

Crossing ID	Chainage	Location	Drainage	Key Habitat Characteristics Within Project Area
1	31+043 100+300 400+700	Main Lanes Ramp Ramp	Black Brook	Substrate dominated by gravel, fines and some sand. Beaver dam present immediately upstream of Route 11.
1A	400+415 300+650 70+255	Ramp Ramp Access Road	Black Brook	Shallow open water marsh draining into a steep sided, low gradient watercourse bounded by grasses and alder wetland.
2	31+575 300+400	Main Lanes Ramp	Borrow Pit Pond Unmapped Trib to Black Brook	Western and central extent of pond in Borrow Pit Pond with emergent, floating and submergent aquatic vegetation. Pond was being filled in with construction debris from southern extent.
2A	70+675	Access Road	Borrow Pit Pond Unmapped Trib to Black Brook	Eastern extent and outlet of pond in Borrow Pit with emergent, floating and submergent aquatic vegetation. Pond was being filled in with construction debris from southern extent.
2B	200+450	Main Ramp	Drainage to Borrow Pit Pond (Unmapped Trib to Black Brook)	Small, mostly < 1 m wide, excavated channel draining water into Borrow Pit Pond.
2C	80+525	Ramp	Drainage to Borrow Pit Pond (Unmapped Trib to Black Brook)	Drainage ditch, with offshoot wetland areas draining in Borrow Pit Pond
2D	31+700 300+480 200+550	Main Lanes Ramp Ramp	Drainage to Borrow Pit Pond (Unmapped Trib to Black Brook)	Main inlet area of Borrow Pit Pond and of the confluence with WC 2 E and 2 F, and 2 C.
2E	80+630	Ramp	Drainage to Borrow Pit Pond (Unmapped Trib to Black Brook)	Constructed drainage channel. Downstream extent of WC 2 F.
2F	31+750 200+700 80+840	Main Lanes Ramp Ramp	Drainage to Borrow Pit Pond A (Unmapped Trib to Black Brook)	Excavated drainage channel running the most of the length of the northern extent of the borrow pit. Channel was up to 150 cm wide and averaged 50 cm deep. Very shallow gradient with emergent, floating and submergent aquatic plants present. Upstream extent of WC 2 E.
3	33+810	Main Lanes	Unnamed Trib. to Unnamed Trib. to Napan River	Ditch/swale drains surface water in pasture for ~400 m within Project Area and is passed under a farm lane through a culvert. Downstream of culvert, banks well-formed and vegetated with shrubs, grassed and trees. One notable pool is present at the culvert outlet.
4	34+225	Main Lanes	Unnamed Trib. to Napan River	Small watercourse flowing through cow pasture. Water is passed under a farm lane through a concrete culvert. Banks well grassed and mostly stable.
5	34+540	Main Lanes	Napan River	Main stem of Napan River with some well-formed riffle/runs/pool sequences. Banks steep sided with a mixture of gravel, sand, fines and some rock forming substrate.
6	34+945	Main Lanes	Unnamed Trib. to Napan River	Small watercourse flowing through alder grove. One notable pool present in Project Area. Substrate consists of a mixture of gravel, sand, fines and some rock forming substrate.
6A	36+250	Main Lanes	Unnamed Trib. to Unnamed Trib. to Napan River	Small watercourse dominated by sand substrate with some fines.
NA	36+290	Main Lanes	Mapped as an Unnamed Trib. to Unnamed Trib. to Napan River	No watercourse present in Mapped Location.
6B	37+325	Main Lanes	Unnamed Trib. to Unnamed Trib. to Napan River	Watercourse bounded by wetlands, upstream portion of PDA consists of partially wash out beaver pond. In beaver pond and downstream portion of PDA substrate is composed of fines.
7	A140+390	Main Lanes	Trib to Black River	Watercourse flowed through a grassed/alder wetland. Channel was steep sided, with substrate consisting of organics with some boulders and rocks. Previous signs of beaver dam.

**Table 2. Fish sampling results in watercourses/ponds within the Glenwood Area to Miramichi Bypass Project Area.**

Watercourse Crossing ID	Chainage	Watercourse/ Pond Location	Drainage	Sampling Method	Fish Species Sampled
1	34+225 100+300 400+700	Main Lanes Ramp Ramp	Black Brook	Fyke net and Electrofishing	Stickleback Dace (XXX sp) Brook trout None
1A	4+425 4+275 70+250	Ramp Ramp Access Road	Black Brook		
2	31+575 300+400	Main Lanes Ramp	Borrow Pit Pond Unmapped Trib to Black Brook	Minnow traps Electrofishing	Stickleback Dace (XXX sp) Notropis sp. Dead White sucker observed
2A	70+675	Access Road	Eastern extent and outlet of Borrow Pit Pond (Unmapped Trib to Black Brook).		
2B	200+550	Main Ramp	Drainage to Borrow Pit Pond(Unmapped Trib to Black Brook)		
2C	80+525	Ramp	Drainage to Borrow Pit Pond (Unmapped Trib to Black Brook)		
2D	31+700 300+480 200+550	Main Lanes Ramp Ramp	Outlet and lower extent of drainage to Borrow Pit Pond (Unmapped Trib to Black Brook)		
2E	80+630	Ramp	Drainage to Borrow Pit Pond (Unmapped Trib to Black Brook)		
2F	31+750 200+700 80+840	Main Lanes Ramp Ramp	Drainage to Borrow Pit Pond (Unmapped Trib to Black Brook)		
3	33+810	Main Lanes	Unnamed Trib. To Unnamed Trib. to Napan River	Electrofishing	No fish sampled
4	34+225	Main Lanes	Unnamed Trib. to Napan River	Electrofishing	Brook trout
5	34+540	Main Lanes	Napan River	Electrofishing	Brook trout Atlantic salmon gaspereau (observed)
6	34+945	Main Lanes	Unnamed Trib. to Napan River	Electrofishing/Minnow Trap	Brook trout
6A	36+250	Main Lanes	Unnamed Trib. To Unnamed Trib. to Napan River	Electrofishing	Brook trout
NA	36+290	Main Lanes	Mapped as an Unnamed Trib. To Unnamed Trib. to Napan River	NA	NA
6B	37+325	Main Lanes	Unnamed Trib. To Unnamed Trib. to Napan River	Too warm to Electrofishing	Cyprinids observed.
7	40+375	Main Lanes	Trib to Black River	Electorfish	None, too deep to sample. Fish presence expected

**Table 3. Determination of fish habitat within Glenwood Area to Miramichi Bypass Project Area.**

Watercourse Crossing ID	Chainage	Watercourse/ Pond Location	Watercourse on 1:10,000 Mapping?	Fish Present Within Project Area	Fish Habitat Present Within Project Area	Fish Passage Recommended	Estimated Length of Watercourse in Project Area (m)	Average Bank Channel Width (m) in Project Area	Estimated Area of Fish Habitat (m <sup>2</sup> )/Footprint in Project Area *	Comments
1	34+225 100+300 400+700	Main Lanes Ramp Ramp	Yes	No	Yes	Yes	150	2.5	375	Although the watercourse does not extend substantially upstream of the project, it is used by several warm and cool water fish species. The wetland habitat upstream of the existing Route 11 has a moderate spatial area that would be used seasonally.
1A	4+425 4+275 70+250	Ramp Ramp Access Road	Yes	No	Yes	No	175	2.25	3476	
2	31+575 300+400	Main Lanes Ramp	No	No	Yes	No	Estimated impact Borrow Pit Pond (2 and 2A): 2279 m <sup>2</sup> * NBHN mapped water bodies 1694 m <sup>2</sup> unmapped Total estimate open water area 3973 m <sup>2</sup> Drainage Channel (2B) ~ 80 m <sup>2</sup> Drainage Channel (2C) ~ 250 m <sup>2</sup> Drainage Channels (2D, 2E and 2F) ~ 300 m <sup>2</sup>	The head waters of this partially mapped open water (Borrow Pit Pone) and unmapped watercourse are contained within the borrow pit. Based on aerial imagery from 2000s to present the open water area and drainages have been substantially altered over the last decade and a half. Much, if not all, of the habitat present is there because the landscape has been altered to facilitate drainage. The Project will directly interact with/impact much of the habitat and little to no upstream habitat will be present due to the pit being at the headwaters of the watercourse.		
2A	70+675	Access Road		Yes	Yes	No				
2B	200+550	Main Ramp		Yes	Yes	No				
2C	80+525	Ramp		No	Yes	No				
2D	31+700 300+480 200+550	Main Lanes Ramp Ramp		Yes	Yes	No				
2E	80+630	Ramp		Yes	Yes	No				
2F	31+750 200+700 80+840	Main Lanes Ramp Ramp		No	Yes	No				
3	33+810	Main Lanes	Yes	Yes	potentially	No	70	1.2	84*	No fish were sampled and the PDA is the upper extent of channelization for this watercourse.
4	34+225	Main Lanes	Yes	Yes	Yes	Yes	67	1.8	121	
5	34+540	Main Lanes	Yes	Yes	Yes	Yes	85	13	1,105	Riffle, run and pool habitat.
6	34+945	Main Lanes	Yes	Yes	No	Yes	75	1.2	90	Pool present within Project Area
6A	36+250	Main Lanes	Yes	No	Potentially	No	75	1.4	105*	No fish sampled. Quality of fish habitat is low and is even poorer upstream of Project Area.
NA	36+290	Main Lanes	Yes	No	NA	NA	NA	NA	0	No watercourse in mapped location
6B	37+325	Main Lanes	Yes	Yes	Yes	Yes	10 65	4 1.9	164	Watercourse was too warm to electrofish. Cyprinids observed in PDA.
7	40+375	Main Lanes	Yes	Yes	Yes	No	75	5	375	Low gradient warm water habitat.

\*The footprint approximations are provided for planning purposes, as a reasonable representation of the anticipated extent of construction and alterations. However, the actual footprint may vary from what is identified above in some areas once constructed. The final footprint of the Project will be determined when design drawings are prepared.

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